

FINAL REPORT

VOLUME I

**Alternative Oil Spill Occurrence Estimators for the
Beaufort and Chukchi Seas – Fault Tree Method**

MMS Contract Number 01-00-PO-17199

August, 2002

By



Bercha International Inc.
Calgary, Alberta, Canada



U.S. Department of the Interior
Minerals Management Service
Alaska Outer Continental Shelf Region

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ABSTRACT

Oil spill occurrence estimates were generated for several expected future oil and gas development scenarios (including exploration, production, and abandonment) in the Beaufort and Chukchi Seas Offshore Continental Shelf (OCS) lease sale regions. Because sufficient historical data on offshore oil spills for these regions do not exist, an oil spill occurrence model based on fault tree methodology was developed and applied. Using the fault trees, base data from the Gulf of Mexico were modified and augmented to represent expected Arctic offshore oil spillage frequencies. Three principal spill occurrence indicators, as follows, were quantified:

- Annual spill frequency
- Annual spill frequency per barrel produced
- Spill index, the product of spill size and spill frequency

These indicators were quantified for the following spill sizes:

- Small - = 50 < 100 bbl
- Medium - = 100 < 1,000 bbl
- Large - = 1,000 < 10,000 bbl
- Huge - = 10,000 bbl

Quantification was carried out for each future year for four different Beaufort Sea development scenarios, ranging in duration up to 38 years, and for two Chukchi Sea scenarios of 10-year duration. In addition, comparative scenarios for non-Arctic locations were formulated and analyzed for oil spill occurrence. Generally, it was found that the non-Arctic spill indicators were likely to be significantly higher than those for similar scenarios in the Arctic. The computations were carried out using a Monte Carlo process to permit the inclusion of estimated uncertainties in the Arctic effects. A wide range of details for each scenario was generated, including the following:

- Expected time history of spill occurrences over the scenario life.
- Spill occurrence variations by spill volumes in the above spill size ranges.
- Spill occurrence variation by spill cause such as boat anchoring or ice gouging.
- Spill occurrence contribution from each main facility type, including pipelines, platforms, and wells.
- Comparison of spill occurrence predictions between Arctic and non-Arctic scenarios.
- The variability in the results due to uncertainties in the Arctic effects introduced, expressed as cumulative distribution functions and statistical measures.

In the final report, a detailed description of the methodology, results, and conclusions and recommendations is given, as well as a section on limitations of the study.

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- Dennis Hinnah, Office of Field Operations

This work was carried out by the Bercha Group with assistance from S.L. Ross Environmental Consultants on the historical data assimilation. Key personnel on the project team were as follows:

- Dr. Frank G. Bercha, Project Manager and Principal Engineer, Bercha Group
- Dr. Seymour L. Ross, Oil Spill Specialist, S.L. Ross Environmental Consultants
- Dr. Norman Davies, Statistical Specialist, Cambridge University, UK
- Milan Cerovšek, Reliability Engineering Specialist, Bercha Group
- Archie C. Churcher, Offshore Operations Specialist, Bercha Group
- Wesley Abel, Offshore Engineering Specialist, Bercha Group

This work is dedicated to the memory of Dr. Norman Davies, who regrettably passed away before its completion.

EXECUTIVE SUMMARY

A. Summary of Work Done

Oil spill occurrence estimators were generated for several expected future oil and gas development scenarios (including exploration, production, and abandonment) in the Beaufort and Chukchi Seas Offshore Continental Shelf (OCS) lease sale regions. Because sufficient historical data on offshore oil spills for these regions do not exist, an oil spill occurrence model based on fault tree methodology was developed and applied. Using the fault trees, base data from the Gulf of Mexico were modified and augmented to represent expected Arctic offshore oil spillage frequencies. Three principal spill occurrence indicators, as follows, were quantified:

- Annual spill frequency
- Annual spill frequency per barrel produced
- Spill index, the product of spill size and spill frequency

These indicators were quantified for the following spill sizes:

- Small (S) - = 50 < 100 bbl
- Medium (M) - = 100 < 1,000 bbl
- Large (L) - = 1,000 < 10,000 bbl
- Huge (H) - = 10,000 bbl

Quantification was carried out for each future year for four different Beaufort Sea development scenarios, ranging in duration up to 38 years, and for two Chukchi Sea scenarios of 10-year duration. In addition, comparative scenarios for non-Arctic locations were formulated and analyzed for oil spill occurrence. Generally, it was found that the non-Arctic spill indicators were likely to be significantly higher than those for similar scenarios in the Arctic. The computations were carried out using a Monte Carlo process to permit the inclusion of estimated uncertainties in the Arctic effects. A wide range of details for each scenario was generated, including the following:

- Expected time history of spill occurrences over the scenario life.
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- Comparison of spill occurrence predictions between Arctic and non-Arctic scenarios.

- The variability in the results due to uncertainties in the Arctic effects introduced, expressed as cumulative distribution functions and statistical measures.

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B. Conclusions

B.1 Conclusions on Spill Indicator Trends

The three spill occurrence indicators – annual frequency, annual frequency per barrel produced, and spill index – exhibit a wide range of values varying with location, scenario year, facility composition, and spill size. For the Beaufort Sea and Chukchi Sea locations, comparative non-Arctic scenarios were also postulated and analyzed.

B.1.1 Spill Occurrence Indicator Variations by Spill Size and Location

How do spill indicators for the different scenarios and for their non-Arctic counterparts vary by spill size and location? Table 1 summarizes the spill indicator values for representative years. Representative years are chosen as the peak production years. Figures 1 and 2 show the spill size composition associated with each scenario representative year chosen. The total values of each spill index are also given in a rectangle in the bottom right hand corner of each pie chart. The following can be observed from Figures 1 and 2 and Table 1.

- Each spill indicator for Beaufort Sea Sale 1, 2, and 3 is similar in value. The indicators are higher for the composite “Sale All” scenario (Table 1).
- Chukchi Sea spill indicators are all higher than Beaufort Sea indicators (Table 1).
- Spill frequency per year and per barrel produced decreases significantly with increasing spill size for all scenarios (Figures 1 and 2). The spill frequency and spill frequency per barrel proportions are the same for any given year. Their absolute value differs only because the latter is divided by the annual production volume.
- The spill index increases dramatically with spill size for all scenarios (Table 1 and Figures 1 and 2).
- All non-Arctic scenario spill indicators are greater than their Arctic counterparts. Non-Arctic spill frequencies are approximately 40% greater; spill indices, 8% greater for the non-Arctic scenarios (Table 1).

In addition, the unit Arctic oil spill frequencies for pipelines show a decrease with increasing water depth. That is, pipeline failures per km-yr are highest for shallow water and lowest for deep water. Thus, given the same size and length of pipeline in shallow and deep water, the spill indicators for deep water pipelines would be lower than those for shallow water pipelines. The opposite trend was observed to apply to platforms. No water depth effect was introduced for wells.

Table 1
Summary of Spill Indicators for All Scenarios

SPILL INDICATORS Spill Size bbl x 1000		Beaufort Sea					Chukchi Sea		
		Year 2016	Year 2019	Year 2024	Year 2020	Year 2020	Year 2010	Year 2010	Year 2010
		Sale 1	Sale 2	Sale 3	Sale All	Sale All Non Arctic	Base Case	High Case	High C Non Arctic
Spill Frequency per 10 ³ years	SM	9.97	10.17	9.84	29.98	43.90	37.66	70.18	95.17
	L	4.53	4.42	4.07	13.02	17.83	15.23	25.34	36.70
	H	2.39	2.34	2.21	6.93	8.31	7.68	14.38	17.85
	All	16.88	16.93	16.12	49.93	70.04	60.58	109.91	149.72
Spill Frequency per 10 ⁹ bbl produced	SM	0.21	0.24	0.25	0.40	0.59	0.41	0.31	0.42
	L	0.10	0.11	0.11	0.17	0.24	0.17	0.11	0.16
	H	0.05	0.06	0.06	0.09	0.11	0.08	0.06	0.08
	All	0.36	0.40	0.42	0.67	0.94	0.66	0.48	0.66
Spill Index [bbl] (Product of spill frequency and mean spill size)	SM	2	2	2	6	9	8	13	19
	L	28	27	26	81	102	92	171	218
	H	170	169	165	505	529	534	1150	1211
	All	200	199	193	592	640	633	1335	1448

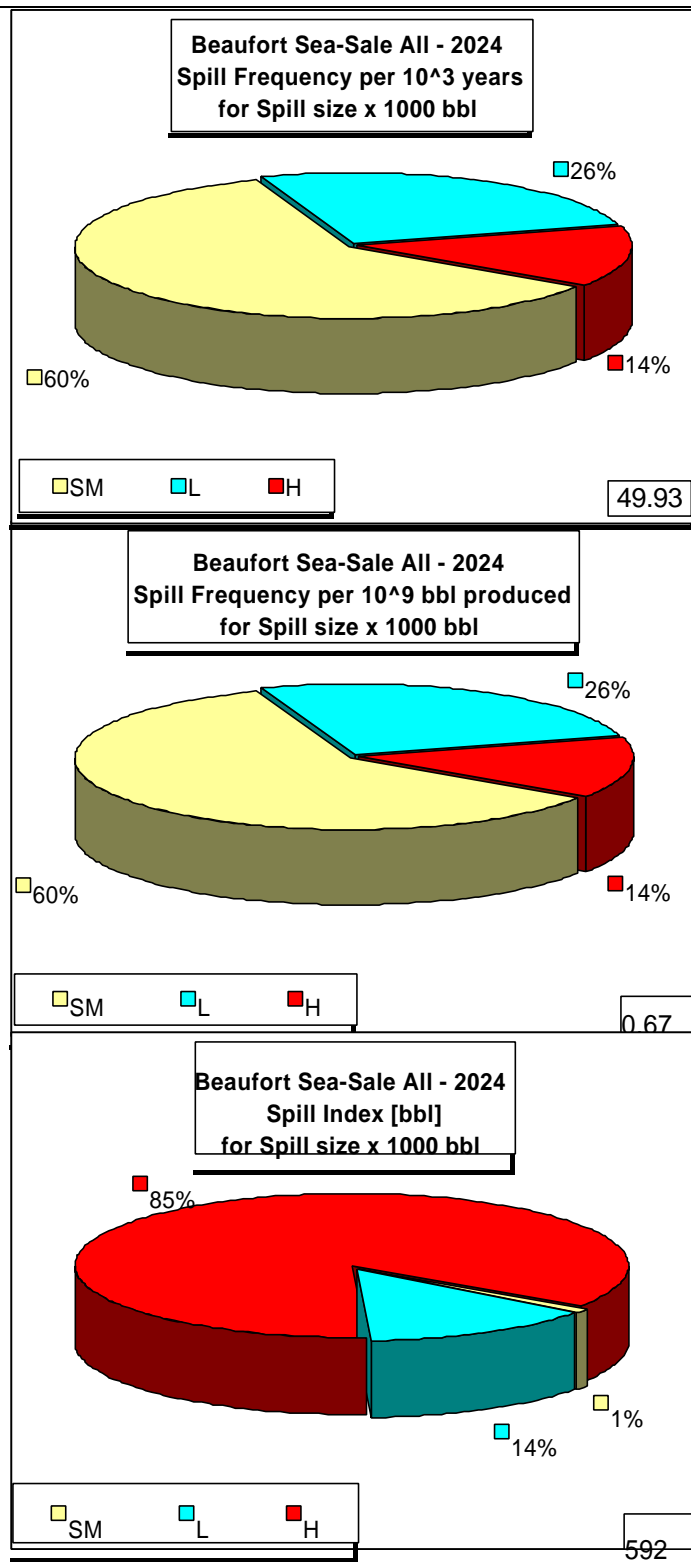


Figure 1
Beaufort Sea 'Sale All' Spill Indicators – Year 2024

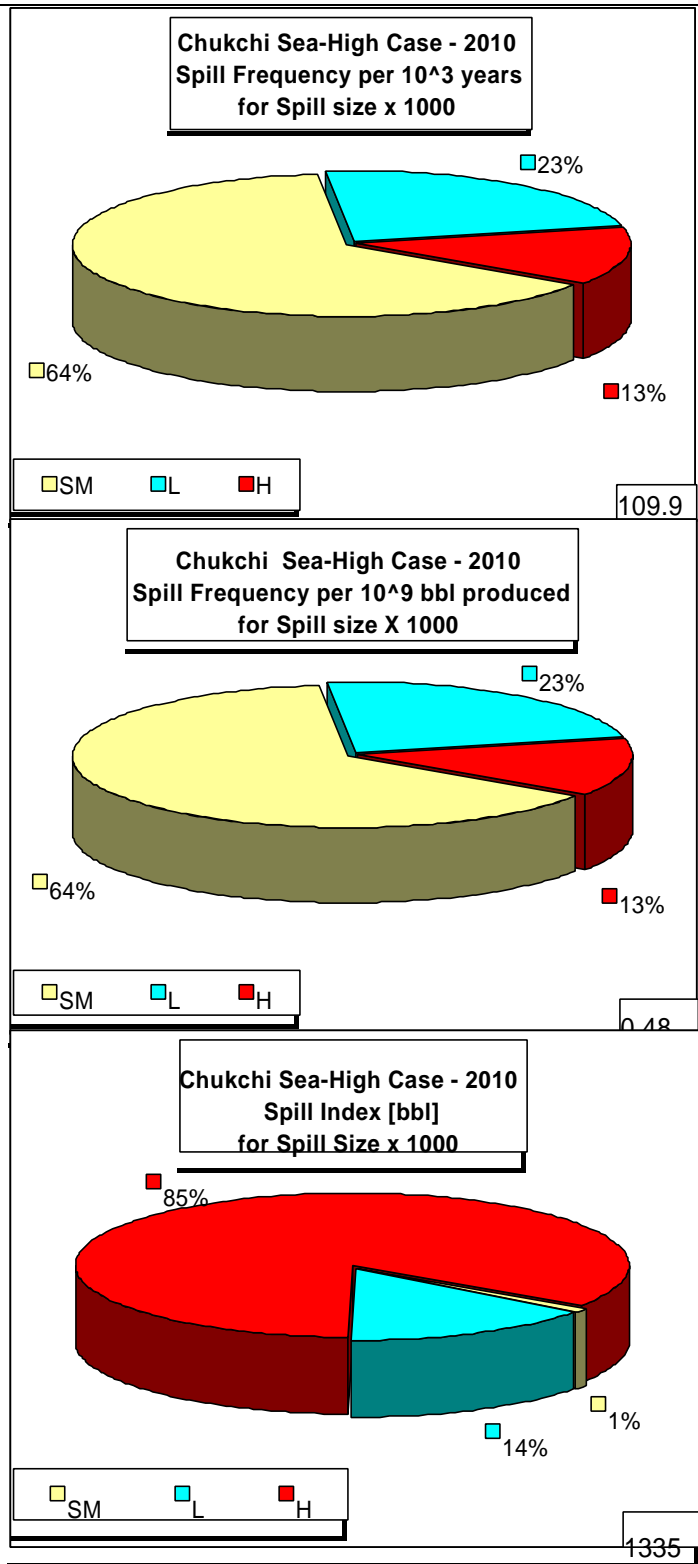


Figure 2
Chukchi Sea ‘High Case’ Spill Indicators – Year 2010

B.1.2 Facility Contributions to Spill Occurrence Indicators

How do the spill indicators vary by facility type for representative scenarios? The contributions of spill indicators by facility have also been summarized for representative scenario years. Figures 3 and 4 gives the relative component contributions, in absolute value and percent, for each of the main facility types; namely, pipelines (P/L), platforms, and wells. Platform spills do not include blowouts. Blowouts are the only spill events categorized under well spills. The following may be noted from these figures:

- For both the Beaufort and Chukchi scenarios, platforms contribute the most (50% and 61% respectively) to the two spill frequency indicators, but the least (5% and 6% respectively) to the spill index (Figure 3 and 4).
- Pipelines in the Beaufort scenarios are next in relative contribution to spill frequencies (31%) and intermediate in contribution to spill index (10%) (Figure 3).
- The relative contribution of pipelines to spill frequencies in the Chukchi, however, are approximately the same (19%) as contributions of wells (20%) (Figure 4).
- Wells are by far the highest contributors to spill index in the Beaufort and Chukchi Seas, at 85% and 89% respectively, while platforms and wells are each responsible for 10% or less contribution to the spill index (Figures 3 and 4).
- It can be concluded that platforms are likely to have the most, but smaller spills, while wells will have the least number, but largest spills. Pipelines will be in between, with a tendency towards more spills than wells, but less or about the same number as platforms. Pipeline spill volumes will tend to be greater than (in Beaufort) or similar in size (in Chukchi) to platform spills.

B.1.3 Projected Annual Variations of Spill Occurrence Indicators

How do spill indicators vary over the development life cycle? Figure 5 shows the composite Beaufort Sea scenario annual variation in spill indicators over the expected development lifetime. Generally, spill frequencies and the spill index can be seen to follow the facility build-up and phase-out, as they are directly proportional to facility quantities. Spill frequency per barrel produced, however, continues to rise beyond the peak production year. The lack of fall of spills per billion barrels produced in years after peak production is partially artificial. The development scenarios used by MMS in environmental analyses (and used in this report) assume pipelines, platforms, and wells are abandoned at a rate lower than the rate of decrease in production. This leads to the artifact that as production goes to zero, spills per barrel produced increase to infinity. The artifact disappears when spill rates are summed or normalized over the life of the fields.

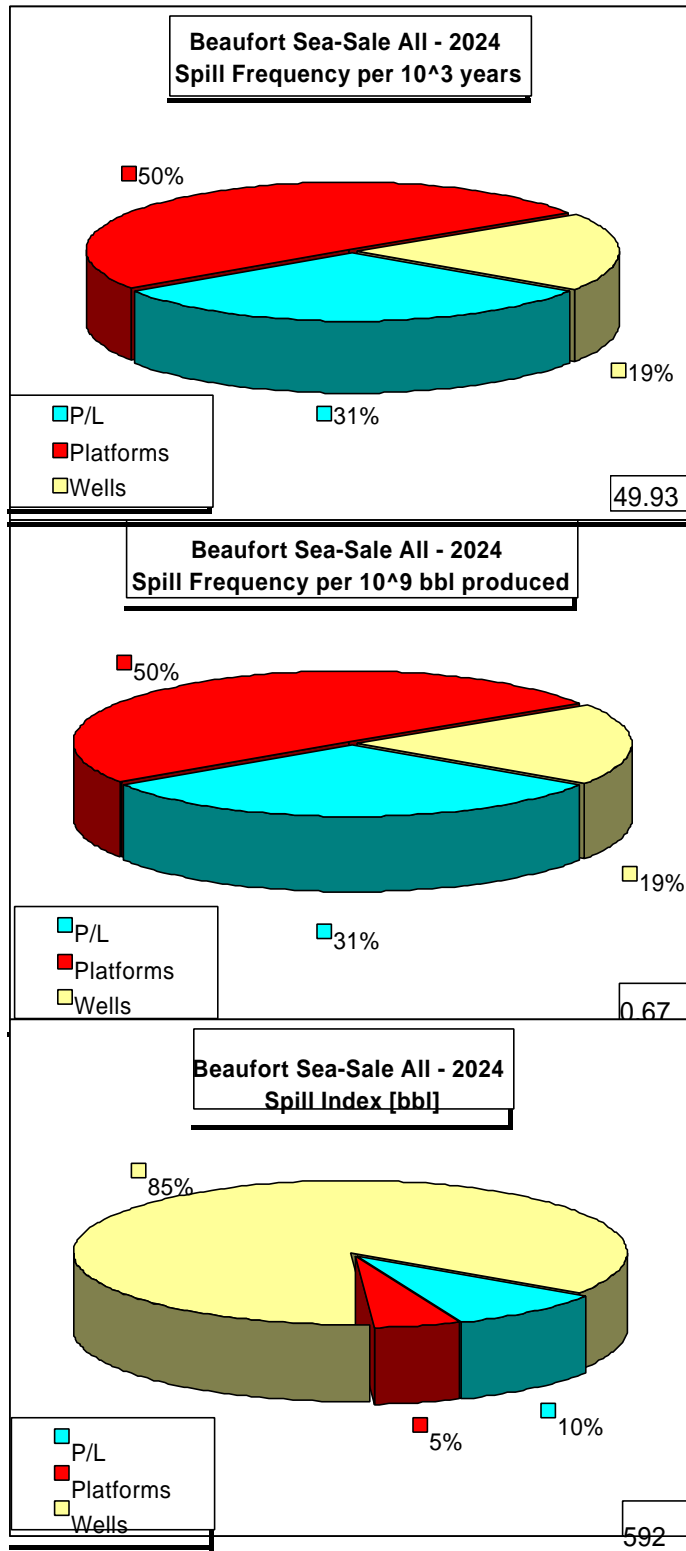


Figure 3
Beaufort Sea 'Sale All' Spill Indicators – Year 2024

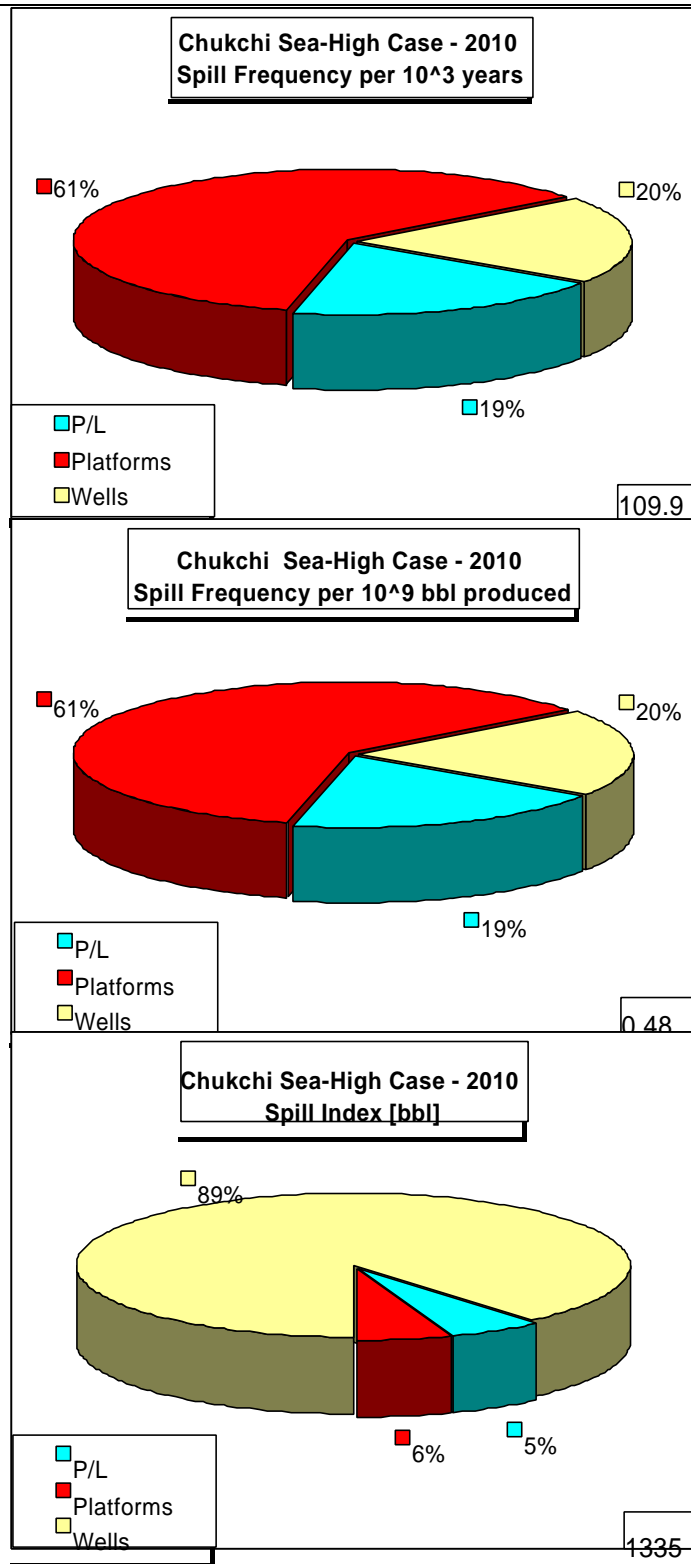


Figure 4
Chukchi Sea ‘High Case’ Spill Indicators – Year 2010

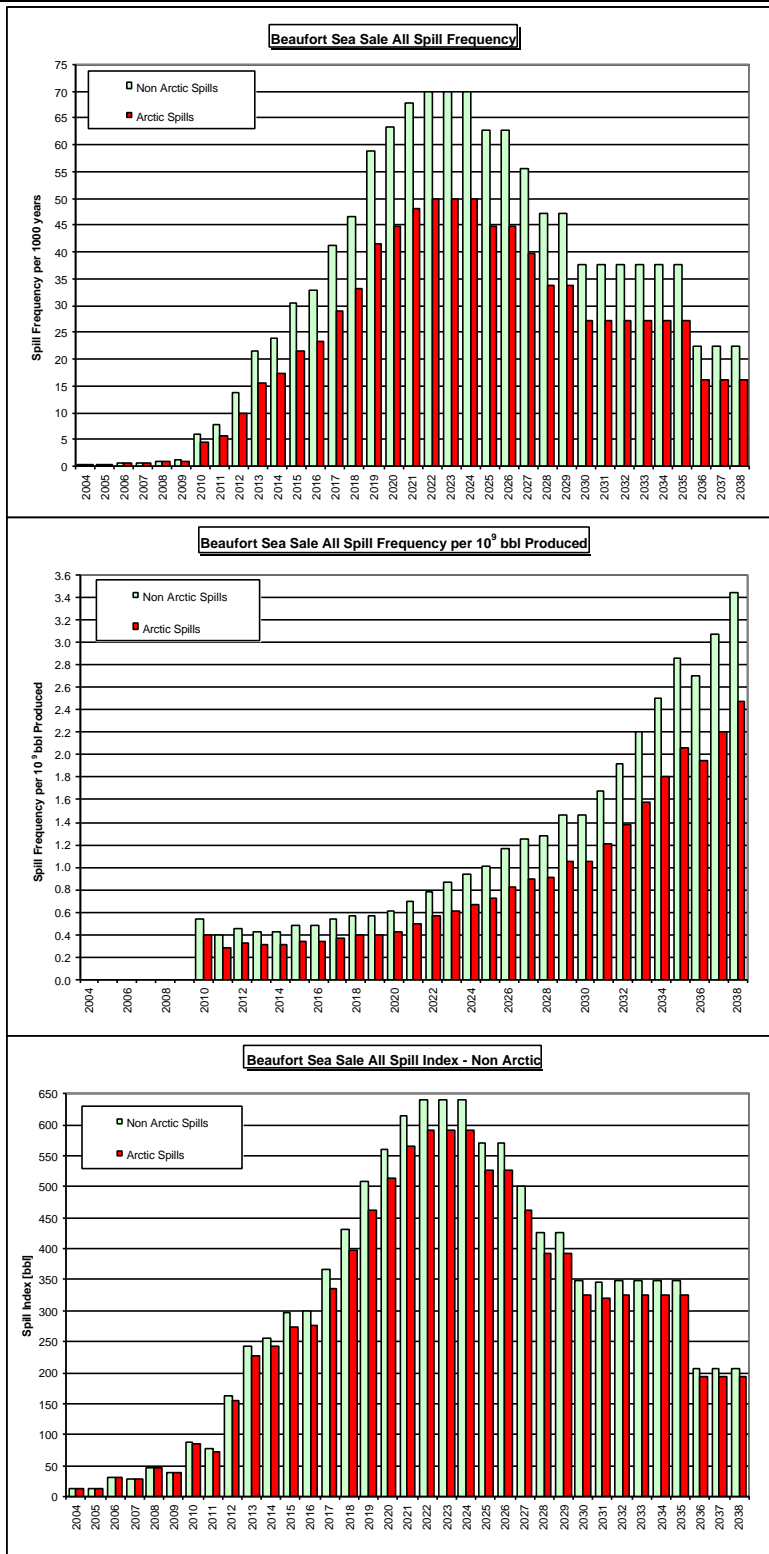


Figure 5
Beaufort Sea Composite Scenario Annual Variation
in Arctic and Non-Arctic Spill Occurrence Indicators

B.1.4 Spill Indicator Statistical Variance

The variance introduced into the spill occurrence indicators by the incorporation of Arctic effects was numerically evaluated. Figure 6 shows typical distributions of the resulting indicators, in this case for the Beaufort Sea composite (All Sales) scenario. The slope of each line is an indicator of its variance. Specifically, it was found that for all spills the standard deviation ranged from 12% to 15% of the mean, while the upper and lower bound (95th percentile and 5th percentile, respectively) ranged from 20% to 30%, with the smaller variances corresponding to the Beaufort Sea scenarios and the large ones to the Chukchi Sea scenarios. Upper (95%) and lower (5%) bounds, however, varied as much as 20 to 50% and 20 to 35% of the mean. Since many of the variations in the Arctic inputs ranged in excess of plus or minus 80% of the mean value, the relatively small variance of the indicators suggest that the total model is quite robust; large variances in inputs cause only small variances in outputs. However, this small variance relates only to the Arctic effects; variance in historical spill size and frequency was considered to be zero. Thus, the variances discussed here characterize the uncertainties associated with the Arctic effects incorporated through the fault tree methodology in this study.

B.2 Conclusions on the Methodology and Its Applicability

An analytical tool for the prediction of oil spill occurrence indicators for systems without history has been developed based on the utilization of fault tree methodology. Although the results generated are voluminous, they are essentially transparent, simple, and easy to understand. The analytical tool developed is also quite transparent, very efficient in terms of computer time and input-output capability, and user friendly for users that are generally familiar with the process. In addition, the basic model is setup so that any input variables can be entered as distributions; the model presented in this study only uses distributed values of the Arctic effect inputs.

A wealth of information that can be utilized for the optimal planning and regulation of future developments is generated by the analytical tool. Key aspects of the analytical tool capability may be summarized as follows:

- Ability to generate expected and mean values as well as their variability in rigorous numerical statistical format.
- Use of verifiable input data based on MMS historical spill data and statistics.
- Ability to independently vary the impacts of different causes on the spill occurrences as well as add new causes such as some of those that may be expected for the Arctic or other new environments.
- Ability to generate spill occurrence indicator characteristics such as annual variations, facility contributions, spill size distributions, and spill causes.

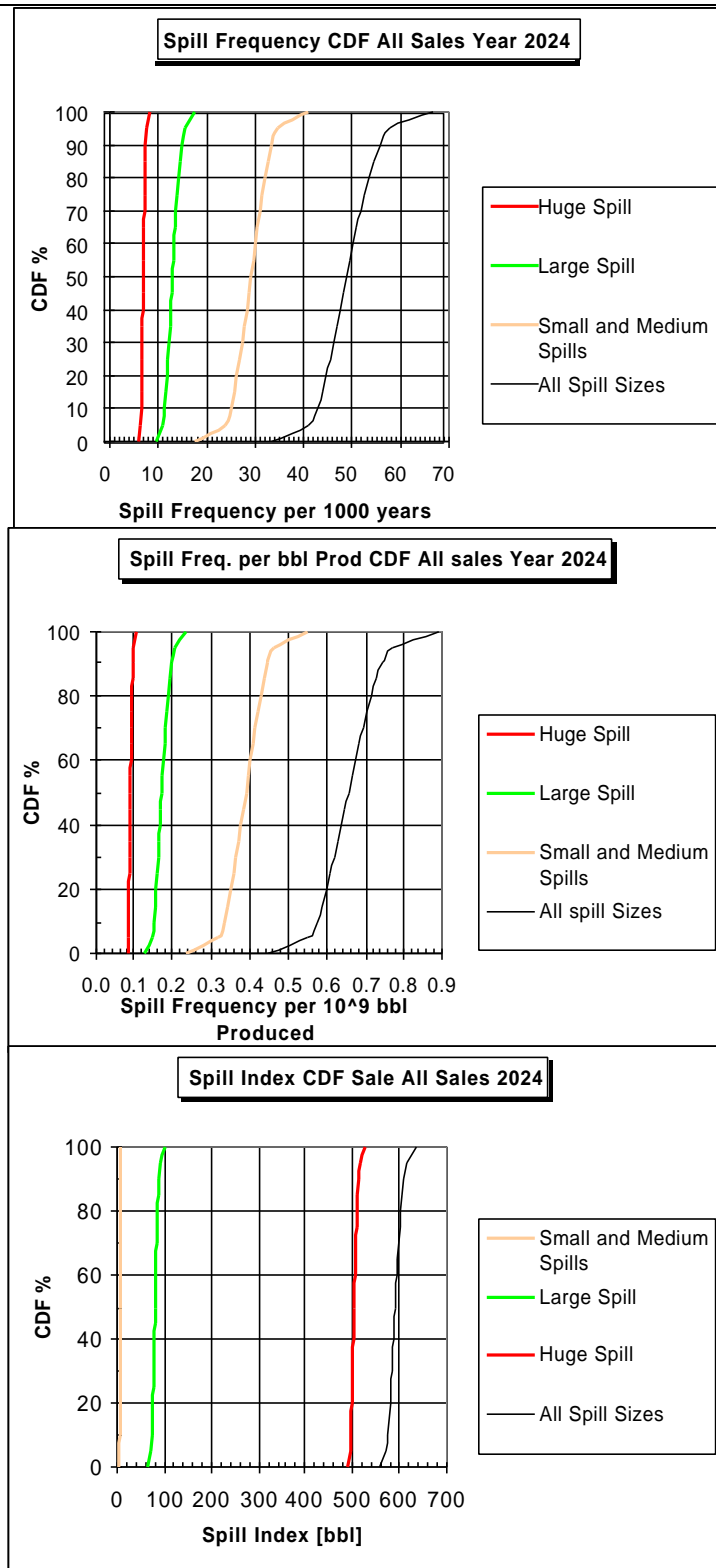


Figure 6
Typical Spill Occurrence Indicator Variance Graphs

- Ability to generate comparative spill occurrence indicators such as those of comparable scenarios in more temperate regions. The model developed provides a basis for estimating each Arctic effect's importance through sensitivity analysis as well as propagation of uncertainties.
- Capability to quantify uncertainties rigorously, together with their measures of variability.

C. Limitations of Methodology and Results

C.1 General Description of Limitations

During the work, a number of limitations in the input data, the scenarios, the application of the fault tree methodology, and finally the oil spill occurrence indicators themselves have been identified. These shortcomings are summarized in the following paragraphs.

C.2 Limitations of Input Data

Two categories of input data were used; namely the historical spill data and the Arctic effect data. Although a verifiable and optimal historical spill data set has been used, the following shortcomings may be noted:

- Gulf of Mexico (OCS) historical data bases were provided by MMS and used as a starting point for the fault tree analysis; however, some inconsistencies were identified in these databases as discussed in Appendix A, Section A.2.4.
- Only the historical spill frequency point value was utilized, since adequate data were not provided to create distributions of these frequencies.
- Several ranges of spill sizes were analyzed, but only the mean value of each spill size range was used to characterize representative spill size for each range. Spill size distribution data for each spill size range was available, but was not used in the interest of restricting the uncertainties to the Arctic effects.
- The assessment of the variability or statistical properties of the GOM historical data is a significant study in itself, which is expected to be carried out in the companion study being conducted in parallel with the present work
- The Arctic effects include modifications in causes associated with the historical data set as well as additions of spill causes unique to the Arctic environment. Quantification of existing causes for Arctic effects was done in a relative cursory way restricted to engineering judgement.
- A reproducible but relatively elementary analysis of gouging and scour effects was carried out.

- Upheaval buckling and thaw settlement effect assessments were included on the basis of an educated guess; no engineering analysis was carried out for the assessment of frequencies to be expected for these effects.
- No Arctic effects were estimated for the wells, which were considered to blowout with frequencies the same as those for the GOM.

C.3 Scenarios

The scenarios are those developed for use in the MMS Alaska OCS Region Environmental Impact Statements for Oil and Gas Lease Sales. As estimated they appear reasonable and were incorporated in the form provided. There are two possible shortcomings of the scenarios as follows:

- Distributed values for the key quantities were not provided, thus precluding their incorporation as distributions in the Monte Carlo analysis.
- The facility abandonment rate is significantly lower than the rate of decline in production.

C.4 Fault Tree Methodology

Generally, the fault tree methodology was limited primarily by the shortcomings in input data discussed above.

- The primary method for assessing uncertainties was restricted to the fault tree module, which incorporates the uncertainties or bounds assigned to the Arctic effects. The treatment of uncertainties could be expanded to incorporate distributions in volume of spills, and the original historical frequencies.
- The treatment of uncertainties was carried out utilizing a Monte Carlo process, which requires an add-in (called @Risk[®]) to the Excel spreadsheet within which the algorithms have been programmed. For some users, this might be slightly arcane; accordingly, it may be desirable to have two versions, the Monte Carlo version which gives more rigorous results and is used for results in the body of this report, and an expected value version, which may be utilized for rough estimates. Appendix C gives the detailed results and calculations for the Monte Carlo model; Appendix D gives those from the expected value model.
- The Monte Carlo results give higher oil spill occurrence indicators than the expected value results. This is due to the skewness of the Arctic effect distributed values, which are inputs to the Monte Carlo calculations.

C.5 Limitations of Indicators Generated

The following comments can be made on limitations associated with the indicators that have been generated.

- The indicators have inherited the deficiencies in the input and scenario data noted above. Indicators should be viewed primarily as trend indicators of the expected values and their distributions for Arctic developments.
- The indicator distribution shows relatively small variability – this is primarily because the only variability introduced is that of the Arctic effects.
- The model generating the indicators is fundamentally a linear model which ignores the effects of scale, of time variations such as the learning and wear-out curves (Bathtub curve), and production volume non-linear effects.
- The expected value (simpler) calculation results (given in Appendix D) should be used with caution since they underestimate the spill indicators. The underestimation ranges from 3 to 76%. Appendix D gives all the expected value calculations. The body of the report is based on the Monte Carlo results given in Appendix C.

D. Recommendations

D.1 Recommendations on Direct Application of Results from This Study

The results of this study can be applied directly in two principal ways; namely, on an annual per barrel produced basis, and on a total production volume basis.

On an annual basis, the peak production year oil spill frequency per barrel produced can be used to calculate corresponding annual spill frequencies for other annual production rate scenarios. This is done simply by multiplying the appropriate spill frequency per billion barrels produced from Table 1 by the subject annual production rate.

To apply the results on a total production volume basis, the following steps can be used:

- For the desired spill size range and facility component (or all facilities), add together the annual spill frequencies for each year of the production life.
- Divide the sum of the frequencies by the total production volume. This provides the number of spills per barrel produced for the entire development.
- For another development, multiply the above spills per barrel produced by the other development's total production volume.
- The resultant is the expected number of spills of the desired spill size range and for the desired facility component for the total production life of the other development.

D.2 General Recommendations

The following recommendations based on the work may be made:

- Utilize the oil spill occurrence indicator model to generate additional model validation information, including direct application to specific non-Arctic scenarios, such as GOM projects, which have an oil spill statistical history.
- Utilize the oil spill occurrence indicator model in a sensitivity mode to identify the importance of different Arctic effect variables introduced to provide a prioritized list of those items having the highest potential impact on Arctic oil spills.
- Use GOM historical data together with its measures of spill size variance and setup the Monte Carlo model to run with these measures of spill size variance.
- Generalize the model so that it can be run both in an expected value and a distributed value (Monte Carlo) form with the intent that expected value form can be utilized without the Monte Carlo add-in for preliminary estimates and sensitivity analyses, while for more comprehensive rigorous studies, the Monte Carlo version can be used. All calculations in this report are based on the Monte Carlo version.
- Finally, convert the current oil spill occurrence indicator model into a user friendly software package, which can be used for the assessment of oil spill occurrence indicators and their characteristics for any designated scenario. The software package should include the following:
 - Modular structure
 - User manual
 - Online help
 - Password protected parameters and algorithms
 - Extensive graphical outputs

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GLOSSARY OF TERMS AND ACRONYMS

Acute Risk	Risk that has an immediate adverse effect due to a single accident such as an oil blowout.
ALARP	As Low as Reasonably Practicable
API	American Petroleum Institute
ARM	Availability, Reliability and Maintainability
BOP	Blowout Preventer
CDF	Cumulative Distribution Function
Chronic Risk	Risk that has an adverse effect only after long-term or repeated occurrences.
Consequence	The direct effect of an accidental event.
DJU	Drilling Jack-Up
ESD	Emergency Shutdown
ESDV	Emergency Shutdown Valve
FPSO	Floating Production and Storage Operation
GBS	Gravity Base Structure
GOM	Gulf of Mexico
H ₂ S	Hydrogen Sulfide
Hazard	A condition with a potential to create risks such as accidental leakage of natural gas from a pressurized vessel.
HT	High Temperature
HTHP	High Temperature, High Pressure
LFL	Lower Flammability Limit
MAOP	Maximum Allowable Operating Pressure. The highest pressure at which a pipeline or vessel can be operated considering design and regulatory conditions.
MMS	Minerals Management Service, Department of the Interior
Monte Carlo	A numerical method for evaluating algebraic combinations of statistical distributions.
MSL	Mean Sea Level
NOP	Normal Operating Pressure. The highest pressure at which a pipeline or vessel can be operated considering design conditions.
NPD	Norwegian Petroleum Directorate
OCS	Offshore Continental Shelf

OIM	Offshore Installation Manager
QRA	Quantitative Risk Assessment
Risk	A compound measure of the probability and magnitude of adverse effect.
ROV	Remotely Operated Vehicle
Spill Frequency	The number of spills of a given spill size range per year. Usually expressed as spills per 1,000 years (and so indicated).
Spill Frequency per Barrel Produced	The number of spills of a given spill size range per barrel produced. Usually expressed as spills per billion barrels produced (and so indicated).
Spill Index	The product of spill frequency for a given spill size range and the mean spill size for that spill size range.
Spill Occurrence	Characterization of an oil spill as an annual frequency and associated spill size or spill size range.
Spill Occurrence Indicator	Any of the oil spill occurrence characteristics; namely, spill frequency, spill frequency per barrel produced, or spill index (defined above).
Spill Sizes	Small (S) = 50 < 100 bbl Medium (M) = 100 < 1,000 bbl Large (L) = 1,000 < 10,000 bbl Huge (H) = 10,000 bbl
SPM	Single Point Mooring
SSIV	Sub-Sea Isolation Valve
SSSV	Subsurface Safety Valve
UFL	Upper Flammability Limit
UKCS	UK Continental Shelf

CHAPTER 1

INTRODUCTION

1.1 General Introduction

The MMS Alaska OCS Region uses oil spill occurrence predictions for National Environmental Protection Act assessments for all parts of their area of jurisdiction, ranging from onshore through shallow water, to deeper water. In 1999-2000, a study, OCS Study MMS 2000-007 [22]^{*}, was carried out to collate readily available information on oil industry spills in the Alaska and North Slope and Arctic Canada, to verify spill information for spills of at least 500 barrels and to estimate provisional spill rates for use in the near shore Beaufort Sea OCS. Based on this study, MMS estimated pipeline and facility spill rates from Alaskan North Slope and Trans-Alaska Pipeline onshore oil spill experience to shallow coastal waters and the near shore Beaufort Sea. However, as water depth increases and one moves further from shore, extrapolation of these statistics is not necessarily valid due to the change in operational modes and environmental conditions. There are no adequate historical statistics to characterize spill rates in deeper waters in the Beaufort and Chukchi Seas, for forthcoming lease areas.

Accordingly, MMS implemented the present study to develop and apply alternative methodologies for the assessment of oil spill rates associated with exploration and production facilities and operations in deeper waters in the Chukchi and Beaufort Seas. The prediction of the reliability (or failure) of systems without history can be approached through a variety of mathematical techniques, the most preferable and accepted being fault trees [2, 7, 10, 11, 14, 15, 18, 23, 26, 45, 51, 65], and their possible combination with numerical distribution methods such as Monte Carlo simulation. In the current study, fault tree methodology was applied to the prediction of oil spill rates for oil and gas developments such as those now operational or contemplated for the Beaufort and Chukchi Seas in the Alaska OCS, and used to generate predictions of oil spill occurrence indicators.

1.2 Study Objectives

The objectives of this study are as follows:

- Assimilate and analyze world-wide and US OCS oil spill statistics and evaluate their applicability to deeper lease tracts which could be offered in the upcoming Beaufort Sea sales or in subsequent Chukchi Sea sales.
- Develop the fault tree method for estimating oil spill occurrences from Beaufort Sea and Chukchi Sea developments associated with spills less than and greater than 1,000 bbl.

^{*} Numbers in square brackets refer to citations listed in the “References” section of this report.

- Using the fault tree approach, develop alternative oil spill indicators and assess their robustness.
- Provide statistical support to MMS in evaluation of statistical issues in estimation of oil spill rates.

1.3 Study Area Definition

The geographical study area is the offshore continental shelf in the U.S. Chukchi and Beaufort Seas, as generally illustrated in Figure 1.1. Of interest is the offshore area from landfall to approximately the 60-meter isobath. This area is selected due to the possibility of future oil and gas development within it, based on potential leases. Although a depth greater than 60 meters was originally contemplated as part of the study area, the analysis of development scenarios has indicated that it is highly unlikely that any oil and gas developments will take place in depths greater than 60 meters. More details on the leases and the geology of the study area are described in several MMS publications [35, 36, 37, 38, 39].

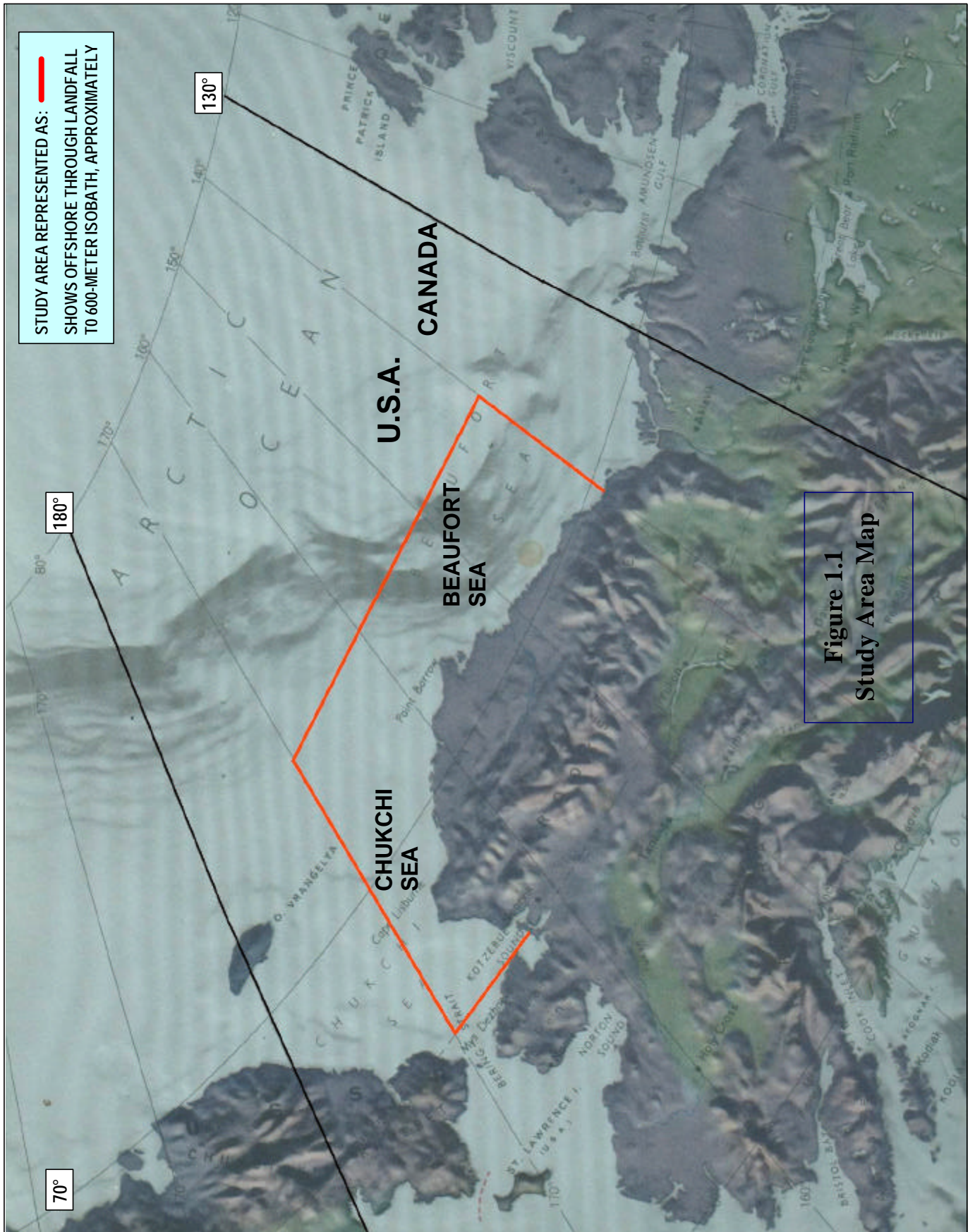
Temporally, the study scenarios investigated span into the future by nearly half a century from the present to Year 2038.

1.4 Scope of Work

The scope of work has been subdivided functionally into seven principal tasks as follows:

- Tasks 1 to 4 are the definitive study tasks and are reported in the present report in the Chapters indicated above.
- Task 5 is a service task directed at facilitating the transfer of technology from this study to MMS staff.
- Task 6 is simply the coordination and management process applied throughout.
- Task 7 is reporting. Four Progress Reports were issued throughout the study, but all salient aspects of them are incorporated in this Final Report, so that they need not be referenced.

The general relationship among the principal technical tasks is shown in Figure 1.2. Essentially, following the start-up procedure of the study, including final scope definition and refinement in Task 1, two parallel tasks, Tasks 2 and 3, were conducted. Task 2 dealt with the assimilation of historical data, while Task 3 dealt with the projection of future development scenarios for the next 40 years more or less. Next, the analytical aspects of the work were contained under Task 4, which was subdivided into Task 4A, the fault tree spill frequency analysis, and Task 4B, the oil spill indicator quantification. Task 5 consists of statistical consulting services to MMS. Task 6 entails coordination of the entire project. This report constitutes the principal output from Task 7.



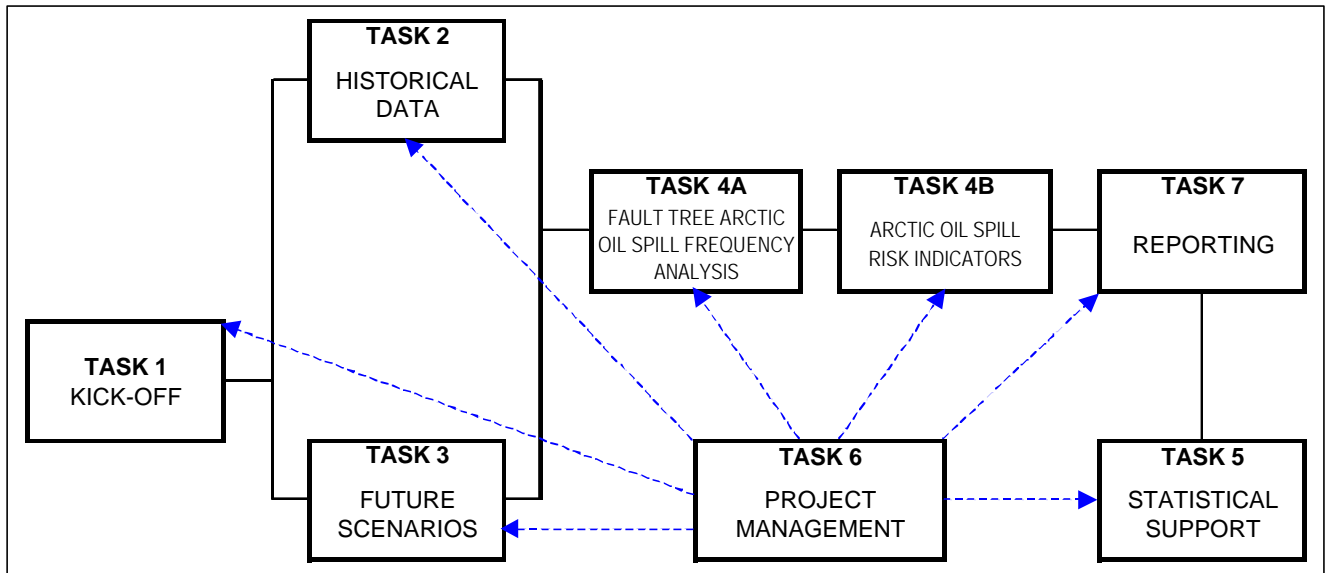


Figure 1.2
Work Flow Schematic

1.5 Work Organization

The present study consisted of statistical and engineering investigations, followed by extensive numerical analysis. Although the assimilation of historical and future scenario data is of indisputable significance to the work, the salient contribution consisted primarily of the analytical work involving fault trees and oil spill occurrence indicator generation. Although the individual calculations are relatively simple, the subdivision of the calculations into realistic representative categories of facilities, spill sizes, and water depth for several development scenarios resulted in a relatively complex mix of computations, generally illustrated in the flow chart in Figure 1.3. Moving from left to right; initially historical data were obtained for each of three principal facility categories, pipelines, platforms, and wells. These facility quantities are referred to as “hazard scenarios”, since they are considered to be the primary source of oil spill hazard. Pipelines were further subdivided among < 10 inch and = 10 inch diameter lines. Wells were categorized in two ways: according to producing (production) wells and the drilling (D) of exploration and development wells. For each of the above facility subcategories, spill causes were analyzed for small, medium, large, and huge spills, defined as follows:

- Small (S) - = 50 < 100 bbl
- Medium (M) - = 100 < 1,000 bbl
- Large (L) - = 1,000 < 10,000 bbl
- Huge (H) - = 10,000 bbl

For those spills greater than 10,000 bbl, the term ‘huge spill’ has been introduced to permit unique designation of each spill category by one letter, rather than the more customary terminology of ‘very large’ which would require two letters.

In the interests of conciseness and clarity, the above four categories of spill sizes will generally be designated by either their name (small, medium, large, huge) or, when space is limited, by their acronym (S, M, L, H), in the balance of this report.

Next, in the frequency analysis utilizing fault trees, each of three representative water depth ranges was assessed as follows:

- Shallow - < 10 meters
- Medium - = 10 < 30 meters
- Deep - = 30 < 60 meters

Although originally it was anticipated that ‘very deep’ water would be considered, it was found that none of the development scenarios extended beyond the 60-meter isobath.

A total of six different future development scenarios were defined, four for the Beaufort Sea, and two for the Chukchi Sea. Each scenario was described for each year in its development history, as far as the year 2038 for the longest duration scenarios. In addition, a hypothetical scenario for comparative purposes was developed for each study sub-region on the assumption that it was located in a non-Arctic area. This permitted the comparison of the spill indicator results with and without the application of the fault tree analysis to account for Arctic effects.

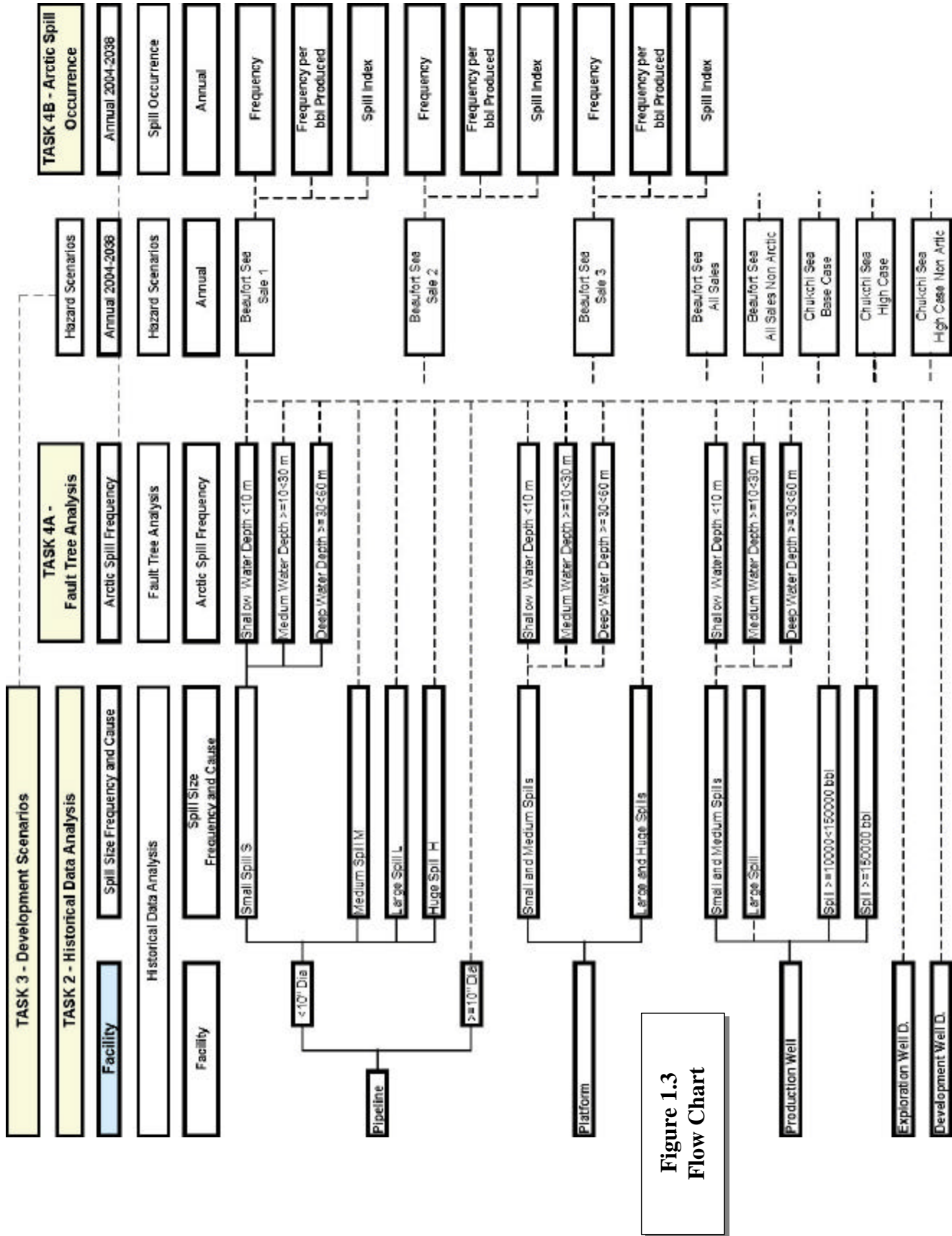


Figure 1.3
Flow Chart

Finally, for each of the combinations considered, three Arctic oil spill occurrence indicators were generated, as follows:

- Oil spill frequency
- Oil spill frequency per barrel produced
- Spill index, which is the product of the oil spill frequency and the mean spill size (for the particular category under consideration)

The flow chart in Figure 1.3, of course, does not show all the different combinations and permutations; rather, it indicates the typical calculations for one case, and suggests the balance by dotted lines. The total number of spill indicator quantifications conducted was 1,728 for each year of the scenario development profile, or approximately 60,000 indicators.

1.6 Outline of Report

Following this brief introductory chapter, Volume I of the final report addresses each of the principal tasks and subtasks in its logical sequence. Accordingly, Chapter 2 describes the historical data assimilation and analysis, Chapter 3 defines the future development scenarios to be utilized, Chapter 4 deals with the fault tree analysis to obtain Arctic oil spill frequencies, while Chapter 5 summarizes the results of the oil spill occurrence indicator computations and their distributions. Chapter 6 summarizes conclusions and recommendations including a section on the benefits and shortcomings of the present study. Extensive references and bibliography are given in the References.

The appendices given in Volume II form an integral part of the work for the reader who wishes to learn about background and calculation details. Accordingly, Appendix A summarizes the historical data assimilated and analyzed. Because Chapter 2, on historical data, is restricted to the data actually utilized in the present computations, Appendix A will be of interest to readers wanting a more comprehensive view of oil spill occurrence statistics including those from other parts of the world as well as ones associated with tanker traffic and operations. Appendix B gives details on the future development scenarios utilized as a basis for the study. Appendix C gives a printout of all the calculation steps utilized in the development of the Arctic oil spill occurrence indicators using the Monte Carlo approach; Appendix D gives the corresponding calculations for the expected value approach.

CHAPTER 2

HISTORICAL DATA

2.1 Approaches to Historical Data

Historical data on offshore oil spills were utilized as a numerical starting point for predicting Arctic offshore oil spill characteristics. Because a statistical history on Arctic offshore oil spills does not exist, oil spill histories for temperate offshore locations were utilized. Although Arctic offshore exploration and production was started in the early 1970s, operations have been sporadic, with very few spills, so that a statistical history cannot be generated.

The following data sets or databases were reviewed:

- (a) Gulf of Mexico (GOM) Offshore Continental Shelf (OCS) Pipeline Spills (1972-1999)
- (b) GOM OCS Platform Spills (1972-1999)
- (c) North Sea Pipeline Spills (1980-1995)
- (d) Crude Oil Tanker Spills, Worldwide (1964-1999)
- (e) Above Ground Storage Tank Spills, Worldwide (1980-1995)
- (f) Gas Blowouts, Worldwide (1955-1993)
- (g) Oil Blowouts, Worldwide (1955-1995)

All of the above categories of data are discussed and summarized in Appendix A. The contents of the balance of this chapter are restricted to the presentation and discussion of only those data sets utilized in the balance of the present study. Specifically, the data sets in categories (a), (b), and (g) were selected. None of the development scenarios considered here (see Chapter 3) included tankers; hence, (d) data were not required. Gas blowouts (f) are also not part of this study. Above ground storage tank spills (e) are included in platform spills (b). And finally, the pipeline spill data in category (a) contained a more appropriate level of detail than that from the North Sea in category (c).

2.2 Pipeline Oil Spill Data

The MMS database called *PPL_REPAIRS* was used as a basis for the assessment of subsea pipeline oil spills. This database contains records of all reported spills in the GOM. The database was used to obtain spill records for spills of 50 bbl or more between January 1st, 1972 and December 31st, 1999. The 31 spills reported in this date range were further subdivided into volume, pipeline diameter, pipeline segment length, and pipeline segment depth ranges as summarized in Table 2.1.

Table 2.1
GOM OCS Pipeline Spills Summary (1972-1999)

GOM OCS Pipeline Spills, Categorized 1972-99		Spill Statistics**			Exposure (km-years)	Frequency (spill per 10 ⁴ km-yr)
		Number of Spills	Average Volume (bbl)	Median Volume (bbl)		
By Pipe Diameter	<10"	16	2141	173	142,892	1.1197
	=10"	15	4070	1211	111,011	1.3512
By Pipeline Minimum Depth	Bad Depth Data*	14				
	< 10 m	6	2310	1211	161,966	0.3704
	= 10 m	11	3165	1040	94,641	1.1623
By Segment Length	< 0.5 km	0	0	0	2,359	0.0000
	= 0.5 < 2 km	2	2335	2335	25,484	0.7848
	= 2 < 5 km	7	820	100	35,279	1.9842
	= 5 km	22	3859	850	192,270	1.1442
By Spill Size***	Small	6	58	50	253,903	0.2363
	Medium	12	317	230	253,903	0.4726
	Large	10	4133	4267	253,903	0.3939
	Huge	3	16611	15576	253,903	0.1182
By Diameter, By Spill Size						
<10"	Small	4	58	50	142,892	0.2799
	Medium	7	266	135	142,892	0.4899
	Large	4	4436	4551	142,892	0.2799
	Huge	1	14423	14423	142,892	0.0700
= 10"	Small	2	58	58	111,011	0.1802
	Medium	5	387	312	111,011	0.4504
	Large	6	3932	3600	111,011	0.5405
	Huge	2	17705	17705	111,011	0.1802

* 14 of the 31 records have both MIN_WATER_DEPTH and MAX_WATER_DEPTH set to "0".

** Exposure comes from an analysis of PPL_MASTERS database as published by MMS on February 15, 2001.

*** Spill Sizes:

- Small (S) - = 50 < 100 bbl
- Medium (M) - = 100 < 1,000 bbl
- Large (L) - = 1,000 < 10,000 bbl
- Huge (H) - = 10,000 bbl

Next, 31 GOM OCS pipeline spill records were reviewed and analyzed for causal and spill size distributions. In particular, it was necessary to analyze spill frequencies for spills less than and greater than 1,000 bbl. Table 2.2 shows the summary of the record information, while Table 2.3 summarizes the spill cause distributions for two spill size ranges (small and medium, large and huge).

2.3 Platform Spill Data

Platform spills in the MMS database are given for the period from 1972 to 1999. The platform spill data are given with an exposure of producing well-years. As for pipelines, the spill records themselves were accessed in order to obtain the correlation between spill cause and spill size. Table 2.4 shows the results of the causal and spill size distribution analysis, while Table 2.5 gives the causal distribution as well as the spill frequency per 10,000 well-years.

In order to assess spill occurrence from platform facilities, using the above per well-year frequency, it is necessary to estimate the number of wells per platform. The number of production wells given in each scenario was distributed equally among the production platforms specified (by MMS) for this study.

2.4 Well Oil Blowout Data

The development scenarios considered under this study include the drilling of exploratory and development wells, and the process of producing oil from production wells [12, 69]. Table 2.6 shows a summary of well drilling blowout oil spill data generated in support of the Northstar and Liberty oil development projects [52]. Table 2.7 gives the statistics for production wells. The combination of these statistics together with the cumulative distribution function for oil blowout releases given in [59], generated in support of the Northstar project, permits a blowout spill volume frequency distribution as summarized in Table 2.8. It should be noted that the exposure factor or frequency unit varies between the well drilling activities (where it is per well) and the production activities (where it is per well-year).

2.5 Arctic Effects Historical Data

2.5.1 General Approaches to the Quantification of Arctic Effects

There are essentially two main categories of Arctic effects; namely, those that are unique to the Arctic, such as marine ice effects, and those that are the same types of effects as those in temperate areas, but occurring with a different frequency, such as anchor impacts on subsea pipelines. The first will be termed “unique” effects; the second, “modified” effects. Modified Arctic effects are dealt with in conjunction with the fault tree analysis described in Chapter 4. Only those Arctic effects or hazards unique to the Arctic, and potentially having a historical occurrence database, such as ice gouging, are discussed in the balance of this section.

Table 2.2
Analysis of GOM OCS Spill Data for Causal Distribution and Spill Size

CAUSE CLASSIFICATION	# OF SPILLS	SPILL SIZE BBL										NUMBER OF SPILLS					
		1	2	3	4	5	6	7	8	9	10	S	M	L	H	SM	LH
		CORROSION	4											1	2	1	
External	1	80										1				1	
Internal	3	100	5000	414									2	1		2	1
THIRD PARTY IMPACT	16											2	5	6	3	7	9
Anchor Impact	10	19833	65	50	300	900	323	15576	2000	800	1211	2	4	2	2	6	4
Jackup Rig or Spud Barge	1	3200												1			1
Trawl/Fishing Net	5	4000	100	14423	4569	4533							1	3	1	1	4
OPERATION IMPACT	4											3		1		3	1
Rig Anchoring	1	50										1				1	
Work Boat Anchoring	3	50	5100	50								2		1		2	1
MECHANICAL	2												2			2	
Connection Failure	1	135											1			1	
Material Failure	1	210											1			1	
NATURAL HAZARD	4											1	1	2		2	2
Mud Slide	3	250	80	8212								1	1	1		2	1
Storm/ Hurricane	1	3500												1			1
ARCTIC																	
Ice Gouging																	
Strudel Scour																	
Upheaval Buckling																	
Thaw Settlement																	
Other																	
UNKNOWN	1	119											1			1	
TOTALS	31											7	11	10	3	18	13

Table 2.3
Causal and Spill Size Distribution of GOM OCS Pipeline Spills (1972-1999)

CAUSE CLASSIFICATION	Small and Medium Spills				Large and Huge Spills						
	HIST. DISTRIBUTION (%)	# OF SPILLS	EXPOSURE (km-yr)	FREQUENCY (spill per 10 ⁴ km-yr)	HIST. DISTRIBUTION (%)	# OF SPILLS	EXPOSURE (km-yr)	FREQUENCY (spill per 10 ⁴ km-yr)			
CORROSION	16.67	3	253903	0.1182	7.69	1	253903	0.0394			
External	5.56	1		0.0394							
Internal	11.11	2		0.0788				7.69	1		0.0394
THIRD PARTY IMPACT	38.89	7		0.2757				69.23	9		0.3545
Anchor Impact	33.33	6		0.2363				30.77	4		0.1575
Jackup Rig or Spud Barge								7.69	1		0.0394
Trawl/Fishing Net	5.56	1		0.0394				30.77	4		0.1575
OPERATION IMPACT	16.67	3		0.1182				7.69	1		0.0394
Rig Anchoring	5.56	1		0.0394							
Work Boat Anchoring	11.11	2		0.0788				7.69	1		0.0394
MECHANICAL	11.11	2		0.0788							
Connection Failure	5.56	1		0.0394							
Material Failure	5.56	1		0.0394							
NATURAL HAZARD	11.11	2		0.0788				15.38	2		0.0788
Mud Slide	11.11	2		0.0788				7.69	1		0.0394
Storm/ Hurricane								7.69	1		0.0394
ARCTIC											
Ice Gouging											
Strudel Scour											
Upheaval Buckling											
Thaw Settlement											
Other											
UNKNOWN	5.56	1		0.0394							
TOTALS	100.00	18		0.7089	100.00	13		0.5120			

Table 2.4
Analysis of GOM OCS Platform Spill Data for Causal Distribution and Spill Size
(1972-1999)

CAUSE CLASSIFICATION	# OF SPILLS	SPILL SIZE BBL													NUMBER OF SPILLS					
		1	2	3	4	5	6	7	8	9	10	11	12	13	S	M	L	H	SM	LH
		PROCESS FACILITY RLS.	13	130	50	120	104	60	1456	125	50	50	55	400	280	75	6	6	1	
STORAGE TANK RLS.	3	9935	7000	435												1	2		1	2
STRUCTURAL FAILURE	1	58													1				1	
HURRICANE/STORM	2	75	66												2				2	
COLLISION	2	600	108													2			2	
ARCTIC																				
- Ice Force																				
- Facility Low Temperature																				
- Other																				
TOTALS	21														9	9	3		18	3

Table 2.5
Causal and Spill Size Distribution of GOM OCS Platform Spills (1972-1999)

CAUSE CLASSIFICATION	Small and Medium Spills				Large and Huge Spills			
	HIST. DISTRIBUTION (%)	# OF SPILLS	EXPOSURE (well-yr)	FREQUENCY (spill per 10 ⁴ well-yr)	HIST. DISTRIBUTION (%)	# OF SPILLS	EXPOSURE (well-yr)	FREQUENCY (spill per 10 ⁴ well-yr)
PROCESS FACILITY RLS.	66.67	12	119714	1.0024	33.33	1	119714	0.0835
STORAGE TANK RLS.	5.56	1		0.0835	66.67	2		0.1671
STRUCTURAL FAILURE	5.56	1		0.0835				
HURRICANE/STORM	11.11	2		0.1671				
COLLISION	11.11	2		0.1671				
TOTALS	100.00	18		1.5036	100.00	3		0.2506

Table 2.6
Well Drilling Blowout Oil Spill Statistics

Event	Historical Frequency	Experience
Development drilling blowout with oil spill > 10,000 bbl	7.8×10^{-5} /wells drilled	worldwide, 1970 - present
Exploration drilling blowout with oil spill > 10,000 bbl	1.5×10^{-4} /wells drilled	worldwide, 1970 - present
Development drilling blowout with oil spill > 150,000 bbl	3.9×10^{-5} /wells drilled	worldwide, 1970 - present
Exploration drilling blowout with oil spill > 150,000 bbl	5.5×10^{-5} /wells drilled	worldwide, 1970 - present

Table 2.7
Producing Well Blowout Oil Spill Statistics

Event	Historical Frequency	Experience
Blowout during production and workovers involving some oil discharge >1 bbl	6.5×10^{-5} /well-years	U.S. OCS, 1964 - 1995
Production/workover blowout with oil spill > 10,000 bbl	2.5×10^{-5} /well-year	worldwide, 1970 - present
Production/workover blowout with oil spill > 150,000 bbl	1.0×10^{-5} /well-year	worldwide, 1970 - present

Table 2.8
Oil Spill Size Distribution for Well Blowouts

EVENT	FREQUENCY UNIT	SPILL SIZE				
		Small & Medium	Large	Small, Medium, & Large	Spill = 10,000 < 150,000 bbl	Spill = 150,000 bbl
		HISTORICAL FREQUENCY				
PRODUCTION WELL	spill per 10^5 well-years	0.50	3.50	4.00	1.50	1.00
EXPLORATION WELL DRILLING	spill per 10^5 wells	3.16	22.11	25.27	9.50	5.50
DEVELOPMENT WELL DRILLING	spill per 10^5 wells	1.30	9.08	10.38	3.90	3.90

2.5.2 Ice Gouging

Ice gouging occurs when a moving ice feature contacts the sea bottom and penetrates into it, generally as it moves against a positive sea bottom slope. The ice feature can be a multiyear ridge, a hummock, or ice rafting formation. Various studies have been conducted on the frequency and depth distribution of ice gouges [8, 27, 29, 30, 46, 67, 68], and a number of assessments of the likelihood of resultant subsea pipeline failure [8, 29] have also been carried out. Pipeline failure frequencies at different water depth regimes as a result of ice gouging in this study have been estimated on the basis of the historical ice gouge characteristics [29] together with an analytical assessment [8, 68] of their likelihood to damage a pipeline.

According to Weeks [67, 68], a relationship between the expected probability of pipeline failure from ice gouging and ice gouging local characteristics may be expressed as follows:

$$N = e^{-kx} H_S ? F ? T ? L_P ? \sin? \quad (2.1)$$

Where:

- N = Number of pipeline failures at burial depth of cover x (meters)
- k = Inverse of mean scour depth (m^{-1})
- H_S = Probability of pipeline failure given ice gouge impact or hit
- F = Scour flux per km-yr
- L_P = Length of pipeline (km)
- $?$ = Gouge orientation (degrees) from pipeline centerline

For the Northstar project, according to [30], the mean scour depth is 0.4 m giving a k factor of 2.5. In addition, a good estimate of scour flux for shallow water is 4 gouges/km-yr. Using an average pipeline depth of cover of 2.5 m, an average directional angle of 45° , a conditional failure probability (H_S) of 0.8, gives a frequency of 5.23×10^{-6} /km-yr. For the purposes of the analysis, this frequency must be distributed among different spill size consequences. Due to the difficulty of containing spills under ice, one can expect that the majority of spills would be in the large and huge categories. However, huge spills would be limited by segment length. Thus, a conditional probability (given a spill) of 50% has been assigned to large spills, and one of 14% to huge spills. Least likely are small spills, and accordingly they have been given a probability of 13%. The remaining probability of 23% has been assigned to medium sized spills. The resultant distribution of expected frequencies of spill sizes associated with ice gouging is given in Table 2.9.

Also, high and low values have been assigned in order to permit an analysis of the likely distribution of the effects. Essentially, these variations in effect probability were obtained through a parametric sensitivity analysis using Equation 2.1 for a range of likely values of depth of cover from 2.0 m to 3.0 m (with an expected value of 2.5 m). These resultant low and high values are also summarized in Table 2.9. For medium water depth, an analogous process was carried out with a reduced gouge flux of 2 gouges/km-yr. For deep water (= 30 m) no gouging is expected.

Table 2.9
Summary of Arctic Effect Inputs

Cause Classification	Spill Size	Water Depth								
		Shallow			Medium			Deep		
		Frequency Increment per 10 ⁵ km-yr								
		Low	Expected	High	Low	Expected	High	Low	Expected	High
Ice Gouging	S	0.0060	0.0680	0.8290	0.0030	0.0340	0.4145			
	M	0.0090	0.1210	1.4670	0.0045	0.0605	0.7335			
	L	0.0210	0.2610	3.1900	0.0105	0.1305	1.5950			
	H	0.0060	0.0730	0.8930	0.0030	0.0365	0.4465			
Strudel Scour	S	0.0004	0.0012	0.0044						
	M	0.0006	0.0020	0.0078						
	L	0.0014	0.0045	0.0170						
	H	0.0004	0.0012	0.0048						
Upheaval Buckling	S	0.00007	0.00023	0.00088	0.00007	0.00023	0.00088	0.00007	0.00023	0.00088
	M	0.00013	0.00041	0.00156	0.00013	0.00041	0.00156	0.00013	0.00041	0.00156
	L	0.00028	0.00089	0.00340	0.00028	0.00089	0.00340	0.00028	0.00089	0.00340
	H	0.00008	0.00025	0.00095	0.00008	0.00025	0.00095	0.00008	0.00025	0.00095
Thaw Settlement	S	0.00004	0.00012	0.00044	0.00004	0.00012	0.00044	0.00004	0.00012	0.00044
	M	0.00006	0.00020	0.00078	0.00006	0.00020	0.00078	0.00006	0.00020	0.00078
	L	0.00014	0.00045	0.00170	0.00014	0.00045	0.00170	0.00014	0.00045	0.00170
	H	0.00004	0.00012	0.00048	0.00004	0.00012	0.00048	0.00004	0.00012	0.00048

2.5.3 Strudel Scour

When fresh water collecting on top of the ice sheet generally from rivers running into the Arctic seas, and drains through a hole in the ice, its hydrodynamic effect on the ocean floor below forms a depression which is called a strudel scour. Numerous studies have been conducted on strudel scour [29, 30], so that a prediction on the number of strudel scours per unit area can be made on the basis of historical data. Strudel scours are restricted to shallow water. With an average strudel scour frequency of 4 scours/mi² (1.5 scours/km²) [30], the methodology in [30] can be utilized to predict a possible failure rate of subsea pipelines in shallow waters due to strudel scour of approximately 8.9×10^{-8} /km-yr. Using reasoning similar to that for the distribution of spill sizes for ice gouging, and assigning limits based on parametric sensitivity studies, the distribution of strudel scour frequencies for shallow water as shown in Table 2.9 can be derived. Strudel scours are not expected in water depths greater than 10 m.

2.5.4 Upheaval Buckling

Upheaval buckling occurs in a pipeline as a result of its thermal expansion which causes it to buckle upwards to accommodate the extra length generated from thermal effects. Unfortunately, there appears to be no defensible analytical method for calculating the probability of upheaval buckling of Arctic subsea pipelines in general. Accordingly, upheaval buckling has been taken simply as a percentage of the strudel scour effects. Assuming that a upheaval buckling occurs 20% as often as strudel scour, the distribution shown in Table 2.9 can be derived. Upheaval buckling is expected to be independent of water depth; accordingly, the same values have been used for each water depth range.

2.5.5 Thaw Settlement

Thaw settlement occurs when a permafrost lens or formation over which the pipeline was installed melts as a result of the heat generated by the pipeline and ceases to support the pipeline so that the pipeline overburden loads the pipeline and causes it to deflect downwards. As for the case of upheaval buckling, writers are not aware of any method for defensibly calculating the probability of pipeline failures from thaw settlement. Accordingly, resort is again made to the percentage of a known phenomenon approach and thaw settlement has been assumed to occur at a rate equal to 10% of that associated with strudel scour. The resultant distribution is shown in Table 2.9. Like upheaval buckling, thaw settlement is expected to be independent of water depth.

CHAPTER 3

FUTURE DEVELOPMENT SCENARIOS

3.1 Approaches to Future Development Scenarios

For the purposes of the fault tree analysis utilized in this study, future offshore oil and gas development scenarios need to include the following characteristics:

- Water depth range, particularly for pipelines
- Physical quantities of individual facilities (e.g., production wells, pipelines) on an annual basis in correspondence with the baseline data exposure factors (e.g., per well year or per km-yr)
- Associated oil production volumes
- Other characteristics such as pipeline diameter or type of well drilled

Table 3.1 shows the Classification of Development Scenarios by water depth range and operation type. The salient aspect of this classification is subdivision into water depth ranges among which Arctic hazard characteristics (such as ice gouging rates) may change. The following water depth categories have been used:

- Shallow - < 10 meters
- Medium - = 10 < 30 meters
- Deep - = 30 < 60 meters
- Very Deep - = 60 meters

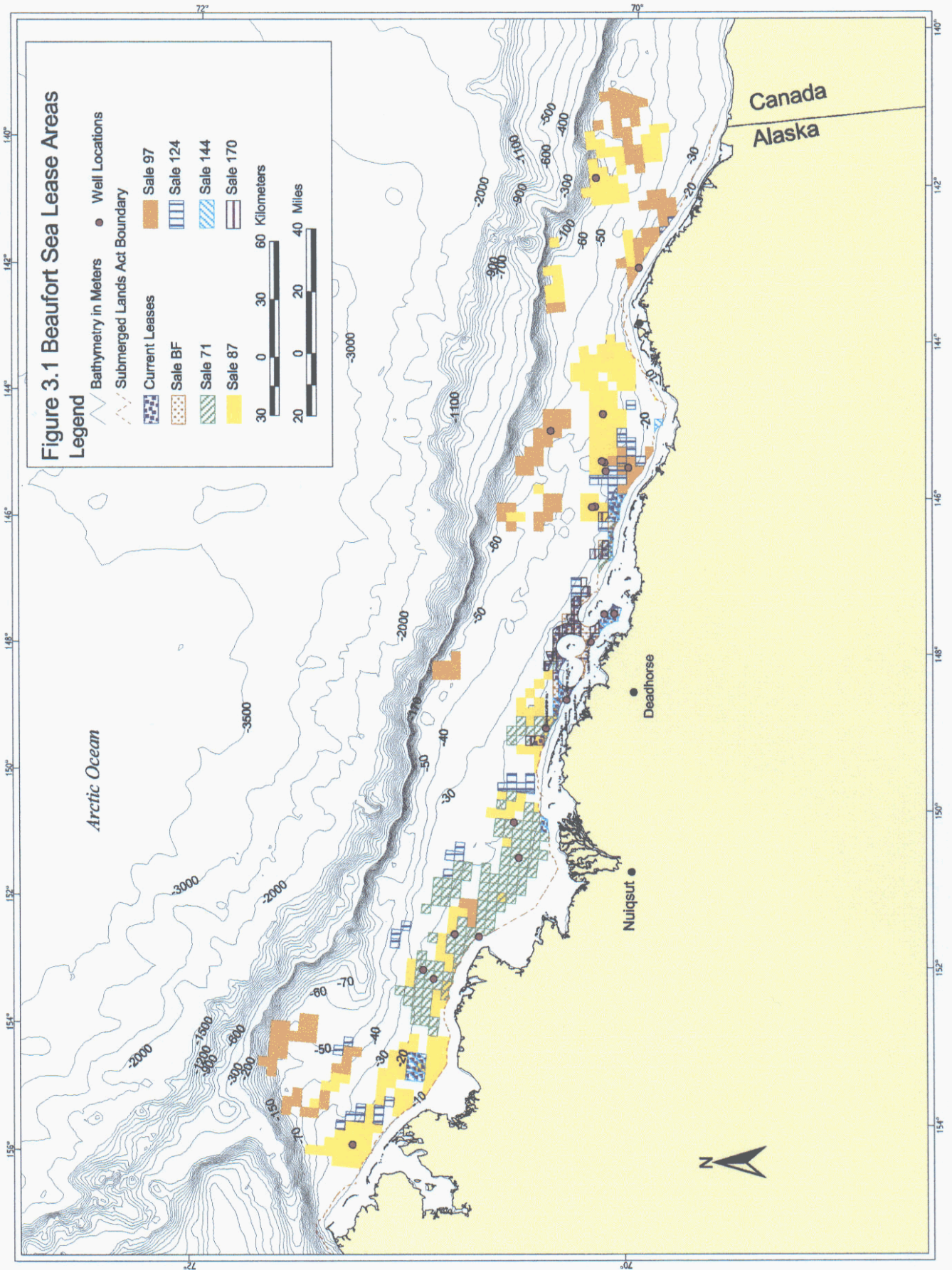
In Table 3.1, an indication is given of the types of facilities that might be utilized in each of the principal types of oil and gas activities, exploration, production, or transportation. As will be seen in this chapter, current forecasts for development scenarios over the next 40 years exclude very deep locations, in excess of 60 m. Accordingly, any suggestions for facilities under the very deep scenario would be speculative and will not be used in the current study.

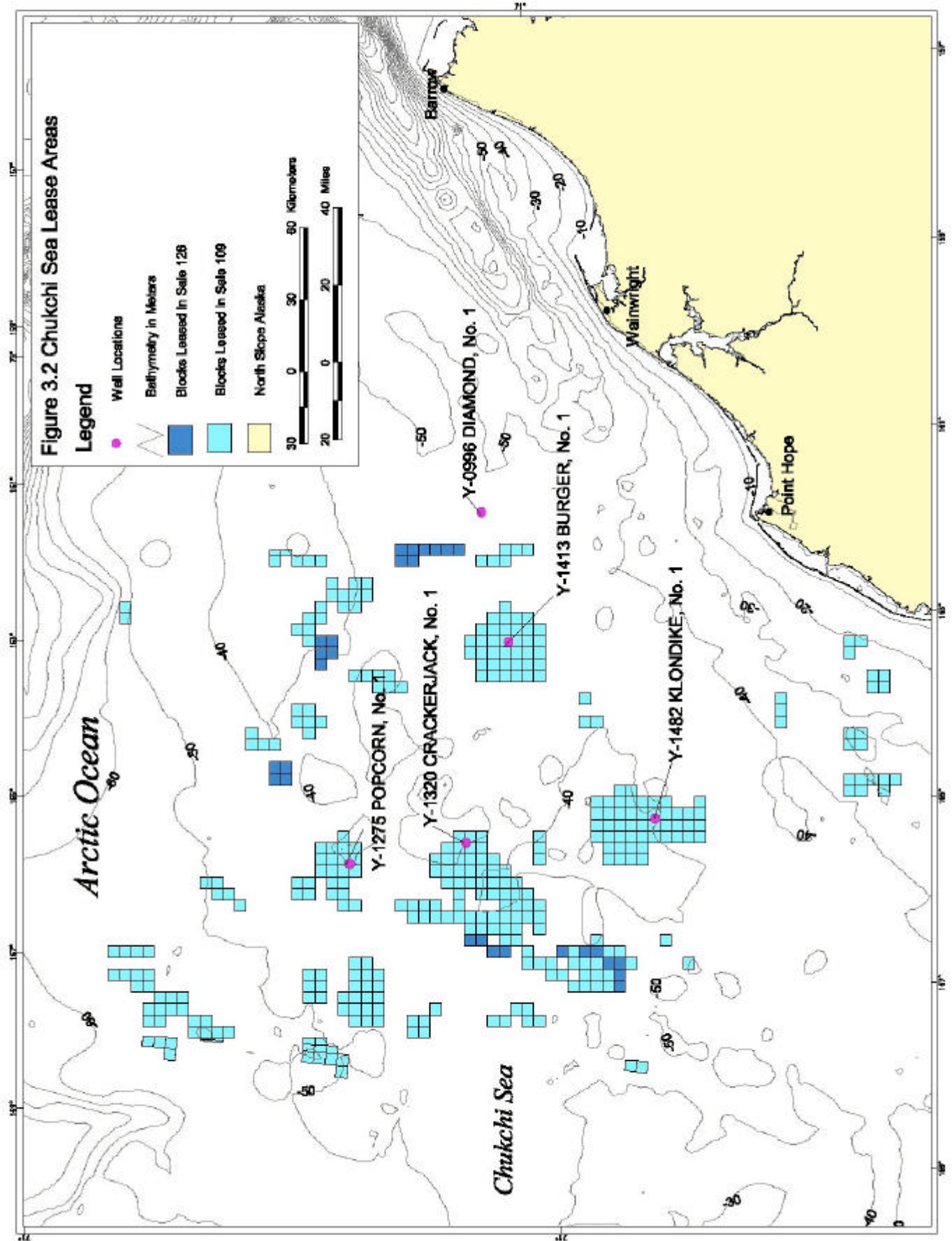
In general, the scenarios described in this chapter were developed to an appropriate level and type of detail to match the type of unit spill data and statistics available as a basis for the oil spill occurrence indicator quantification.

The principal regions of interest within the study area are the Beaufort Sea Lease Areas shown in Figure 3.1 and the Chukchi Sea Lease Areas illustrated in Figure 3.2.

Table 3.1
Classification of Development Scenarios

PRINCIPAL ACTIVITY	WATER DEPTH (m)			
	SHALLOW (< 10)	MEDIUM (= 10 < 30)	DEEP (= 30 < 60)	VERY DEEP (= 60)
EXPLORATION	<ul style="list-style-type: none"> ▪ Artificial island ▪ Drill barge ▪ Ice island 	<ul style="list-style-type: none"> ▪ Artificial island ▪ Drill ship (summer) ▪ Caisson 	<ul style="list-style-type: none"> ▪ Drill ship (summer) ▪ Semisubmersible (summer) 	<ul style="list-style-type: none"> ▪ Drill ship (summer) ▪ Semisubmersible (summer)
PRODUCTION	<ul style="list-style-type: none"> ▪ Artificial island ▪ Caisson island 	<ul style="list-style-type: none"> ▪ Caisson island ▪ Gravity Base Structure (GBS) 	<ul style="list-style-type: none"> ▪ Caisson island ▪ Gravity Base Structure (GBS) 	<ul style="list-style-type: none"> ▪ New design structure ▪ Submarine habitat
TRANSPORT	<ul style="list-style-type: none"> ▪ Subsea pipeline 	<ul style="list-style-type: none"> ▪ Subsea pipeline 	<ul style="list-style-type: none"> ▪ Subsea pipeline ▪ Storage & tankers 	<ul style="list-style-type: none"> ▪ Subsea pipeline ▪ Submarine storage ▪ Icebreaking tankers ▪ Submarine tankers





3.2 Beaufort Sea Development Scenarios

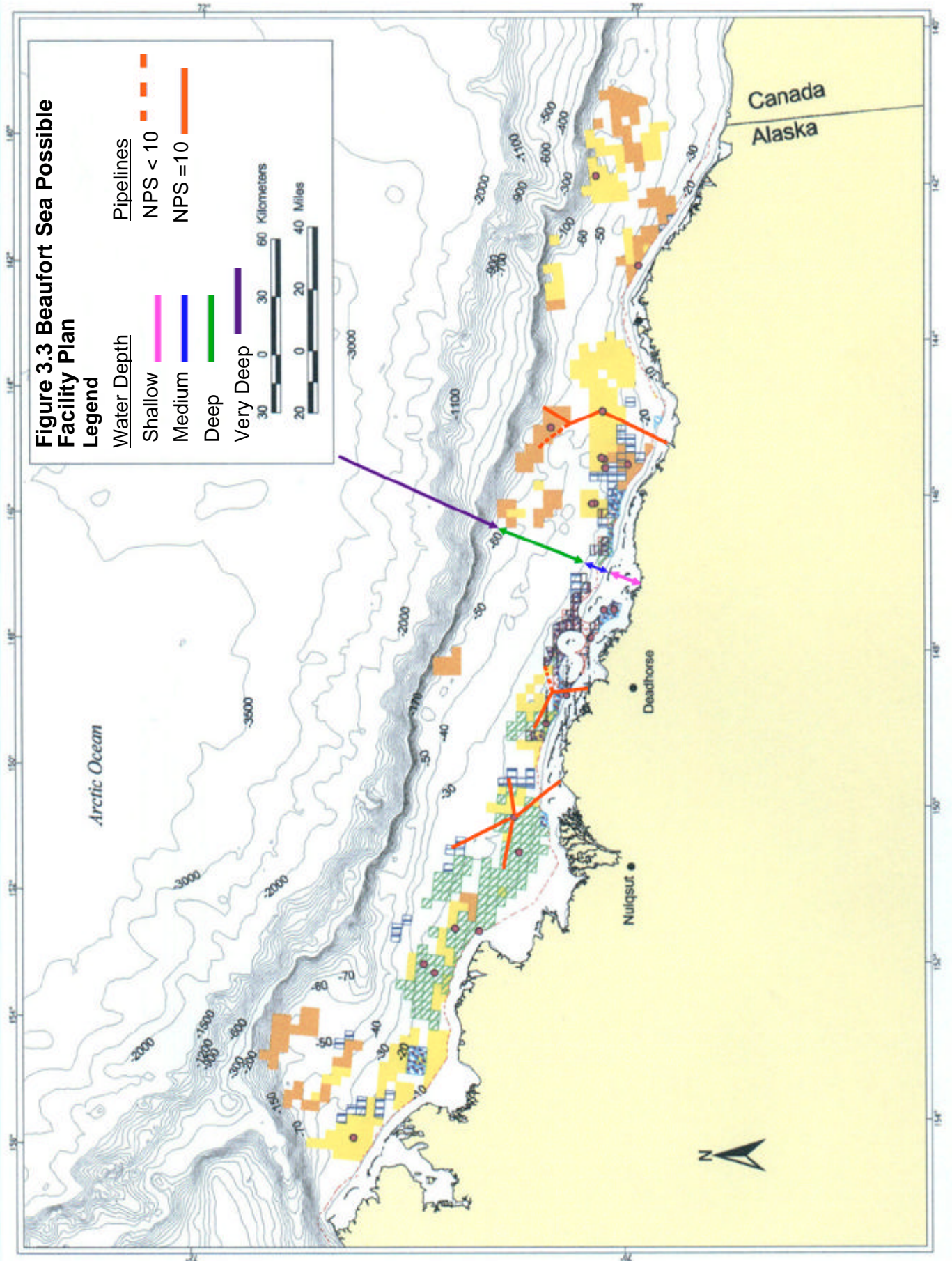
As a basis for the current analysis, the geographic and water depth distribution of the facilities and its variation over the life of the development is required in order to effectively incorporate the effects of Arctic operations on the oil spill occurrences. The obvious way to approach this, at least for an initial scenario, is to sketch a map of the possible geographic configuration of the facilities. Such a map, based on the composite Beaufort Sea (All Sale) scenario is shown in Figure 3.3. This location map also shows the four water depth zones – shallow, medium, deep, and very deep. As can be seen, no facilities are predicted in the very deep region. The details of the development scenarios, given in Appendix B, were generated by Alaska MMS personnel for three different Beaufort Sea Lease Sale alternatives, Sales 1, 2, and 3, and for a composite of all sales.

Table 3.2 summarizes the complete Beaufort Sea composite (Sale All) scenario including its temporal development from the present to Year 2038, at which time it is forecast to cease production. For items such as exploration and field delineation well drilling, the actual number of wells drilled in a given year were needed, since the statistics of well spill (blowouts) are on a per well drilled exposure unit. For items that continue from year to year, such as production wells or subsea pipelines, both the annual incremental and the cumulative total are needed. Specifically, the following facility quantities by water depth zone were estimated and distributed as shown in Table 3.2:

- Exploration wells drilled – annual
- Delineation wells drilled – annual
- Production platforms – annual increment and cumulative number
- Production/service wells – annual increment and cumulative number
- Pipeline quantities for NPS < 10, and NPS = 10, and total – annual increment and cumulative number of pipeline length in service
- Oil production volumes – annual

As noted above, these quantities match the type of unit spill data that can be made available through the analysis. For example, we have spill data by pipeline diameter only for lines < and = 10”, so a full spectrum of pipeline diameters would be redundant. The important aspect of the information in Table 3.2, however, is the distribution of the facilities by water depth, as there is a significant variation in Arctic hazards by water depth.

Similar tables were developed for Lease Sales 1, 2, and 3. These are given in detail in Appendix B. Peak production for the composite scenario occurs in Year 2020. Accordingly, Table 3.3 summarizes the quantities of facilities and their distribution by water depth for Year 2020, the maximum production year of the composite (Sale All) scenario.



**Table 3.2
Beaufort Sea All Sale Production Scenarios**

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Production Wells		In-use Pipeline Length [miles]						Production MMbbl
				Incr.	Cum.	Incr.	Cum.	Sum <10"		Sum >=10"		Sum All		
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2004	Shallow	1												
	Medium													
	Deep													
	Total	1												
2005	Shallow	1												
	Medium													
	Deep													
	Total	1												
2006	Shallow	1	2											
	Medium													
	Deep													
	Total	1	2											
2007	Shallow	2												
	Medium													
	Deep													
	Total	2												
2008	Shallow	1	2											
	Medium	1												
	Deep													
	Total	2	2											
2009	Shallow		2	1	1	3	3							
	Medium	1												
	Deep													
	Total	1	2	1	1	3	3							
2010	Shallow	1			1	10	13			10	10	10	10	10.9
	Medium	1	2											
	Deep													
	Total	2	2		1	10	13			10	10	10	10	10.9
2011	Shallow			1	2	13	26			10		10		19.9
	Medium													
	Deep													
	Total			1	2	13	26			10		10		19.9
2012	Shallow			1	3	13	39			10	20	10	20	30.8
	Medium	2												
	Deep	1												
	Total	3		1	3	13	39			10	20	10	20	30.8
2013	Shallow				3	20	59			15	35	15	35	50.7
	Medium	1	3											
	Deep	1												
	Total	2	3		3	20	59			15	35	15	35	50.7
2014	Shallow				3	10	69			35		35		56.2
	Medium		4	1	1	3	3							
	Deep													
	Total		4	1	4	13	72			35		35		56.2

Table 3.2 - continued

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Production Wells		In-use Pipeline Length [miles]						Production MMbbl
				Incr.	Cum.	Incr.	Cum.	Sum<10"		Sum >=10"		Sum All		
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2015	Shallow				3		69			10	45	10	45	53.3
	Medium		2		1	10	13			10	10	10	10	10.9
	Deep	1												
	Total	1	2		4	10	82			20	55	20	55	64.2
2016	Shallow				3		69			45		45	47.5	
	Medium			1	2	13	26			10		10	19.9	
	Deep													
	Total			1	5	13	95			55		55	67.4	
2017	Shallow				3		69			10	55	10	55	39.1
	Medium			1	3	13	39	5	5	10	20	15	25	38.3
	Deep	1												
	Total	1		1	6	13	108	5	5	20	75	25	80	77.4
2018	Shallow				3		69			55		55	32.3	
	Medium			1	4	24	63		5	20		25	50.6	
	Deep	1												
	Total	1		1	7	24	132		5	75		80	82.9	
2019	Shallow				3		69			15	70	15	70	26.7
	Medium			1	5	24	87	5	10	15	35	20	45	77.9
	Deep													
	Total			1	8	24	156	5	10	30	105	35	115	104.6
2020	Shallow				3		69			70		70	22.0	
	Medium				5	20	107		10	35		45	82.8	
	Deep													
	Total				8	20	176		10	105		115	104.8	
2021	Shallow				3		69			70		70	18.1	
	Medium				5	20	127		10	35		45	80.5	
	Deep													
	Total				8	20	196		10	105		115	98.6	
2022	Shallow				3		69			70		70	15.0	
	Medium				5	10	137		10	35		45	74.2	
	Deep													
	Total				8	10	206		10	105		115	89.2	
2023	Shallow				3		69			70		70	12.5	
	Medium				5		137		10	35		45	68.9	
	Deep													
	Total				8		206		10	105		115	81.4	
2024	Shallow				3		69			70		70	10.4	
	Medium				5		137		10	35		45	64.4	
	Deep													
	Total				8		206		10	105		115	74.8	
2025	Shallow			-1	2	-23	46		-10	60	-10	60	6.5	
	Medium				5		137		10	35		45	56.0	
	Deep													
	Total			-1	7	-23	183		10	-10	95	-10	105	62.5
2026	Shallow				2		46			60		60	5.5	
	Medium				5		137		10	35		45	48.6	
	Deep													
	Total				7		183		10	95		105	54.1	
2027	Shallow			-1	1	-23	23		-10	50	-10	50	2.4	
	Medium				5		137		10	35		45	42.2	
	Deep													
	Total			-1	6	-23	160		10	-10	85	-10	95	44.6
2028	Shallow			-1		-23			-15	35	-15	35		
	Medium				5		137		10	35		45	36.9	
	Deep													
	Total			-1	5	-23	137		10	-15	70	-15	80	36.9



Table 3.2 - continued

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Production Wells		In-use Pipeline Length [miles]						Production MMbbl
				Incr.	Cum.	Incr.	Cum.	Sum<10"		Sum >=10"		Sum All		
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2029	Shallow										35		35	
	Medium				5		137		10		35		45	32.2
	Deep													
	Total				5		137		10		70		80	32.2
2030	Shallow									-10	25	-10	25	
	Medium			-1	4	-23	114		10	-10	25	-10	35	25.8
	Deep													
	Total			-1	4	-23	114		10	-20	50	-20	60	25.8
2031	Shallow										25		25	
	Medium				4		114		10		25		35	22.6
	Deep													
	Total				4		114		10		50		60	22.6
2032	Shallow										25		25	
	Medium				4		114		10		25		35	19.7
	Deep													
	Total				4		114		10		50		60	19.7
2033	Shallow										25		25	
	Medium				4		114		10		25		35	17.2
	Deep													
	Total				4		114		10		50		60	17.2
2034	Shallow										25		25	
	Medium				4		114		10		25		35	15.1
	Deep													
	Total				4		114		10		50		60	15.1
2035	Shallow										25		25	
	Medium				4		114		10		25		35	13.2
	Deep													
	Total				4		114		10		50		60	13.2
2036	Shallow									-10	15	-10	15	
	Medium			-2	2	-46	68	-5	5	-10	15	-15	20	8.3
	Deep													
	Total			-2	2	-46	68	-5	5	-20	30	-25	35	8.3
2037	Shallow										15		15	
	Medium				2		68		5		15		20	7.3
	Deep													
	Total				2		68		5		30		35	7.3
2038	Shallow										15		15	
	Medium				2		68		5		15		20	6.5
	Deep													
	Total				2		68		5		30		35	6.5

Table 3.3
Summary of Development Scenarios for Year 2020¹

Sale	Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Production Wells		Prod. / Serv. Wells	In-use Pipeline Length [miles]						Production [MMbbl]	
					Incr.	Cum.	Incr.	Cum.		Sum<10"		Sum >=10"		Sum All			
										Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		
1	2020	Shallow				2			46					30		30	12.8
		Medium				1			23					10		10	13.5
		Deep															
		Total					3			69					40		40
2	2020	Shallow				1			23					25		25	9.2
		Medium				2			46		5			10		15	30.7
		Deep															
		Total					3			69		5			35		40
3	2020	Shallow												15		15	
		Medium				2	20		38		5			15		20	38.6
		Deep															
		Total					2	20		38		5			30		35
ALL	2020	Shallow				3			69					70		70	22.0
		Medium				5	20		107		10			35		45	82.8
		Deep															
		Total					8	20		176		10			105		115

¹ Year 2020 is the maximum production year for All Sale scenario.

3.3 Chukchi Sea Development Scenarios

The data for the Chukchi Sea development scenarios was based on Lease Sale 126 [38] publication. Two scenarios were selected; the base case mid point and the high case mid point, given in that publication.

Figure 3.4 shows a possible pipeline and facility plot plan corresponding to the base case mid point facility peak production (Year 2007) quantities.

The Chukchi Sea base case mid point scenario facility quantities, up to Year 2010, are given in Table 3.4, while the high case mid point scenario is provided in Table 3.5.

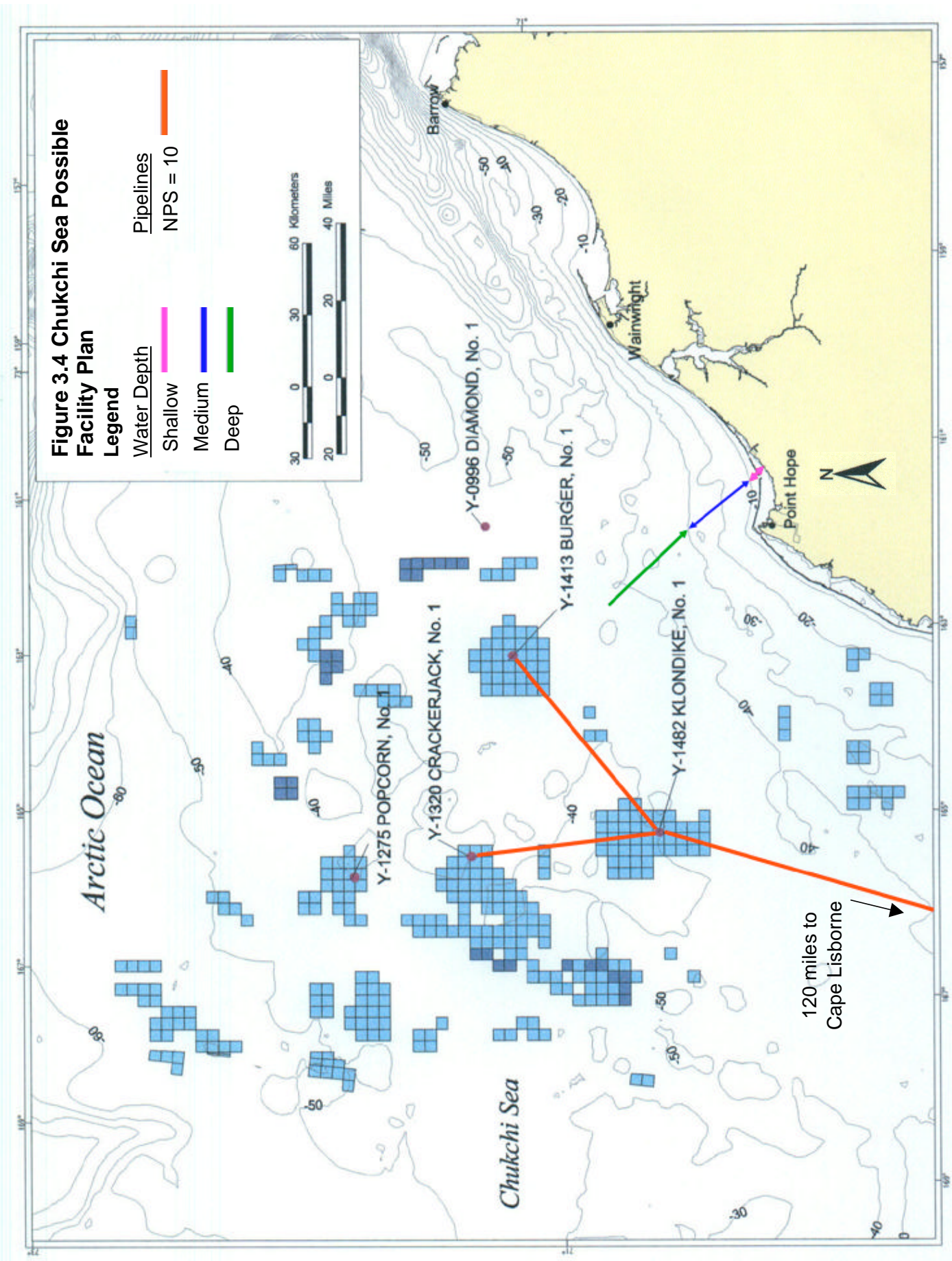


Table 3.4
Chukchi Sea Base Case Mid Point Development Scenario

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Prod./Serv. Wells		Pipeline Length [miles]						Production MMbbl	
				Incr.	Cum.	Incr.	Cum.	Sum <10"		Sum >=10"		Sum All			
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		
1998	Shallow														
	Medium														
	Deep	2	2												
	Total	2	2												0
1999	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep									135	135	135	135		
	Total									200	200	200	200		0
2000	Shallow									5		5			
	Medium									60		60			
	Deep			2	2	8	8			135		135			
	Total			2	2	8	8			200		200			0
2001	Shallow									5		5			
	Medium									60		60			
	Deep			2	4	40	48			135		135			
	Total			2	4	40	48			200		200			0
2002	Shallow									5		5			
	Medium									60		60			
	Deep			2	6	60	108			135		135			
	Total			2	6	60	108			200		200			101
2003	Shallow									5		5			
	Medium									60		60			
	Deep				6	80	188			135		135			
	Total				6	80	188			200		200			135
2004	Shallow									5		5			
	Medium									60		60			
	Deep				6	26	214			135		135			
	Total				6	26	214			200		200			135
2005	Shallow									5		5			
	Medium									60		60			
	Deep				6		214			135		135			
	Total				6		214			200		200			135
2006	Shallow									5		5			
	Medium									60		60			
	Deep				6		214			135		135			
	Total				6		214			200		200			135
2007	Shallow									5		5			
	Medium									60		60			
	Deep				6		214			135		135			
	Total				6		214			200		200			135
2008	Shallow									5		5			
	Medium									60		60			
	Deep				6		214			135		135			
	Total				6		214			200		200			119
2009	Shallow									5		5			
	Medium									60		60			
	Deep				6		214			135		135			
	Total				6		214			200		200			103
2010	Shallow									5		5			
	Medium									60		60			
	Deep				6		214			135		135			
	Total				6		214			200		200			92

Table 3.5
Chukchi Sea High Case Mid Point Development Scenario

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Prod./Serv. Wells		Pipeline Length [miles]						Production MMbbl	
				Incr.	Cum.	Incr.	Cum.	Sum<10"		Sum >=10"		Sum All			
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		
1998	Shallow														
	Medium														
	Deep	3	1												
	Total	3	1												0
1999	Shallow														
	Medium														
	Deep	2	1												
	Total	2	1												0
2000	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep	2		2	2					135	135	135	135		
	Total	2		2	2					200	200	200	200		0
2001	Shallow										5		5		
	Medium										60		60		
	Deep			6	8	50	50				135		135		
	Total			6	8	50	50				200		200		0
2002	Shallow										5		5		
	Medium										60		60		
	Deep			4	12	80	130				135		135		
	Total			4	12	80	130				200		200		0
2003	Shallow										5		5		
	Medium										60		60		
	Deep					12	140	270			135		135		
	Total					12	140	270			200		200		223
2004	Shallow										5		5		
	Medium										60		60		
	Deep					12	140	410			135		135		
	Total					12	140	410			200		200		297
2005	Shallow										5		5		
	Medium										60		60		
	Deep					12	72	482			135		135		
	Total					12	72	482			200		200		297
2006	Shallow										5		5		
	Medium										60		60		
	Deep					12		482			135		135		
	Total					12		482			200		200		297
2007	Shallow										5		5		
	Medium										60		60		
	Deep					12		482			135		135		
	Total					12		482			200		200		297
2008	Shallow										5		5		
	Medium										60		60		
	Deep					12		482			135		135		
	Total					12		482			200		200		297
2009	Shallow										5		5		
	Medium										60		60		
	Deep					12		482			135		135		
	Total					12		482			200		200		262
2010	Shallow										5		5		
	Medium										60		60		
	Deep					12		482			135		135		
	Total					12		482			200		200		227

CHAPTER 4

FAULT TREE ANALYSIS FOR ARCTIC OIL SPILL FREQUENCIES

4.1 General Description of Fault Tree Analysis

Fault trees are a method for modeling the occurrence of failures. They are used when an adequate history to provide failure statistics is not available. Developed initially by Rasmussen for the US Nuclear Regulatory Commission in the early 1970s [65, 51], fault trees have become a popular risk analytic tool for predicting risks, assessing relative risks, and quantifying comparative risks [2, 7, 9, 14, 15, 18, 23, 26, 45]. In 1976, fault trees were first used by Bercha to quantify oil spill probabilities in the Canadian Beaufort Sea for the Canadian Department of the Environment [10, 11]. In the present study they are used for the transformation of historical spill statistics for non-Arctic regions to predictive spill statistics for Arctic regions in the study area.

4.2 Fault Tree Methodology

4.2.1 *Fault Tree Analysis Basics*

The basic symbols used in the graphic depiction of simple (as used here) fault tree networks are illustrated in Figure 4.1. As may be seen, the two types of symbols designate logic gates and event types. The basic fault tree building blocks are the events and associated sub-events, which form a causal network. The elements linking events are the AND and OR gates, which define the logical relationship among events in the network. The output event from an OR gate occurs if any one or more of the input events to the gate occurs. The output event from an AND gate occurs only if all the input events occur simultaneously.

The basic structure of a fault tree is illustrated in Figure 4.2. Because of their connection through an AND gate, Event D and Event E must both occur for the resultant Event B to occur. An OR gate connects Events B and C; therefore, the occurrence of either one or both of Events B and C results in the occurrence of the resultant Event A. As may be seen, the principal fault tree structures are easy to apply; however, the representation of complex problems often requires very large fault trees, which become more difficult to analyze and require more advanced techniques such as minimal cut-set analysis [2, 14, 18, 23, 51]. For the present application, a simple system connected through OR gates only will be used.

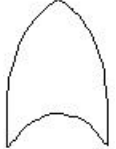
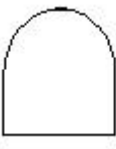


SYMBOL	DESCRIPTION
A. LOGIC	
	EITHER / OR GATE
	AND GATE
B. EVENT	
	RESULTANT EVENT
	BASIC EVENT

Figure 4.1
Basic Fault Tree Symbol Legend

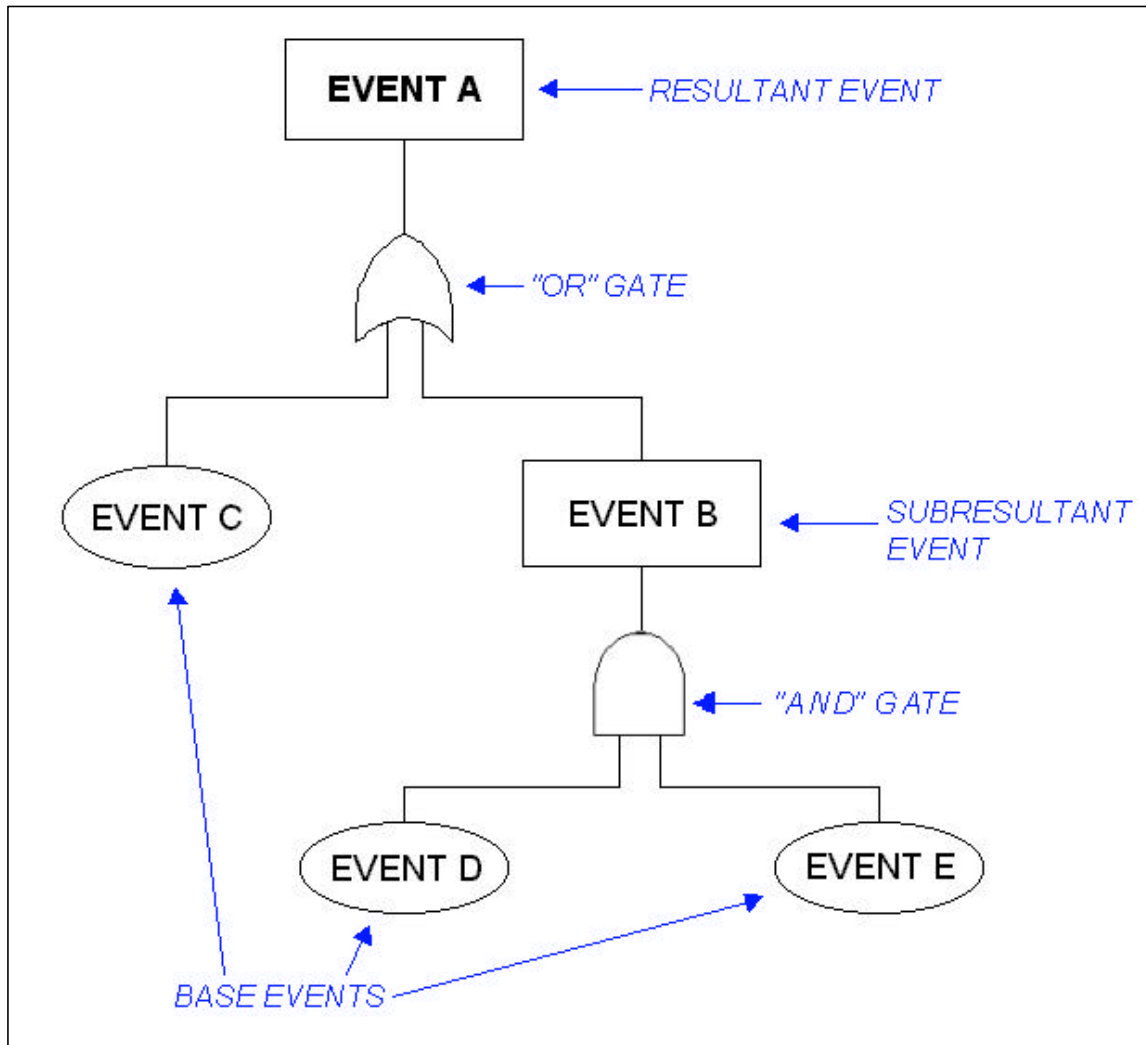


Figure 4.2
Basic Fault Tree Structure

Computationally, the probability of input events joined through an AND gate are multiplied to calculate the probabilities of the output event. The probabilities of input events joined through an OR gate are added to calculate the probability of the output event. The relevant equations and associated assumptions may be summarized as follows:

$$\text{For AND Gate: } P = \prod_{i=1}^n P_i \quad (4.1a)$$

Example: Output Event Probability = P_x
Input Events failure probabilities, P_1, P_2, \dots

$$P_x = P_1(P_2)(P_3) \quad (4.1b)$$

$$\text{For OR Gate: } P = 1 - \prod_{i=1}^n (1 - P_i) \quad (4.2a)$$

Example: Output Event Probability = P_y
Input Event failure probabilities, P_1, P_2, \dots

$$P_y = 1 - \prod_{i=1}^n (1 - P_i)(1 - P_2)(1 - P_3)$$

$$P_y = P_1 + P_2 + P_3; P_i \leq 0.1 \quad (4.2b)$$

In more complex fault trees, it is necessary to assure that base events which affect more than one fault tree branch are not numerically duplicated. This is done through the use of minimal cut-set theory [2, 14, 18, 23, 51]. However, as indicated earlier, the fault trees used in this study are sufficiently simple in structure and level of detail to exclude the requirement of using minimal cut-set theory in their computation algorithms.

4.2.2 Current Application of Fault Trees

Figure 4.3 illustrates a two-tier fault tree that can be used to develop pipeline large spill frequencies for the Arctic study area from the historical frequencies. Note that this example is illustrative of the process only, and does not correspond to the same numerical values used in computations later. The type of fault tree shown, to be used extensively later, is a relatively simple fault tree showing the resultant event, the spill, generated from a series of subresultant events corresponding to the pipeline spill causal classification introduced earlier in Tables 2.2 and 2.9. The upper tier of numbers (marked “H”) below each of the events in the fault tree represents the historical frequency (per 100,000 km-yr) while the lower one (marked “A”) represents the modified frequency for Arctic operations. As these fault trees are composed entirely of OR gates, the computation of resultant events is quite simple – consisting of the addition of the probabilities of events at each level of the fault tree to obtain the resultant probability at the next higher value. For example, to obtain the “Natural Hazard” Arctic (“A”) probability of 0.151, add 0.043 and 0.108. Essentially, the fault tree resultant (top event) shows that the Arctic frequency of spills (for the example pipeline category, location, and spill size) is approximately 1 in 100,000 km-yr or 1.015×10^{-5} /km-yr. The non-Arctic historical frequency for this spill size, by comparison, is 2.799×10^{-5} /km-yr, or approximately 2.8 times higher.

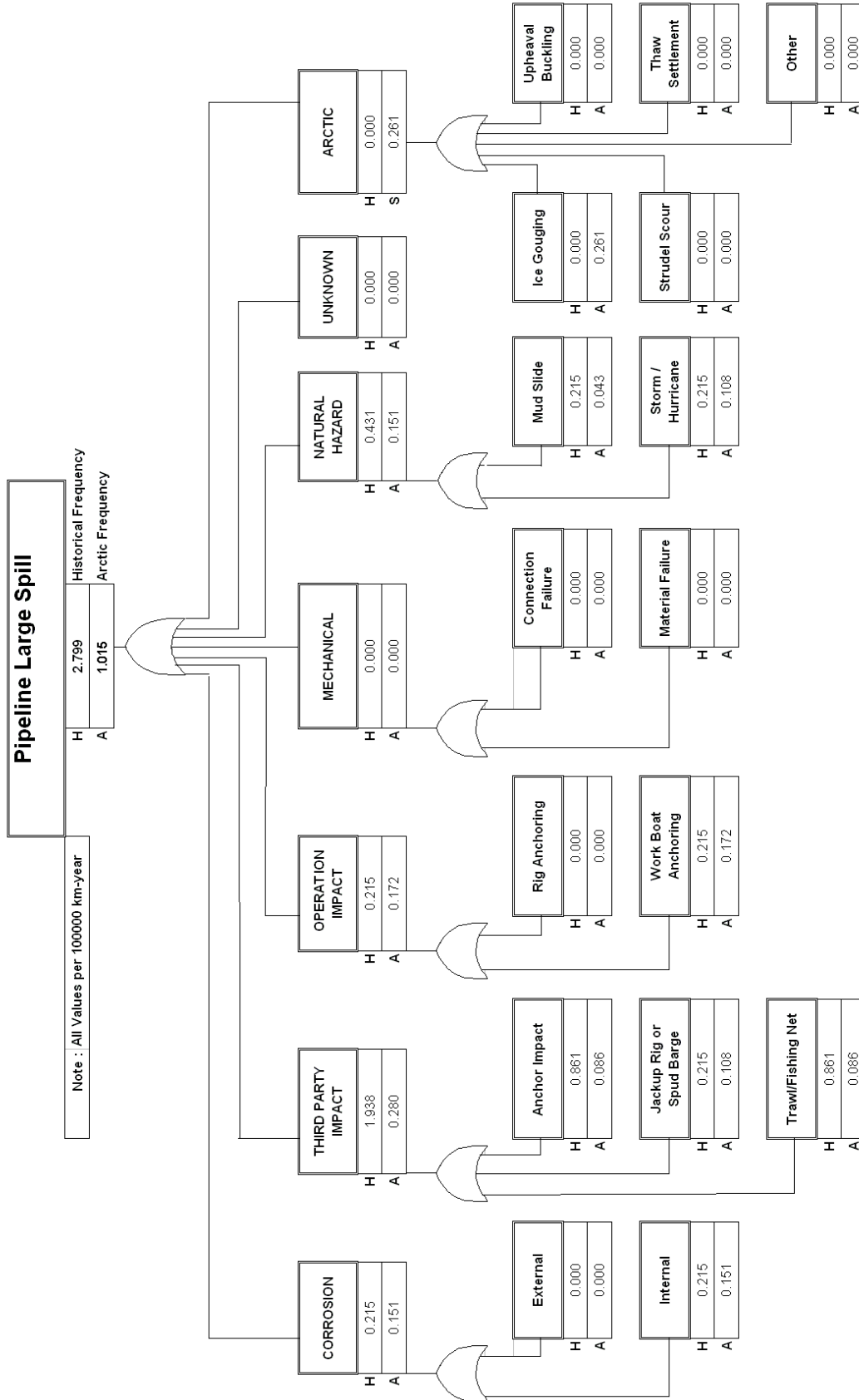


Figure 4.3 Example of Fault Tree to Transform Historical (GOM) to Arctic Spill Frequencies¹

¹ The input data used here are only illustrative and do not represent the inputs used later in this study.

4.3 Pipeline Fault Tree Analysis

4.3.1 Fault Tree Inputs

The effects of the Arctic environment and operations are reflected in the effect on facility failure rates in two ways; namely, through “Modified Effects”, those changing the frequency component of certain fault contributions such as anchor impacts which are common in both Arctic and temperate zones, and through “Unique Effects” or additive elements such as ice gouging which are unique to the Arctic offshore environment. Table 4.1 shows the frequency modifications (in %) and frequency increment additions (per 10⁵ km-yr) developed for Arctic pipelines for different spill sizes throughout the three relevant water depth ranges. The right hand column of the table gives a summary of the reasoning behind the effects. For the Arctic unique effects, both the expected value (from Table 2.9) and the median value, determined through the Monte Carlo analysis, are given. The median values differ from the expected values due to skewness of the distributions introduced through the assigned values of the upper and lower bounds (Table 2.9). The following comments can be made for each of the causes described:

- *External corrosion* – Due to the low temperature, limited biological and lowered chemical effects are expected. Coatings will be state of art and high level of quality control will be used during pipeline installation resulting in high integrity levels of coating to prevent external corrosion.
- *Internal corrosion* – Additional (above historical levels) inspection or smart pigging is anticipated.
- *Anchor impact* – The very low traffic densities of third party shipping in the area justify a 90% reduction in anchor impact expectations on the pipeline.
- *Jack-up rig or spud barges* – Associated or other operations are going to be substantially more limited than they are in the historical data population in the Gulf of Mexico.
- *Trawl/Fishing net* – Very limited fishing is expected in the Beaufort Sea. A slight increase in fishing activity might be justifiable in the case of the Chukchi, but this was not done here.
- *Rig anchoring* – Although it is anticipated that no marine traffic except possibly icebreakers will occur during the ice season, an increased traffic density during the four month open water season to resupply the platforms is expected, justifying only a 20% decrease in this failure cause.
- *Workboat anchoring* – The same applies to workboat anchoring as to rig anchoring.
- *Mechanical connection failure or material failure* – No change was made to account for Arctic effects.
- *Mudslide* – A relatively low gradient resulting in limited mudslide potential is anticipated. A gradual increase in the mudslide potential (reflected by smaller decreases in failure frequency) ranging from 80% for shallow water to only 40% in deep water was included to account for the anticipated increase in gradient as deeper waters are encountered.

**Table 4.1
Pipeline Fault Tree Analysis Input Rationalization**

CAUSE CLASSIFICATION	Spill Size	Shallow	Medium	Deep	Reason
		Frequency Change %			
ARCTIC MODIFIED					
CORROSION					
External	All	(50)	(50)	(50)	Limited temperature and bio effects. Extra smart pigging.
Internal	All	(30)	(30)	(30)	Extra smart pigging.
THIRD PARTY IMPACT					
Anchor Impact	All	(90)	(90)	(90)	Low traffic.
Jackup Rig or Spud Barge	All	(50)	(50)	(50)	Low facility density.
Trawl/Fishing Net	All	(90)	(90)	(90)	Low fishing activity.
OPERATION IMPACT					
Rig Anchoring	All	(20)	(20)	(20)	No marine traffic during ice season (8 months).
Work Boat Anchoring	All	(20)	(20)	(20)	No work boat traffic during ice season (8 months).
MECHANICAL					
Connection Failure	All				
Material Failure	All				
NATURAL HAZARD					
Mud Slide	All	(80)	(60)	(40)	Gradient low. Mud slide potential (gradient) increases with water depth.
Storm/ Hurricane	All	(50)	(50)	(50)	Fewer severe storms.
ARCTIC UNIQUE		Freq. Inc. per 10⁵ km-yr			
		Median	Median	Median	
		Expected	Expected	Expected	
Ice Gouging	S	0.3495	0.1747		Ice gouge failure rate calculated using exponential failure distribution for 2.5-m cover, 0.2-m average gouge depth, 4 gouges per km-yr flux. Spill size Distribution explained in text Section 2.5.2
		0.0680	0.0340		
	M	0.6178	0.3089		
		0.1210	0.0605		
	L	1.3438	0.6719		
0.2610		0.1305			
Strudel Scour	S	0.0021			Only in shallow water. Average frequency of 4 scours/mile ² and 100 ft of bridge length with 10% conditional P/L failure probability. The same spill size distribution as above.
		0.0012			
	M	0.0038			
		0.0020			
	L	0.0082			
0.0045					
Upheaval Buckling	S	0.0004	0.0004	0.0004	All water depth. The failure frequency is 20% of that of Strudel Scour.
		0.0002	0.0002	0.0002	
	M	0.0008	0.0008	0.0008	
		0.0004	0.0004	0.0004	
	L	0.0016	0.0016	0.0016	
0.0009		0.0009	0.0009		
Thaw Settlement	S	0.0002	0.0002	0.0002	All water depth. The failure frequency is 10% of that of Strudel Scour.
		0.0001	0.0001	0.0001	
	M	0.0004	0.0004	0.0004	
		0.0002	0.0002	0.0002	
	L	0.0008	0.0008	0.0008	
0.0004		0.0004	0.0004		
Other	S	0.0881	0.0438	0.0002	To be assessed as 25% of above.
		0.0174	0.0086	0.0001	
	M	0.1557	0.0775	0.0003	
		0.0309	0.0153	0.0002	
	L	0.3386	0.1686	0.0006	
0.0667		0.0330	0.0003		
H	0.0948	0.0472	0.0002		
	0.0187	0.0092	0.0001		

- *Storms* – Considerably fewer severe storms are anticipated on an annual basis in the Arctic than in GOM, due to damping of the ocean surface by ice cover.
- *Arctic effects* – Arctic effects are effects which are unique to the Arctic and are not reflected in the historical fault tree itself. Arctic effects were discussed in detail in Chapter 2, Section 2.5. The discussion in that section is summarized in the right hand column of Table 4.1. The frequency increments in this table are given as both the “expected” values and the “median” values. The expected values are the expected values given in Table 2.9. The median values, however, are those calculated using the Monte Carlo method with the low, expected, and high values from Table 2.9, as inputs to the Monte Carlo. These median values are clearly considerably higher than the expected values. This lack of coincidence between expected and median values is due to the skewness of the distribution.

4.3.2 Arctic Pipeline Fault Tree Frequency Calculations

Incorporation of the frequency effects as variations in and additions to the historical frequencies can be represented in a fault tree, as shown for the large spill size for Arctic pipelines in Figure 4.4. In this figure, the historical frequency as well as that associated with small, medium, and deep-water zones are shown under each of the event boxes. Each box is further split into two, for pipelines < and = 10” diameter as represented in the historical database. Such fault trees were developed for all of the pipeline spill sizes, and these additional spill size fault trees, for small, medium, and huge spills are presented in Appendix C, where the complete calculations are given.

Of greatest importance, however, are the pipeline failure frequencies or failure rates per km-yr. These failure rates for the entire range of spill sizes, small, medium, large, and huge, are given in Tables 4.2, 4.3, 4.4, and 4.5, respectively.

Indeed, a huge array of numbers is shown in these tables. Consider Table 4.4 (page 4.12), which is the frequency calculation corresponding to the large spill size fault tree shown in Figure 4.4. Consider the bottom line opposite totals. What the table tells us is that the total spill frequency for pipelines less than 10” diameter was, as we well know, 2.799 (per 10⁵ km-yr) historically. With the frequency changes attributable to Arctic effects, this frequency is reduced to 2.636 for shallow water, to 1.812 for medium depth water, and to 1.015 for deep water. A similar trend in the reduction of failure frequencies with increasing water depth for pipelines greater than 10” is manifested in the right hand side of the table. Because the frequencies per unit pipeline length and operating year are the key drivers in the balance of the analysis, they have been given in the body of the report (in Tables 4.2 to 4.5) for each of the spill sizes for pipelines.

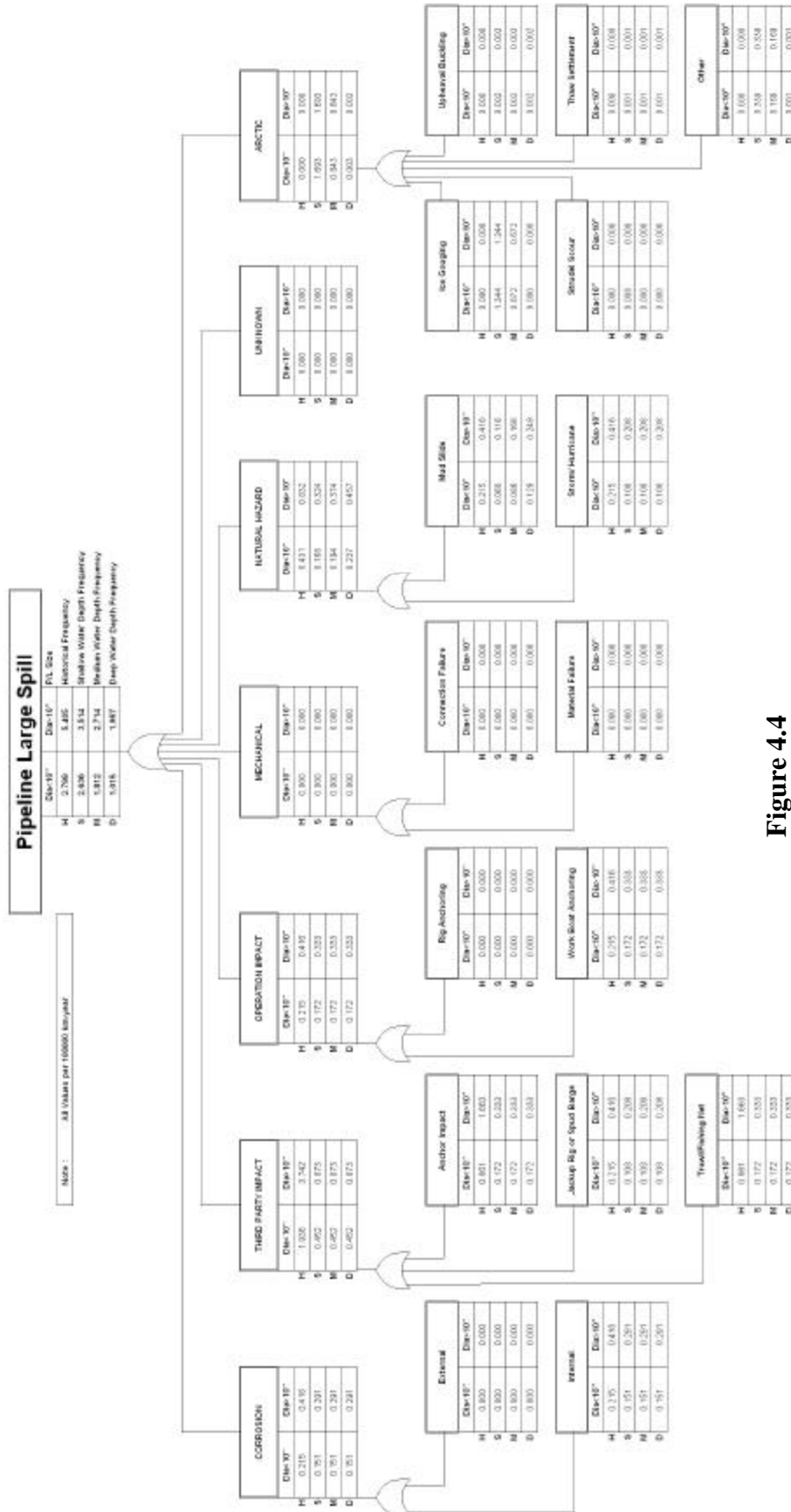


Figure 4.4
Large Spill Size Frequencies for Pipeline

**Table 4.2
Pipeline Small Spill Size Frequencies**

CAUSE CLASSIFICATION	HISTORICAL DISTRIBUTION %	SMALL SPILL*																			
		Pipeline Diameter <10"									Pipeline Diameter = 10"										
		FREQUENCY (spill per 10 ³ km-yr)	Shallow			Medium			Deep			FREQUENCY (spill per 10 ³ km-yr)	Shallow			Medium			Deep		
			Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %		Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
CORROSION	16.67	0.467	(0.171)	0.295	15.71	(0.171)	0.295	17.42	(0.171)	0.295	19.18	0.300	(0.110)	0.190	13.91	(0.110)	0.190	16.25	(0.110)	0.190	19.18
External	5.56	0.156	(0.078)	0.078	4.14	(0.078)	0.078	4.58	(0.078)	0.078	5.05	0.100	(0.050)	0.050	3.66	(0.050)	0.050	4.28	(0.050)	0.050	5.05
Internal	11.11	0.311	(0.093)	0.218	11.58	(0.093)	0.218	12.83	(0.093)	0.218	14.13	0.200	(0.060)	0.140	10.25	(0.060)	0.140	11.98	(0.060)	0.140	14.13
THIRD PARTY IMPACT	38.89	1.089	(0.871)	0.218	11.58	(0.871)	0.218	12.83	(0.871)	0.218	14.13	0.701	(0.561)	0.140	10.25	(0.561)	0.140	11.98	(0.561)	0.140	14.13
Anchor Impact	33.33	0.933	(0.746)	0.187	9.93	(0.746)	0.187	11.00	(0.746)	0.187	12.11	0.601	(0.480)	0.120	8.79	(0.480)	0.120	10.26	(0.480)	0.120	12.11
Jackup Rig or Spud Barge																					
Trawl/Fishing Net	5.56	0.156	(0.124)	0.031	1.65	(0.124)	0.031	1.83	(0.124)	0.031	2.02	0.100	(0.080)	0.020	1.46	(0.080)	0.020	1.71	(0.080)	0.020	2.02
OPERATION IMPACT	16.67	0.467	(0.093)	0.373	19.85	(0.093)	0.373	22.00	(0.093)	0.373	24.23	0.300	(0.060)	0.240	17.57	(0.060)	0.240	20.53	(0.060)	0.240	24.22
Rig Anchoring	5.56	0.156	(0.031)	0.124	6.62	(0.031)	0.124	7.33	(0.031)	0.124	8.08	0.100	(0.020)	0.080	5.86	(0.020)	0.080	6.84	(0.020)	0.080	8.07
Work Boat Anchoring	11.11	0.311	(0.062)	0.249	13.23	(0.062)	0.249	14.67	(0.062)	0.249	16.15	0.200	(0.040)	0.160	11.71	(0.040)	0.160	13.69	(0.040)	0.160	16.15
MECHANICAL	11.11	0.311		0.311	16.54		0.311	18.33		0.311	20.19	0.200		0.200	14.64		0.200	17.11		0.200	20.19
Connection Failure	5.56	0.156		0.156	8.27		0.156	9.17		0.156	10.10	0.100		0.100	7.32		0.100	8.55		0.100	10.09
Material Failure	5.56	0.156		0.156	8.27		0.156	9.17		0.156	10.10	0.100		0.100	7.32		0.100	8.55		0.100	10.09
NATURAL HAZARD	11.11	0.311	(0.224)	0.087	4.62	(0.187)	0.124	7.33	(0.124)	0.187	12.11	0.200	(0.144)	0.056	4.09	(0.120)	0.080	6.84	(0.080)	0.120	12.11
Mud Slide	11.11	0.311	(0.224)	0.087	4.62	(0.187)	0.124	7.33	(0.124)	0.187	12.11	0.200	(0.144)	0.056	4.09	(0.120)	0.080	6.84	(0.080)	0.120	12.11
Storm/ Hurricane																					
ARCTIC			0.440	0.440	23.42	0.219	0.219	12.92	0.001	0.001	0.05		0.440	0.440	32.21	0.219	0.219	18.74	0.001	0.001	0.08
Ice Gouging			0.3495	0.3495	18.59	0.1747	0.1747	10.30					0.3495	0.3495	25.56	0.1747	0.1747	14.93			
Strudel Scour			0.0021	0.0021	0.11								0.0021	0.0021	0.16						
Upheaval Buckling			0.0004	0.0004	0.02	0.0004	0.0004	0.03	0.0004	0.0004	0.03		0.0004	0.0004	0.03	0.0004	0.0004	0.04	0.0004	0.0004	0.04
Thaw Settlement			0.0002	0.0002	0.01	0.0002	0.0002	0.01	0.0002	0.0002	0.01		0.0002	0.0002	0.02	0.0002	0.0002	0.02	0.0002	0.0002	0.02
Other			0.0881	0.0881	4.68	0.0438	0.0438	2.58	0.0002	0.0002	0.01		0.0881	0.0881	6.44	0.0438	0.0438	3.75	0.0002	0.0002	0.02
UNKNOWN	5.56	0.156		0.156	8.27		0.156	9.17		0.156	10.10	0.100		0.100	7.32		0.100	8.55		0.100	10.09
TOTALS	100.00	2.799	(0.919)	1.880	100.00	(1.103)	1.697	100.00	(1.259)	1.540	100.00	1.802	(0.435)	1.367	100.00	(0.632)	1.170	100.00	(0.810)	0.992	100.00

* Small (S) - = 50 < 100 bbl

**Table 4.3
Pipeline Medium Spill Size Frequencies**

CAUSE CLASSIFICATION	HISTORICAL DISTRIBUTION %	MEDIUM SPILL*																			
		Pipeline Diameter <10"									Pipeline Diameter = 10"										
		FREQUENCY (spill per 10 ⁵ km-yr)	Shallow			Medium			Deep			FREQUENCY (spill per 10 ⁵ km-yr)	Shallow			Medium			Deep		
			Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %		Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
CORROSION	16.67	0.816	(0.299)	0.517	15.68	(0.299)	0.517	17.39	(0.299)	0.517	19.18	0.751	(0.275)	0.475	15.36	(0.275)	0.475	17.20	(0.275)	0.475	19.18
External	5.56	0.272	(0.136)	0.136	4.13	(0.136)	0.136	4.58	(0.136)	0.136	5.05	0.250	(0.125)	0.125	4.04	(0.125)	0.125	4.53	(0.125)	0.125	5.05
Internal	11.11	0.544	(0.163)	0.381	11.55	(0.163)	0.381	12.82	(0.163)	0.381	14.13	0.500	(0.150)	0.350	11.32	(0.150)	0.350	12.67	(0.150)	0.350	14.13
THIRD PARTY IMPACT	38.89	1.905	(1.524)	0.381	11.55	(1.524)	0.381	12.82	(1.524)	0.381	14.13	1.752	(1.401)	0.350	11.32	(1.401)	0.350	12.67	(1.401)	0.350	14.13
Anchor Impact	33.33	1.633	(1.306)	0.327	9.90	(1.306)	0.327	10.98	(1.306)	0.327	12.11	1.501	(1.201)	0.300	9.70	(1.201)	0.300	10.86	(1.201)	0.300	12.11
Jackup Rig or Spud Barge																					
Trawl/Fishing Net	5.56	0.272	(0.218)	0.054	1.65	(0.218)	0.054	1.83	(0.218)	0.054	2.02	0.250	(0.200)	0.050	1.62	(0.200)	0.050	1.81	(0.200)	0.050	2.02
OPERATION IMPACT	16.67	0.816	(0.163)	0.653	19.80	(0.163)	0.653	21.97	(0.163)	0.653	24.23	0.751	(0.150)	0.601	19.40	(0.150)	0.601	21.72	(0.150)	0.601	24.23
Rig Anchoring	5.56	0.272	(0.054)	0.218	6.60	(0.054)	0.218	7.32	(0.054)	0.218	8.08	0.250	(0.050)	0.200	6.47	(0.050)	0.200	7.24	(0.050)	0.200	8.08
Work Boat Anchoring	11.11	0.544	(0.109)	0.435	13.20	(0.109)	0.435	14.65	(0.109)	0.435	16.15	0.500	(0.100)	0.400	12.93	(0.100)	0.400	14.48	(0.100)	0.400	16.15
MECHANICAL	11.11	0.544		0.544	16.50		0.544	18.31		0.544	20.19	0.500		0.500	16.17		0.500	18.10		0.500	20.19
Connection Failure	5.56	0.272		0.272	8.25		0.272	9.15		0.272	10.10	0.250		0.250	8.08		0.250	9.05		0.250	10.10
Material Failure	5.56	0.272		0.272	8.25		0.272	9.15		0.272	10.10	0.250		0.250	8.08		0.250	9.05		0.250	10.10
NATURAL HAZARD	11.11	0.544	(0.392)	0.152	4.61	(0.327)	0.218	7.32	(0.218)	0.327	12.11	0.500	(0.361)	0.140	4.52	(0.300)	0.200	7.24	(0.200)	0.300	12.11
Mud Slide	11.11	0.544	(0.392)	0.152	4.61	(0.327)	0.218	7.32	(0.218)	0.327	12.11	0.500	(0.361)	0.140	4.52	(0.300)	0.200	7.24	(0.200)	0.300	12.11
Storm/ Hurricane																					
ARCTIC			0.778	0.778	23.60	0.388	0.388	13.04	0.001	0.001	0.05		0.778	0.778	25.15	0.388	0.388	14.02	0.001	0.001	0.06
Ice Gouging			0.6178	0.6178	18.73	0.3089	0.3089	10.39					0.6178	0.6178	19.96	0.3089	0.3089	11.17			
Strudel Scour			0.0038	0.0038	0.11								0.0038	0.0038	0.12						
Upheaval Buckling			0.0008	0.0008	0.02	0.0008	0.0008	0.03	0.0008	0.0008	0.03		0.0008	0.0008	0.02	0.0008	0.0008	0.03	0.0008	0.0008	0.03
Thaw Settlement			0.0004	0.0004	0.01	0.0004	0.0004	0.01	0.0004	0.0004	0.01		0.0004	0.0004	0.01	0.0004	0.0004	0.01	0.0004	0.0004	0.02
Other			0.1557	0.1557	4.72	0.0775	0.0775	2.61	0.0003	0.0003	0.01		0.1557	0.1557	5.03	0.0775	0.0775	2.80	0.0003	0.0003	0.01
UNKNOWN	5.56	0.272		0.272	8.25		0.272	9.15		0.272	10.10	0.250		0.250	8.08		0.250	9.05		0.250	10.10
TOTALS	100.00	4.899	(1.600)	3.298	100.0	(1.926)	2.973	100.00	(2.203)	2.696	100.00	4.504	(1.409)	3.095	100.00	(1.739)	2.765	100.00	(2.025)	2.479	100.00

* Medium (M) - = 100 < 1,000 bbl

**Table 4.4
Pipeline Large Spill Size Frequencies**

CAUSE CLASSIFICATION	HISTORICAL DISTRIBUTION %	LARGE SPILL*																			
		P/L Dia <10"									P/L Dia >10"										
		Shallow			Medium			Deep			FREQUENCY (spill per 10 ³ km-yr)	Shallow			Medium			Deep			
		Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %		Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	
CORROSION	7.69	0.215	(0.065)	0.151	5.72	(0.065)	0.151	8.32	(0.065)	0.151	14.85	0.4158	(0.125)	0.291	8.28	(0.125)	0.291	10.72	(0.125)	0.291	14.87
External																					
Internal	7.69	0.215	(0.065)	0.151	5.72	(0.065)	0.151	8.32	(0.065)	0.151	14.85	0.4158	(0.125)	0.291	8.28	(0.125)	0.291	10.72	(0.125)	0.291	14.87
THIRD PARTY IMPACT	69.23	1.938	(1.486)	0.452	17.15	(1.486)	0.452	24.96	(1.486)	0.452	44.54	3.7419	(2.869)	0.873	24.85	(2.869)	0.873	32.17	(2.869)	0.873	44.61
Anchor Impact	30.77	0.861	(0.689)	0.172	6.53	(0.689)	0.172	9.51	(0.689)	0.172	16.97	1.6631	(1.330)	0.333	9.47	(1.330)	0.333	12.26	(1.330)	0.333	16.99
Jackup Rig or Spud Barge	7.69	0.215	(0.108)	0.108	4.08	(0.108)	0.108	5.94	(0.108)	0.108	10.61	0.4158	(0.208)	0.208	5.92	(0.208)	0.208	7.66	(0.208)	0.208	10.62
Trawl/Fishing Net	30.77	0.861	(0.689)	0.172	6.53	(0.689)	0.172	9.51	(0.689)	0.172	16.97	1.6631	(1.330)	0.333	9.47	(1.330)	0.333	12.26	(1.330)	0.333	16.99
OPERATION IMPACT	7.69	0.215	(0.043)	0.172	6.53	(0.043)	0.172	9.51	(0.043)	0.172	16.97	0.4158	(0.083)	0.333	9.47	(0.083)	0.333	12.26	(0.083)	0.333	16.99
Rig Anchoring																					
Work Boat Anchoring	7.69	0.215	(0.043)	0.172	6.53	(0.043)	0.172	9.51	(0.043)	0.172	16.97	0.4158	(0.083)	0.333	9.47	(0.083)	0.333	12.26	(0.083)	0.333	16.99
MECHANICAL																					
Connection Failure																					
Material Failure																					
NATURAL HAZARD	15.38	0.431	(0.263)	0.168	6.37	(0.237)	0.194	10.70	(0.194)	0.237	23.33	0.8315	(0.507)	0.324	9.22	(0.457)	0.374	13.79	(0.374)	0.457	23.37
Mud Slide	7.69	0.215	(0.155)	0.060	2.28	(0.129)	0.086	4.75	(0.086)	0.129	12.73	0.4158	(0.300)	0.116	3.31	(0.249)	0.166	6.13	(0.166)	0.249	12.75
Storm/ Hurricane	7.69	0.215	(0.108)	0.108	4.08	(0.108)	0.108	5.94	(0.108)	0.108	10.61	0.4158	(0.208)	0.208	5.92	(0.208)	0.208	7.66	(0.208)	0.208	10.62
ARCTIC		1.693	1.693	64.23	0.843	0.843	46.52	0.003	0.003	0.30		1.693	1.693	48.18	0.843	0.843	31.06	0.003	0.003	0.16	
Ice Gouging		1.3438	1.3438	50.98	0.6719	0.6719	37.08					1.3438	1.3438	38.24	0.6719	0.6719	24.76				
Strudel Scour		0.0082	0.0082	0.31								0.0082	0.0082	0.23							
Upheaval Buckling		0.0016	0.0016	0.06	0.0016	0.0016	0.09	0.0016	0.0016	0.16		0.0016	0.0016	0.05	0.0016	0.0016	0.06	0.0016	0.0016	0.08	
Thaw Settlement		0.0008	0.0008	0.03	0.0008	0.0008	0.05	0.0008	0.0008	0.08		0.0008	0.0008	0.02	0.0008	0.0008	0.03	0.0008	0.0008	0.04	
Other		0.3386	0.3386	12.85	0.1686	0.1686	9.30	0.0006	0.0006	0.06		0.3386	0.3386	9.64	0.1686	0.1686	6.21	0.0006	0.0006	0.03	
UNKNOWN																					
TOTALS	100.00	2.799	(0.163)	2.636	100.00	(0.987)	1.812	100.00	(1.784)	1.015	100.00	5.4050	(1.891)	3.514	100.00	(2.691)	2.714	100.00	(3.448)	1.957	100.00

* Large (L) - = 1,000 < 10,000 bbl

**Table 4.5
Pipeline Huge Spill Size Frequencies**

CAUSE CLASSIFICATION	HISTORICAL DISTRIBUTION %	HUGE SPILL*																			
		P/L Dia <10"										P/L Dia >10"									
		FREQUENCY (spill per 10 ⁵ km-yr)	Shallow			Medium			Deep			FREQUENCY (spill per 10 ⁵ km-yr)	Shallow			Medium			Deep		
			Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %		Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
CORROSION	7.69	0.054	(0.016)	0.038	5.31	(0.016)	0.038	7.88	(0.016)	0.038	14.84	0.1386	(0.042)	0.097	8.98	(0.042)	0.097	11.29	(0.042)	0.097	14.87
External																					
Internal	7.69	0.054	(0.016)	0.038	5.31	(0.016)	0.038	7.88	(0.016)	0.038	14.84	0.1386	(0.042)	0.097	8.98	(0.042)	0.097	11.29	(0.042)	0.097	14.87
THIRD PARTY IMPACT	69.23	0.485	(0.372)	0.113	15.93	(0.372)	0.113	23.64	(0.372)	0.113	44.53	1.2475	(0.956)	0.291	26.93	(0.956)	0.291	33.86	(0.956)	0.291	44.62
Anchor Impact	30.77	0.215	(0.172)	0.043	6.07	(0.172)	0.043	9.01	(0.172)	0.043	16.96	0.5545	(0.444)	0.111	10.26	(0.444)	0.111	12.90	(0.444)	0.111	17.00
Jackup Rig or Spud Barge	7.69	0.054	(0.027)	0.027	3.79	(0.027)	0.027	5.63	(0.027)	0.027	10.60	0.1386	(0.069)	0.069	6.41	(0.069)	0.069	8.06	(0.069)	0.069	10.62
Trawl/Fishing Net	30.77	0.215	(0.172)	0.043	6.07	(0.172)	0.043	9.01	(0.172)	0.043	16.96	0.5545	(0.444)	0.111	10.26	(0.444)	0.111	12.90	(0.444)	0.111	17.00
OPERATION IMPACT	7.69	0.054	(0.011)	0.043	6.07	(0.011)	0.043	9.01	(0.011)	0.043	16.96	0.1386	(0.028)	0.111	10.26	(0.028)	0.111	12.90	(0.028)	0.111	17.00
Rig Anchoring																					
Work Boat Anchoring	7.69	0.054	(0.011)	0.043	6.07	(0.011)	0.043	9.01	(0.011)	0.043	16.96	0.1386	(0.028)	0.111	10.26	(0.028)	0.111	12.90	(0.028)	0.111	17.00
MECHANICAL																					
Connection Failure																					
Material Failure																					
NATURAL HAZARD	15.38	0.108	(0.066)	0.042	5.91	(0.059)	0.048	10.13	(0.048)	0.059	23.32	0.2772	(0.169)	0.108	9.99	(0.152)	0.125	14.51	(0.125)	0.152	23.37
Mud Slide	7.69	0.054	(0.039)	0.015	2.12	(0.032)	0.022	4.50	(0.022)	0.032	12.72	0.1386	(0.100)	0.039	3.58	(0.083)	0.055	6.45	(0.055)	0.083	12.75
Storm/ Hurricane	7.69	0.054	(0.027)	0.027	3.79	(0.027)	0.027	5.63	(0.027)	0.027	10.60	0.1386	(0.069)	0.069	6.41	(0.069)	0.069	8.06	(0.069)	0.069	10.62
ARCTIC			0.474	0.474	66.78	0.236	0.236	49.34	0.001	0.001	0.34		0.474	0.474	43.85	0.236	0.236	27.45	0.001	0.001	0.13
Ice Gouging			0.3762	0.3762	53.00	0.1881	0.1881	39.33					0.3762	0.3762	34.80	0.1881	0.1881	21.88			
Strudel Scour			0.0023	0.0023	0.32								0.0023	0.0023	0.21						
Upheaval Buckling			0.0005	0.0005	0.06	0.0005	0.0005	0.10	0.0005	0.0005	0.18		0.0005	0.0005	0.04	0.0005	0.0005	0.05	0.0005	0.0005	0.07
Thaw Settlement			0.0002	0.0002	0.03	0.0002	0.0002	0.05	0.0002	0.0002	0.09		0.0002	0.0002	0.02	0.0002	0.0002	0.03	0.0002	0.0002	0.04
Other			0.0948	0.0948	13.36	0.0472	0.0472	9.87	0.0002	0.0002	0.07		0.0948	0.0948	8.77	0.0472	0.0472	5.49	0.0002	0.0002	0.03
UNKNOWN																					
TOTALS	100.00	0.700	0.010	0.710	100.00	(0.222)	0.478	100.00	(0.446)	0.254	100.00	1.8020	(0.721)	1.081	100.00	(0.942)	0.860	100.00	(1.150)	0.652	100.00

* Huge (H) - = 10,000 bbl

4.3.3 Arctic Pipeline Frequency Input Uncertainty Variations

In order to assess the impact of uncertainties in the Arctic hazard effects incorporated fault trees, ranges around the expected value have been estimated for all the Arctic effects, both modified and unique for Arctic effects. The numerical distributions generated through these perturbations in the expected values are modeled as triangular distributions and input to the Monte Carlo simulation analysis conducted as part of the result generation. Table 4.6 shows the unique effect perturbations about the expected value, indicated as low and high. In fact, the low value is defined as the 90% probability of exceedance, while the high one is at the 10% probability of exceedance. The variations in the modified effects were estimated utilizing engineering judgement. For the unique effects, however, the ranges were estimated as described in Section 2.5.2, using parametric analysis.

4.4 Platform Fault Tree Analysis

4.4.1 Arctic Platform Fault Tree Inputs

Table 4.7 summarizes the variations in the modified and unique Arctic effect inputs for platforms. As for pipeline unique effects, both the expected and Monte Carlo median values are given.

The first three modified cause classifications, the process facility release, storage tank release, and structural failure were reduced by 30 to 50% primarily as a result of the state-of-art engineering, construction, and operational standards and practices expected. As before, storms tend to be less severe in the Arctic, and certainly during the ice season would have limited impact on the facility. Due to the extremely low traffic density, as for the case of pipelines, the ship collision cause has been reduced by 90 percent.

Unique effects are also included. Relatively small increments in facility spills were attributed to ice force, low temperature effects, and unknown effects which were taken as a percentage of the other unique Arctic effects. Ice force effect calculations were based on the 1/10,000 year ice force (1/250,000 well year) causing spills, predominantly small and medium. Ice forces are also considered to increase as a contributor to oil spill occurrences with water depth, due to the increasing severity of ice loads as one moves towards the edge of the landfast ice zone with increasing water depth. Increase of low temperature effects with water depth was estimated as 10% of historical process facility spill rates.

**Table 4.6
Arctic Pipeline Impact Uncertainty Variations**

CAUSE CLASSIFICATION	Spill Size	Water Depth								
		Shallow			Medium			Deep		
		Frequency Change %								
		Low	Expected	High	Low	Expected	High	Low	Expected	High
ARCTIC MODIFIED										
CORROSION										
External	All	(25)	(50)	(75)	(25)	(50)	(75)	(25)	(50)	(75)
Internal	All	(15)	(30)	(45)	(15)	(30)	(45)	(15)	(30)	(45)
THIRD PARTY IMPACT										
Anchor Impact	All	(60)	(90)	(95)	(60)	(90)	(95)	(60)	(90)	(95)
Jackup Rig or Spud Barge	All	(25)	(50)	(75)	(25)	(50)	(75)	(25)	(50)	(75)
Trawl/Fishing Net	All	(60)	(90)	(95)	(60)	(90)	(95)	(60)	(90)	(95)
OPERATION IMPACT										
Rig Anchoring	All	(10)	(20)	(30)	(10)	(20)	(30)	(10)	(20)	(30)
Work Boat Anchoring	All	(10)	(20)	(30)	(10)	(20)	(30)	(10)	(20)	(30)
MECHANICAL										
Connection Failure	All									
Material Failure	All									
NATURAL HAZARD										
Mud Slide	All	(50)	(80)	(90)	(30)	(60)	(90)	(20)	(40)	(60)
Storm/ Hurricane	All	(25)	(50)	(75)	(25)	(50)	(75)	(25)	(50)	(75)
Frequency Increment per 10⁵ km-year										
ARCTIC UNIQUE										
Ice Gouging	S	0.0060	0.0680	0.8290	0.0030	0.0340	0.4145			
	M	0.0090	0.1210	1.4670	0.0045	0.0605	0.7335			
	L	0.0210	0.2610	3.1900	0.0105	0.1305	1.5950			
	H	0.0060	0.0730	0.8930	0.0030	0.0365	0.4465			
Strudel Scour	S	0.0004	0.0012	0.0044						
	M	0.0006	0.0020	0.0078						
	L	0.0014	0.0045	0.0170						
	H	0.0004	0.0012	0.0048						
Upheaval Buckling	S	0.00007	0.00023	0.00088	0.00007	0.00023	0.00088	0.00007	0.00023	0.00088
	M	0.00013	0.00041	0.00156	0.00013	0.00041	0.00156	0.00013	0.00041	0.00156
	L	0.00028	0.00089	0.00340	0.00028	0.00089	0.00340	0.00028	0.00089	0.00340
	H	0.00008	0.00025	0.00095	0.00008	0.00025	0.00095	0.00008	0.00025	0.00095
Thaw Settlement	S	0.00004	0.00012	0.00044	0.00004	0.00012	0.00044	0.00004	0.00012	0.00044
	M	0.00006	0.00020	0.00078	0.00006	0.00020	0.00078	0.00006	0.00020	0.00078
	L	0.00014	0.00045	0.00170	0.00014	0.00045	0.00170	0.00014	0.00045	0.00170
	H	0.00004	0.00012	0.00048	0.00004	0.00012	0.00048	0.00004	0.00012	0.00048
Other	S	0.00162	0.01738	0.20869	0.00078	0.00859	0.10396	0.00003	0.00009	0.00033
	M	0.00246	0.03092	0.36929	0.00117	0.01528	0.18396	0.00005	0.00015	0.00059
	L	0.00571	0.06670	0.80303	0.00273	0.03296	0.40003	0.00011	0.00033	0.00128
	H	0.00163	0.01865	0.22480	0.00078	0.00922	0.11198	0.00003	0.00009	0.00036

**Table 4.7
Platform Fault Tree Input Rationalization**

CAUSE CLASSIFICATION	Spill Size	Frequency Change %			Reason
		Shallow	Medium	Deep	
ARCTIC MODIFIED					
PROCESS FACILITY RLS.	All	(50)	(50)	(50)	State of the art now, High QC, High Inspection and Maintenance Requirements
STORAGE TANK RLS.	All	(30)	(30)	(30)	State of the art now, High QC, High Inspection and Maintenance Requirements
STRUCTURAL FAILURE	All	(30)	(30)	(30)	High safety factor, Monitoring Programs
HURRICANE/STORM	All	(80)	(80)	(80)	Less severe storms.
COLLISION	All	(90)	(90)	(90)	Very low traffic density.
		Freq. Increment per 10 ⁴ well-year			
		Median	Median	Median	
		Expected	Expected	Expected	
ARCTIC UNIQUE					
Ice Force	SM	0.1447	0.2170	0.3256	Assumed 1/10000 years ice force causes spill. 85% of the spills are SM.
		0.0340	0.0510	0.0765	
	HL	0.0255	0.0383	0.0575	
		0.0060	0.0090	0.0135	
Facility Low Temperature	SM	0.1000	0.1000	0.1000	Assumed 10% of Historical Process Facilities release frequency and corresponding spill size distribution.
		0.1000	0.1000	0.1000	
	HL	0.0080	0.0080	0.0080	
		0.0080	0.0080	0.0080	
Other	SM	0.0244	0.0316	0.0424	10% of above.
		0.0134	0.0151	0.0177	
	HL	0.0033	0.0046	0.0065	
		0.0014	0.0017	0.0022	

4.4.2 Arctic Platform Fault Tree Spill Frequency Calculations

Figure 4.5 shows the fault tree developed for Arctic platform spills for the different water depth zones for large and huge spill sizes, which were grouped together as described for platforms in Chapter 2. Again, the fault tree gives the historical value, together with the calculated values for shallow, medium, and deep water. In the case of this particular fault tree, there was room to represent both the small and medium or less than 1,000 bbl and the large and huge or greater than 1,000 bbl spills. Like pipelines, it is evident that platforms manifest a somewhat lower frequency for both spill size categories for the Arctic conditions. Tables 4.8 and 4.9 show the frequency calculations for platforms for small and medium and large and huge spill sizes, respectively.

4.4.3 Platform Arctic Effect Frequency Input Variations

Again, for the calculation of probability distributions of the effects of the frequency changes attributable to the Arctic environment and operations, variations about the expected value were estimated. Table 4.10 shows this range of variations for the platform spill frequencies. These are later utilized in the development of probability distributions for the oil spill occurrence indicator using a Monte Carlo process.

4.3 Blowout Frequency Analysis

As the base case blowout values have not been altered for Arctic effects, no fault tree for well blowouts is required. However, a summary of the historical frequencies to be used in blowout oil spill occurrence calculations is given in Table 4.11.

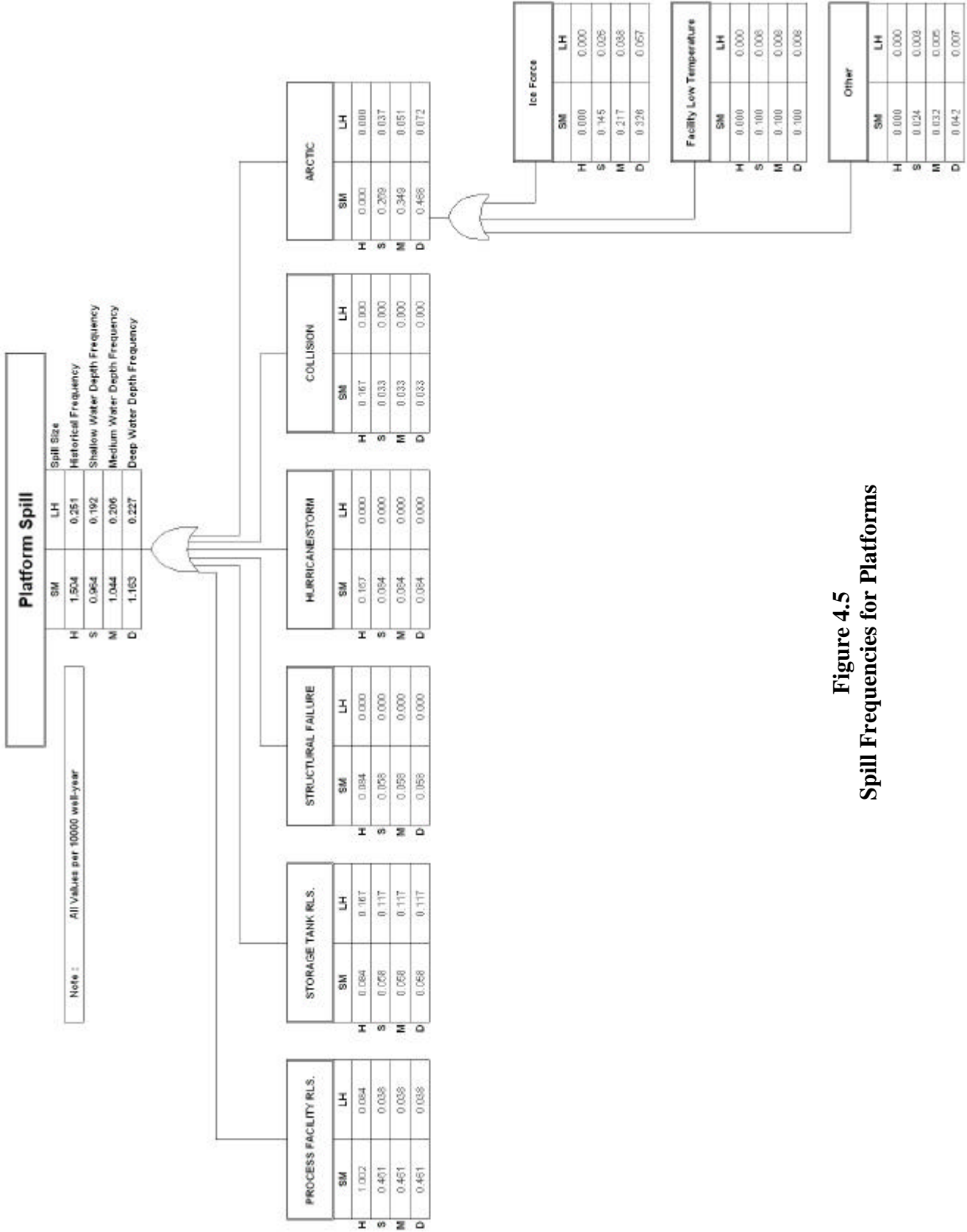


Figure 4.5
Spill Frequencies for Platforms

**Table 4.8
Platform Small and Medium Spill Size Frequencies**

CAUSE CLASSIFICATION	HISTORICAL DISTRIBUTION %	SMALL AND MEDIUM SPILLS									
		FREQUENCY (spill per 10 ⁴ well-yr)	Shallow			Medium			Deep		
			Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
PROCESS FACILITY RLS.	66.67	1.002	(0.541)	0.461	47.85	(0.541)	0.4615	44.20	(0.541)	0.4615	39.67
STORAGE TANK RLS.	5.56	0.084	(0.025)	0.058	6.06	(0.025)	0.0585	5.60	(0.025)	0.0585	5.03
STRUCTURAL FAILURE	5.56	0.084	(0.025)	0.058	6.06	(0.025)	0.0585	5.60	(0.025)	0.0585	5.03
HURRICANE/STORM	11.11	0.167	(0.084)	0.084	8.66	(0.084)	0.0835	8.00	(0.084)	0.0835	7.18
COLLISION	11.11	0.167	(0.134)	0.033	3.46	(0.134)	0.0334	3.20	(0.134)	0.0334	2.87
ARCTIC			0.269	0.269	27.90	0.349	0.3486	33.39	0.468	0.4680	40.23
Ice Force			0.145	0.145	15.00	0.217	0.2170	20.79	0.326	0.3256	27.98
Facility Low Temperature			0.100	0.100	10.37	0.100	0.1000	9.58	0.100	0.1000	8.60
Other			0.024	0.024	2.53	0.032	0.0316	3.03	0.042	0.0424	3.65
TOTALS	100.00	1.504	(0.539)	0.964	100.00	(0.460)	1.0440	100.00	(0.340)	1.1634	100.00

**Table 4.9
Platform Large and Huge Spill Size Frequencies**

CAUSE CLASSIFICATION	HISTORICAL DISTRIBUTION %	LARGE AND HUGE SPILLS									
		FREQUENCY (spill per 10 ⁴ well-yr)	Shallow			Medium			Deep		
			Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
PROCESS FACILITY RLS.	33.33	0.0835	(0.045)	0.0385	20.00	(0.045)	0.0385	18.64	(0.045)	0.0385	16.91
STORAGE TANK RLS.	66.67	0.1671	(0.050)	0.1169	60.82	(0.050)	0.1169	56.68	(0.050)	0.1169	51.43
STRUCTURAL FAILURE											
HURRICANE/STORM											
COLLISION											
ARCTIC			0.037	0.0369	19.18	0.051	0.0509	24.68	0.072	0.0720	31.66
Ice Force			0.026	0.0255	13.28	0.038	0.0383	18.56	0.057	0.0575	25.27
Facility Low Temperature			0.008	0.0080	4.16	0.008	0.0080	3.88	0.008	0.0080	3.52
Other			0.003	0.0033	1.74	0.005	0.0046	2.24	0.007	0.0065	2.87
TOTALS	100.00	0.2506	(0.058)	0.1923	100.00	(0.044)	0.2063	100.00	(0.023)	0.2274	100.00

Table 4.10
Platform Arctic Effects Frequency Variations

CAUSE CLASSIFICATION	Spill Size	Shallow			Medium			Deep		
		Frequency Change %								
		Low	Expected	High	Low	Expected	High	Low	Expected	High
ARCTIC MODIFIED										
PROCESS FACILITY RLS.	All	(30)	(50)	(80)	(30)	(50)	(80)	(30)	(50)	(80)
STORAGE TANK RLS.	All	(20)	(30)	(40)	(20)	(30)	(40)	(20)	(30)	(40)
STRUCTURAL FAILURE	All	(20)	(30)	(40)	(20)	(30)	(40)	(20)	(30)	(40)
HURRICANE/STORM	All	(25)	(50)	(75)	(25)	(50)	(75)	(25)	(50)	(75)
COLLISION	All	(60)	(90)	(95)	(60)	(90)	(95)	(60)	(90)	(95)
Frequency Increment per 10⁴ well-year										
ARCTIC UNIQUE										
- Ice Force	SM	0.003	0.034	0.340	0.005	0.051	0.510	0.008	0.077	0.765
	HL	0.001	0.006	0.060	0.001	0.009	0.090	0.001	0.014	0.135
- Facility Low Temperature	SM	0.050	0.100	0.150	0.050	0.100	0.150	0.050	0.100	0.150
	HL	0.004	0.008	0.012	0.004	0.008	0.012	0.004	0.008	0.012
- Other	SM	0.005	0.013	0.049	0.006	0.015	0.066	0.006	0.018	0.092
	HL	0.000	0.001	0.007	0.000	0.002	0.010	0.001	0.002	0.015

**Table 4.11
Blowout Frequencies**

EVENT	FREQUENCY UNIT	SMALL AND MEDIUM SPILLS						LARGE SPILL							
		HISTORICAL FREQUENCY	Shallow		Medium		Deep		HISTORICAL FREQUENCY	Shallow		Medium		Deep	
			Frequency Change	New Frequency	Frequency Change	New Frequency	Frequency Change	New Frequency		Frequency Change	New Frequency	Frequency Change	New Frequency		
PRODUCTION WELL	spill per 10 ⁵ well-year	0.500		0.500		0.500		0.500	3.500		3.500		3.500		3.500
EXPLORATION WELL	spill per 10 ⁵ wells	3.160		3.160		3.160		3.160	22.110		22.110		22.110		22.110
DEVELOPMENT WELL	spill per 10 ⁵ wells	1.300		1.300		1.300		1.300	9.080		9.080		9.080		9.080
EVENT	FREQUENCY UNIT	SPILL SIZE - 10000 - 150000 BBL						SPILL SIZE - > 150000 BBL							
		HISTORICAL FREQUENCY	Shallow		Medium		Deep		HISTORICAL FREQUENCY	Shallow		Medium		Deep	
			Frequency Change	New Frequency	Frequency Change	New Frequency	Frequency Change	New Frequency		Frequency Change	New Frequency	Frequency Change	New Frequency		
PRODUCTION WELL	spill per 10 ⁵ well-year	1.500		1.500		1.500		1.500	1.000		1.000		1.000		1.000
EXPLORATION WELL	spill per 10 ⁵ wells	9.500		9.500		9.500		9.500	5.500		5.500		5.500		5.500
DEVELOPMENT WELL	spill per 10 ⁵ wells	3.900		3.900		3.900		3.900	3.900		3.900		3.900		3.900

CHAPTER 5

OIL SPILL OCCURRENCE INDICATOR QUANTIFICATION

5.1 Definition of Oil Spill Occurrence Indicators

Three primary oil spill occurrence indicators (generally referred to as “spill indicators” after this) were quantified in this study. These are as follows:

- Frequency in spills per year.
- Frequency in spills per barrel produced in each year.
- Spill index, the product of spill frequency and associated average spill size.

The spill indicators defined above are subdivided as follows for this study:

- By scenario (eight scenarios).
- By water depth (three ranges).
- By facility type (six types).
- By spill size (four sizes).
- By year (between 10 and 38 years depending on scenario).

The above combinations translate into 576 sets of spill indicators, for a total of 1,728 individual indicators. Given that these are calculated for each year, with most of the scenarios lasting roughly for 35 years, gives 60,480 indicators. In this chapter, we will try to summarize only the salient results of the indicators; Appendix C gives the full calculation printouts for the Monte Carlo results used in the body of this report, while Appendix D gives the expected value calculations and results.

5.2 Oil Spill Occurrence Indicator Calculation Process

The oil spill occurrence indicator calculation process is shown in the flow chart originally given in Figure 1.3, and again presented as Figure 5.1. The steps corresponding to Tasks 2, 3, and 4A have been described in Chapters 2, 3, and 4, respectively. This chapter deals with Task 4B.

Essentially, this chapter addresses the combining of the development scenarios described in Chapter 3 with the unit-spill frequency distributions presented in Chapter 4 to provide measures of oil spill occurrence, the oil spill indicators. Although the calculation is complex because of the many combinations considered (approximately 60,000), in principle, it is a simple process of accounting. Essentially, the quantities of potential oil spill sources are multiplied by their appropriate unit oil spill frequency to give the total expected spill distributions. To develop the probability distributions by the Monte Carlo process, each of the 60,000 combinations needs to be sampled, in this case a sampling of 5,000 iterations was carried out for each combination studied. This translates into roughly 300 million arithmetic operations to generate the Monte Carlo results.

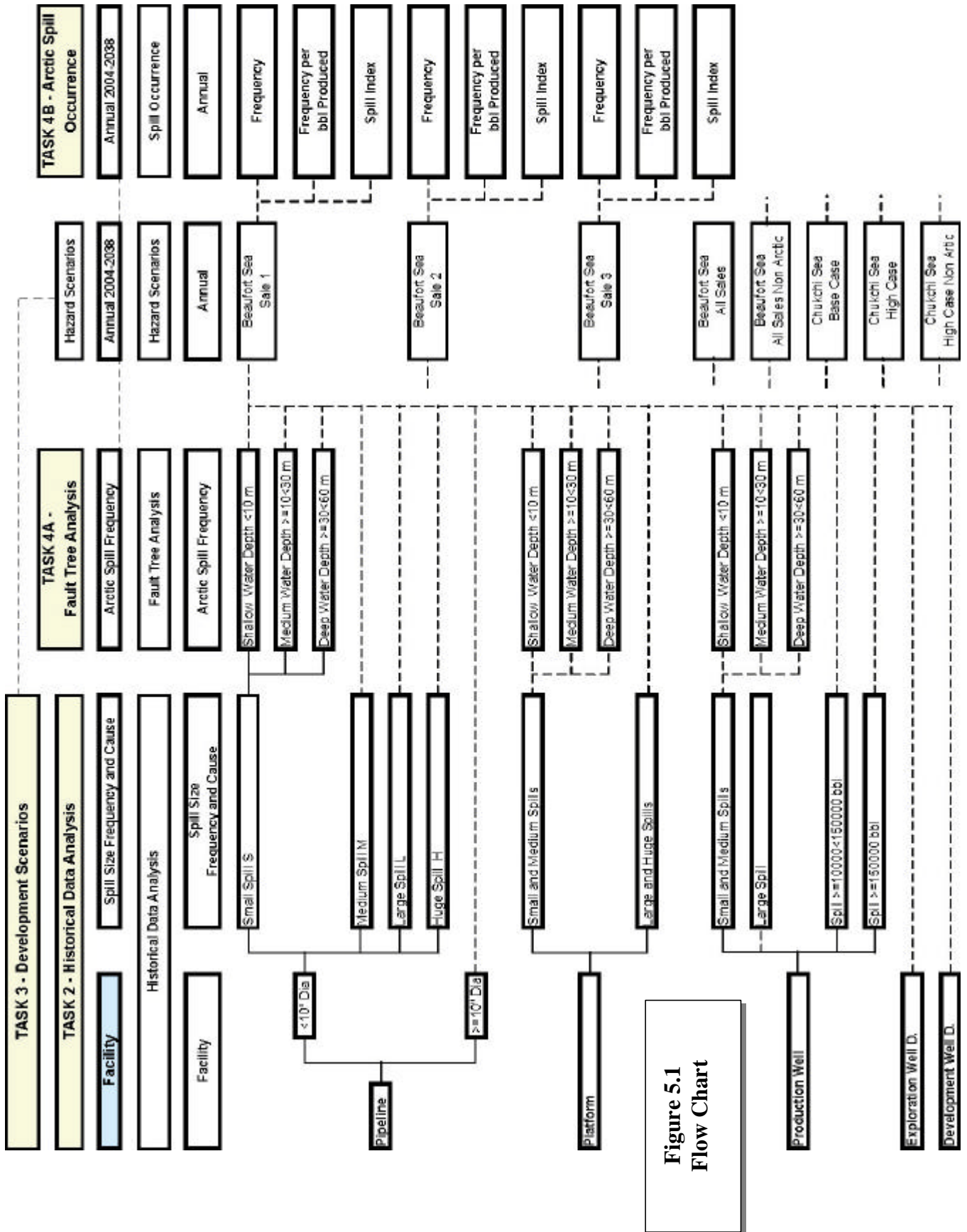


Figure 5.1
Flow Chart

5.3 Summary of Beaufort Sea Oil Spill Occurrence Indicators

5.3.1 Beaufort Sea Sale 1 Oil Spill Occurrence Indicators

Each of the principal oil spill occurrence indicators calculated for the composite of facilities under Sale 1 is given in Figures 5.2, 5.3, and 5.4.

As can be seen, each of these figures spans the development scenario to year 2029 described in Chapter 3. Further, each of the indicators has been subdivided into three segments for each year, those corresponding to spills < 1,000 bbl (small and medium), spills = 1,000 < 10,000 bbl (large), and spills = 10,000 bbl (huge). It should be noted that the spill frequency associated with each spill size is only the increment shown in each of the bars. Thus, for example, for the year 2020, small and medium spills are approximately 10.0 per thousand years. Next, in that year, large spills are approximately 4.5 per thousand years, as shown in the second bar increment (i.e., $14.5 - 10 = 4.5$). Finally, the top increment corresponds to huge spills, and is approximately 2.5 per thousand years. The same form of presentation applies for spills per barrel produced and for the spill index shown in Figures 5.3 and 5.4. Clearly, the spill index is dominated by the huge spills, which have an average spill size of 20,000 bbl. The spills per barrel produced continue to rise beyond the peak production year of 2016, because the facility quantities (and hence spill rate) remain relatively high, while production volumes decrease significantly each year. The reader should note that following this detailed presentation of the spill indicators in separate figures, all three spill indicators will be given in one figure in order to conserve space and make the report a little more concise.

Spill indicators by facility type were also quantified. All three spill indicators for pipelines for Beaufort Sea Sale 1 are shown in Figure 5.5. Figure 5.6 shows the spill indicators for platforms and Figure 5.7 shows the spill indicators for drilling of wells and producing wells. Numerous conclusions can be drawn from the comparison of these spill indicators. For example, it can be seen that the major contributors to spill frequency are platforms. The largest of the facility spill expectations, as represented by spill index, are the wells, simply because they have the potential to release the largest amounts of oil in blowouts.

Finally, as part of the assessment of each lease sale or development scenario, a Monte Carlo analysis was carried out for each year, with the distributed inputs described earlier. For Lease Sale 1, tabular results of the Monte Carlo simulation of 5,000 iterations for distributions in Arctic effects inputs only, is summarized in Table 5.1. This table gives the statistical characteristics of the calculated indicators for each of three spill size ranges, as well as a tabular summary of their cumulative distribution curves for a representative production year (2016). Figure 5.8 shows graphs of the calculated cumulative distribution functions. Basically, the vertical axis gives the probability in percent that the corresponding value on the horizontal axis will not be exceeded. Thus, for example, referring to the central graph, for spills < 1,000 bbl (small and medium), there is a 40% probability that a spill frequency will be no more than 0.2 per billion barrels produced.

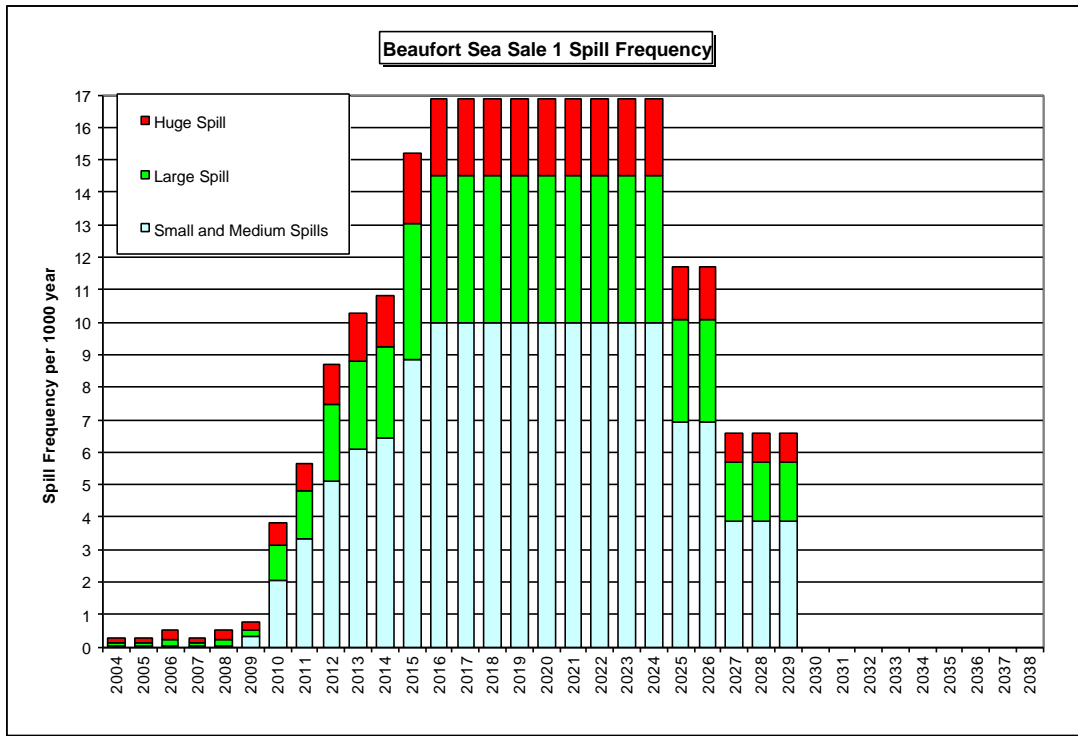


Figure 5.2
Beaufort Sea Sale 1 Spill Frequency

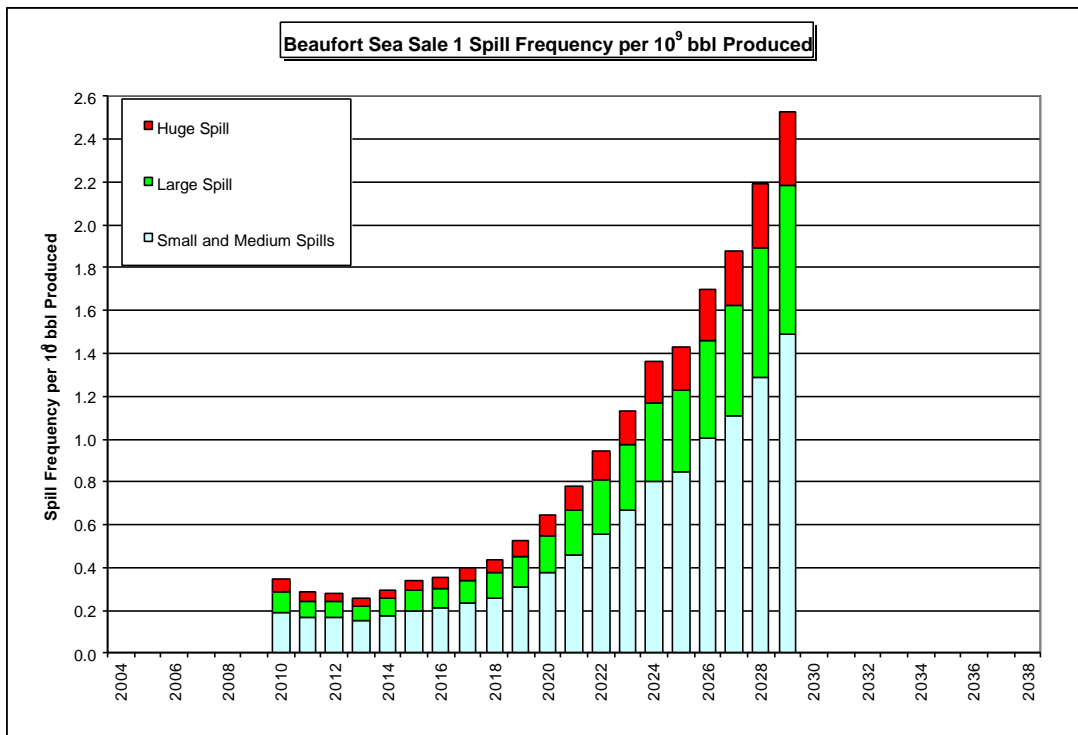


Figure 5.3
Beaufort Sea Sale 1 Spill Frequency per 10⁹ Barrels Produced

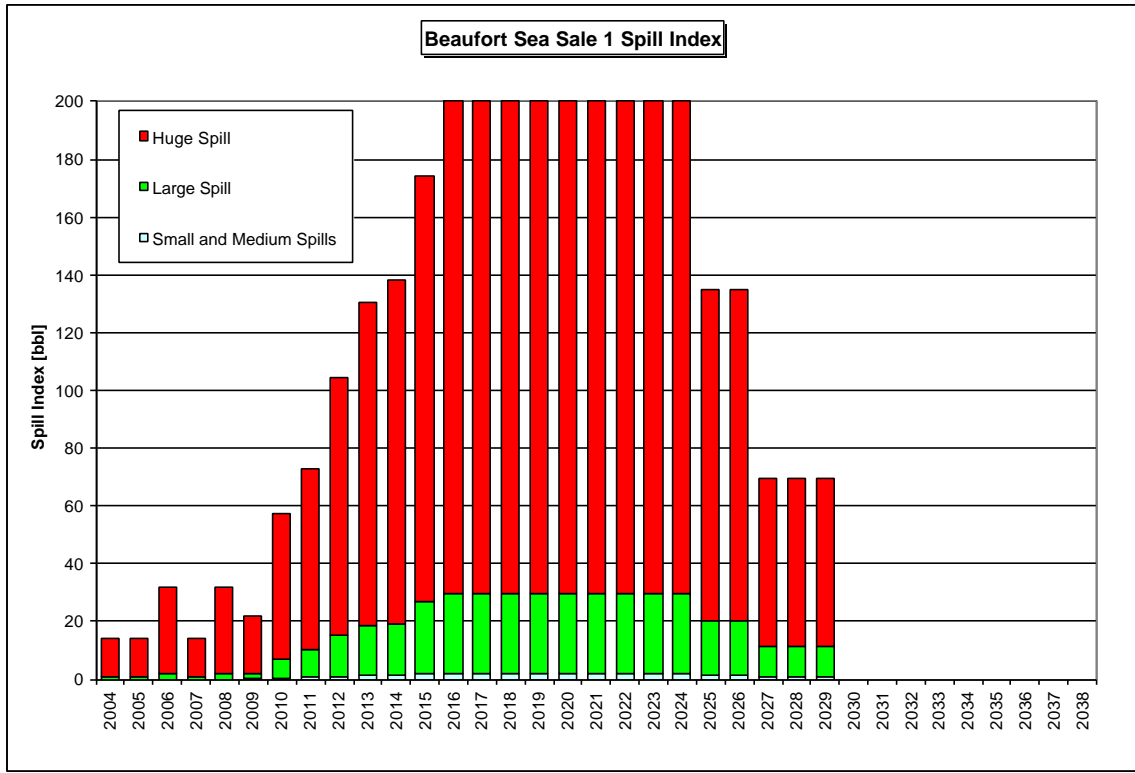


Figure 5.4
Beaufort Sea Sale 1 Spill Index

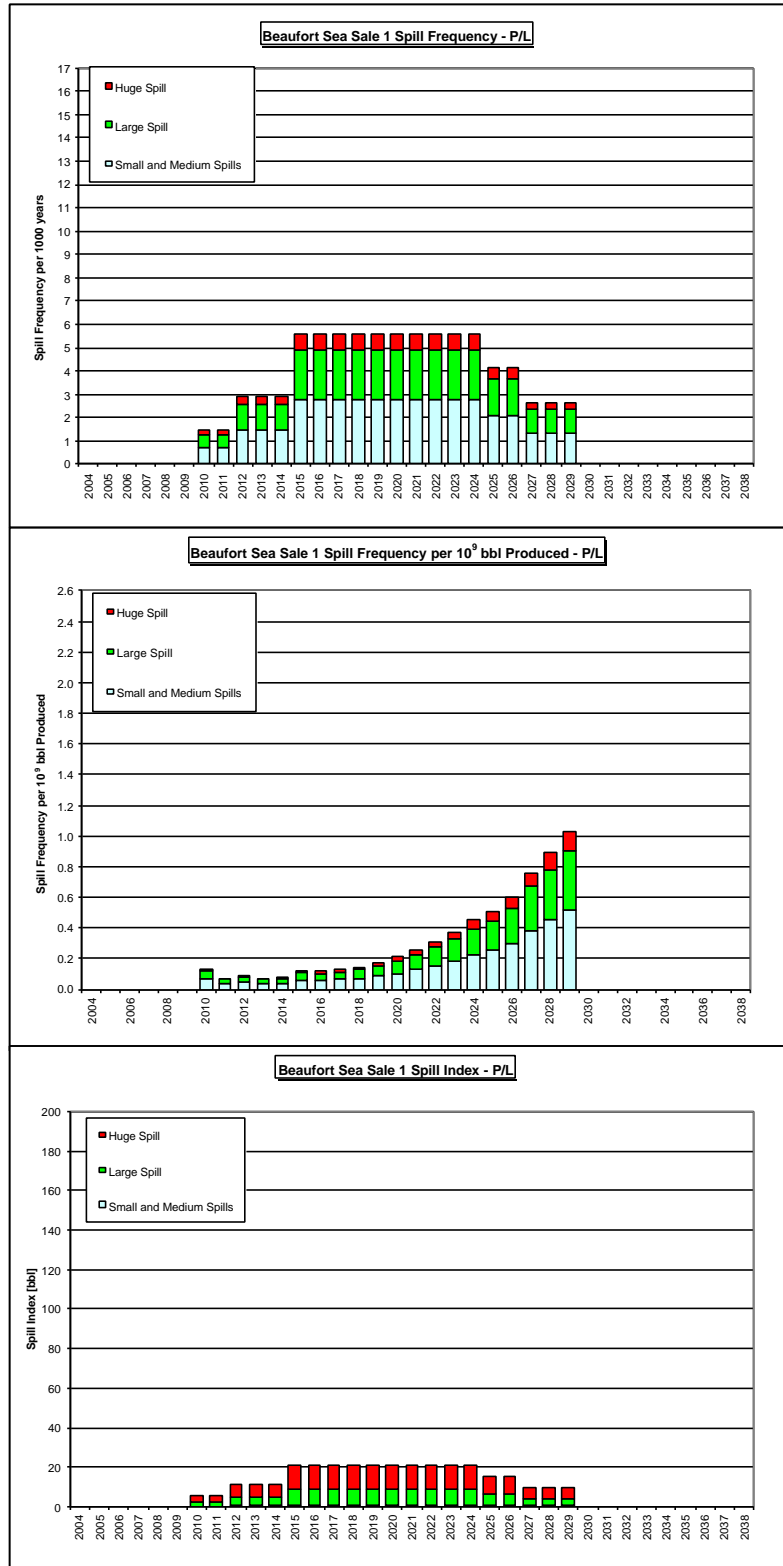


Figure 5.5
Beaufort Sea Sale 1 Indicators – Pipeline

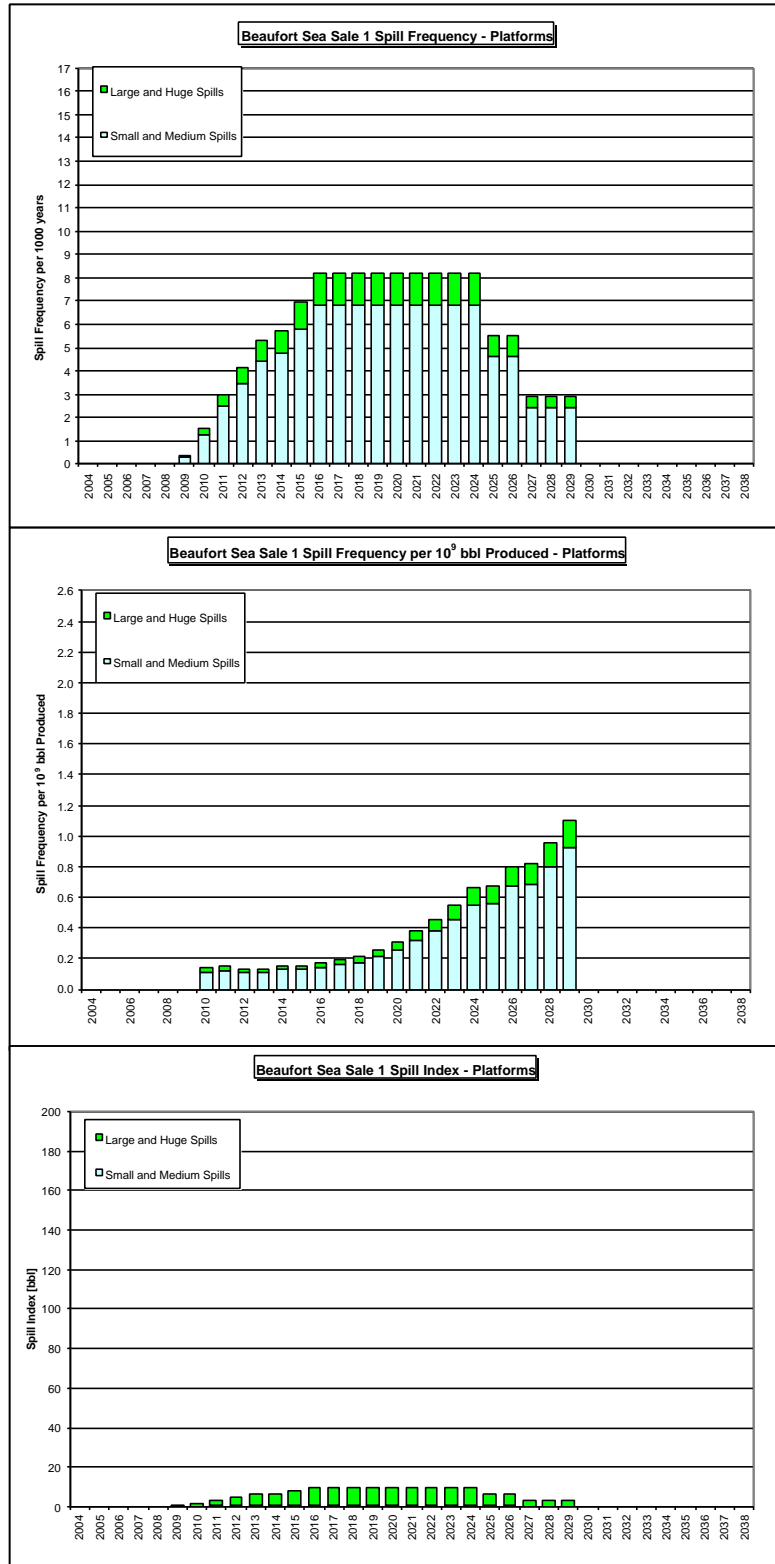


Figure 5.6
Beaufort Sea Sale 1 Indicators - Platforms

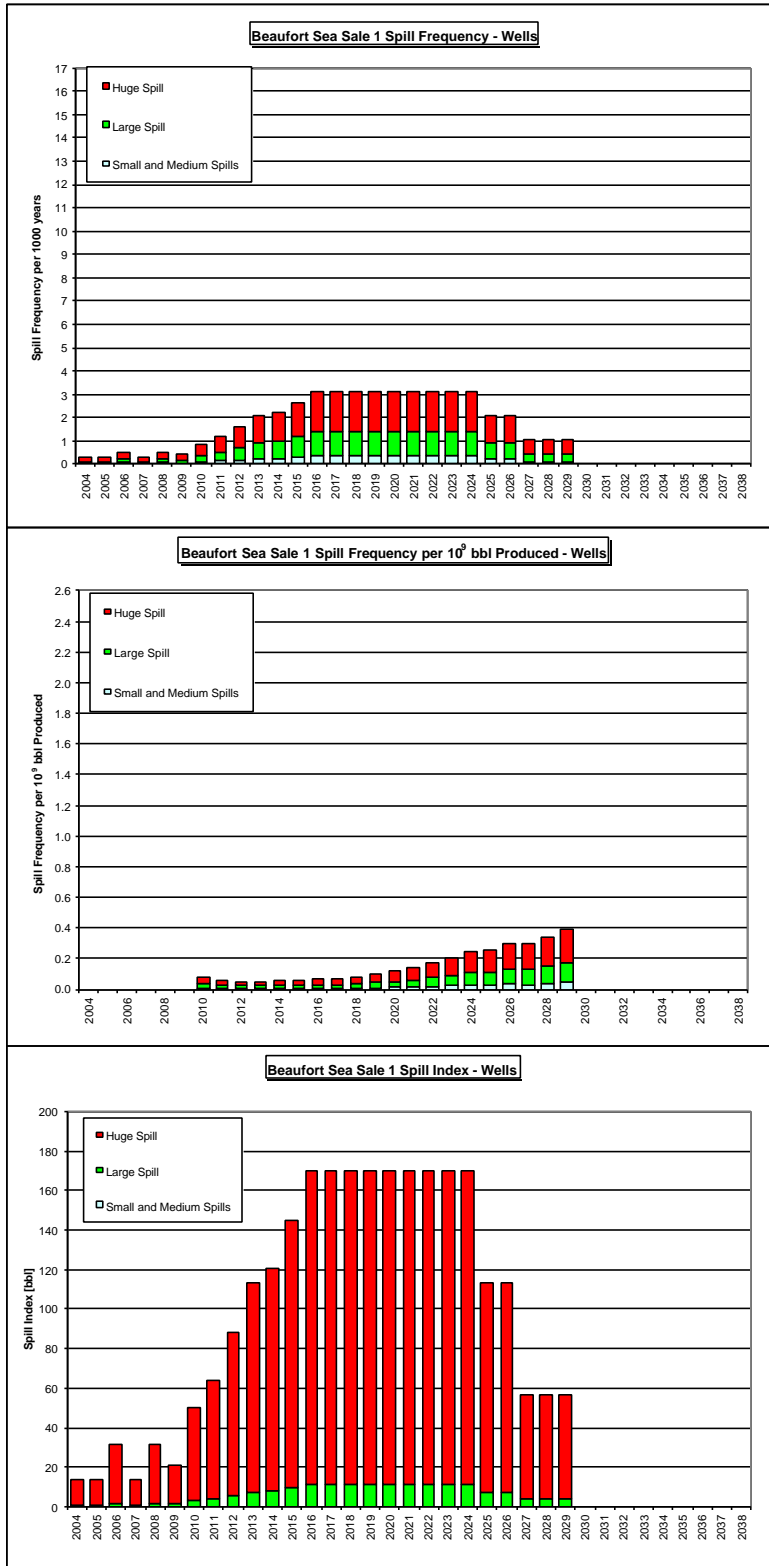


Figure 5.7
Beaufort Sea Sale 1 Indicators - Wells

Table 5.1
Beaufort Sea Sale 1 Year 2016 – Monte Carlo Results

SALE 1 Year 2016	Small and Medium Spills			Large Spills			Huge Spills		
	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
Mean =	9.67	0.20	2.02	4.53	0.10	27.58	2.39	0.05	170.39
Std Deviation =	1.03	0.02	0.18	0.54	0.01	2.20	0.15	0.00	2.61
Variance =	1.07	0.00	0.03	0.29	0.00	4.84	0.02	0.00	6.83
Skewness =	-0.04	-0.04	0.01	0.41	0.41	0.37	0.41	0.41	0.41
Kurtosis =	2.87	2.87	2.89	2.66	2.66	2.70	2.57	2.57	2.57
Mode =	8.63	0.18	1.83	3.97	0.09	29.13	2.33	0.05	167.05
Minimum =	6.02	0.127	1.35	3.20	0.067	21.72	2.00	0.042	163.64
5% Perc =	7.96	0.168	1.71	3.75	0.079	24.31	2.17	0.046	166.63
10% Perc =	8.34	0.176	1.78	3.88	0.082	24.90	2.21	0.046	167.23
15% Perc =	8.59	0.181	1.83	3.97	0.083	25.31	2.23	0.047	167.68
20% Perc =	8.79	0.185	1.86	4.05	0.085	25.62	2.25	0.047	168.05
25% Perc =	8.97	0.189	1.89	4.12	0.087	25.94	2.27	0.048	168.38
30% Perc =	9.13	0.192	1.92	4.19	0.088	26.22	2.29	0.048	168.72
35% Perc =	9.27	0.195	1.95	4.27	0.090	26.56	2.31	0.049	169.04
40% Perc =	9.42	0.198	1.97	4.33	0.091	26.83	2.33	0.049	169.38
45% Perc =	9.55	0.201	2.00	4.40	0.093	27.10	2.35	0.049	169.72
50% Perc =	9.67	0.204	2.02	4.46	0.094	27.38	2.37	0.050	170.05
55% Perc =	9.80	0.206	2.04	4.54	0.095	27.64	2.39	0.050	170.42
60% Perc =	9.95	0.209	2.07	4.61	0.097	27.94	2.41	0.051	170.81
65% Perc =	10.08	0.212	2.09	4.69	0.099	28.28	2.43	0.051	171.26
70% Perc =	10.22	0.215	2.11	4.79	0.101	28.65	2.46	0.052	171.73
75% Perc =	10.37	0.218	2.14	4.89	0.103	29.09	2.49	0.052	172.22
80% Perc =	10.54	0.222	2.17	5.00	0.105	29.49	2.52	0.053	172.78
85% Perc =	10.73	0.226	2.21	5.12	0.108	30.00	2.55	0.054	173.30
90% Perc =	11.01	0.232	2.26	5.28	0.111	30.67	2.60	0.055	174.12
95% Perc =	11.36	0.239	2.33	5.52	0.116	31.58	2.65	0.056	175.06
Maximum =	13.01	0.274	2.65	6.33	0.133	35.39	2.85	0.060	178.64

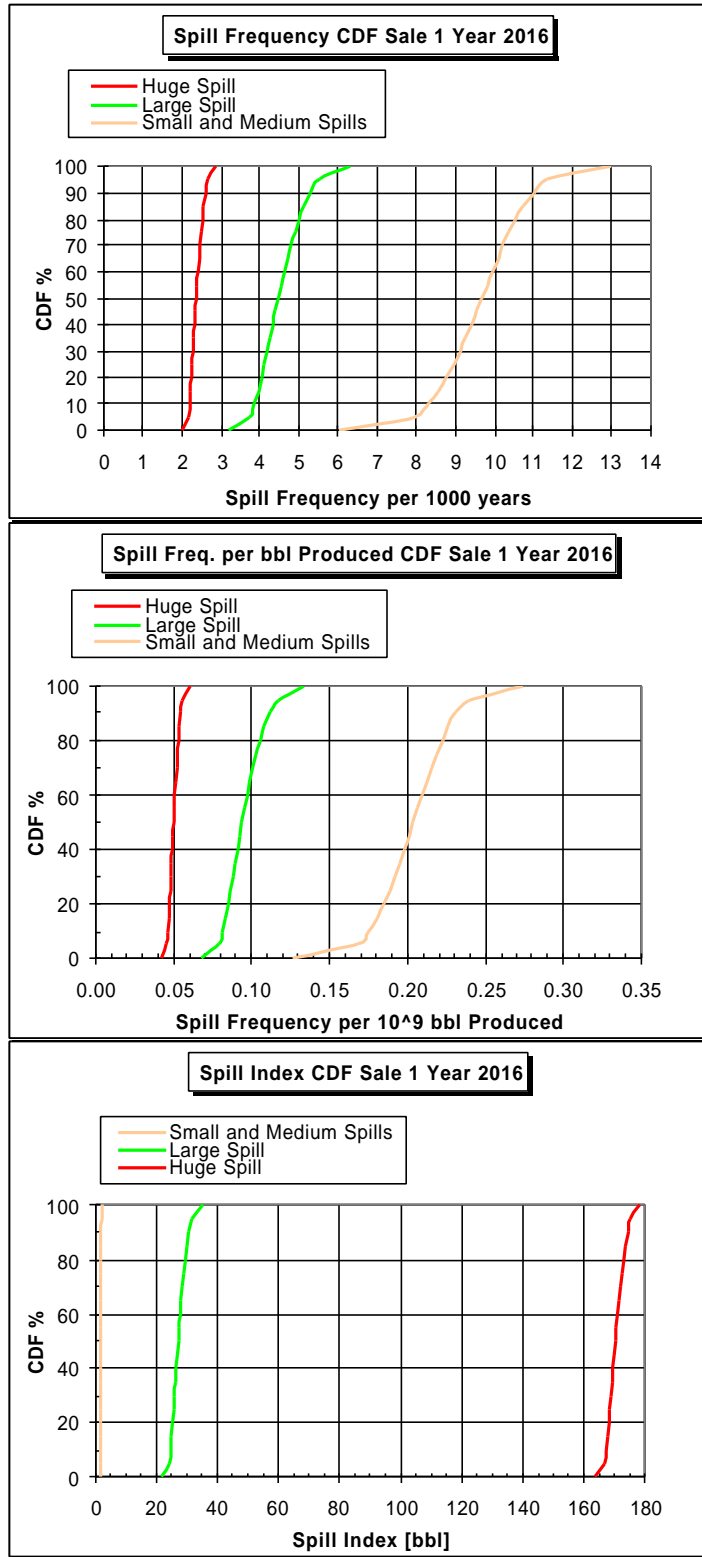


Figure 5.8
Beaufort Sea Sale 1 Indicator Distributions

In other words, there is a 40% chance that small and medium spills will occur at a rate of 0.2 per billion or less. Conversely, there is a 60% chance that the small and medium spill rate will be greater than 0.2 per billion. The distributions show relatively small variance; this is largely attributable to the fact that the historical data used as a basis for the calculations, were considered to be precise; only Arctic effect input distributions were used. The frequency spill indicator variability can be estimated from the upper (95%) and lower (5%) bound values. For example, for large spill frequency (from Table 5.1), the lower bound is 83% of the mean; the upper bound, 130% of the mean.

5.3.2 Beaufort Sea Lease Sale 2 Oil Spill Occurrence Indicators

Figure 5.9 summarizes the three oil spill occurrence indicators for Beaufort Sea Sale 2. The primary difference is one of scheduling with some differences in magnitude of the indicators, although they are not substantially different from those of Sale 1.

5.3.3 Beaufort Sea Lease Sale 3 Oil Spill Occurrence Indicators

Figure 5.10 summarizes all three of the Beaufort Sea Sale 3 oil spill occurrence indicators. Again, these are not substantially different from the Sale 1 and 2 indicators.

5.3.4 Beaufort Sea Sale All Oil Spill Occurrence Indicators

The oil spill occurrence indicators for all three Beaufort Sea Sale development scenarios are summarized in Figure 5.11. As one would expect, the absolute values of spill frequencies are significantly higher than any of the sales, essentially because they are the sum, through the Monte Carlo iteration process, of the three sales spill frequencies. Spills per barrel produced tend to be the same as those of the individual sales. Finally, the spill index, which is the product of the frequency and average spill size, as one would expect, is significantly higher for the composite scenario, roughly three times the average value for the three sales. Naturally, the spill by facility breakdowns, the Monte Carlo results, and all the details of the calculations for the composite scenario as well as each individual sale scenario are given in Appendix C.

5.3.5 Beaufort Sea Sale All Comparative Non-Arctic Indicator Assessment

To give an idea of the effect of the frequency variations introduced in Chapter 4, the composite (Sale All) Beaufort Sea scenario was also modeled utilizing unaltered historical frequencies. That is, no changes to incorporate the Arctic effects were introduced in the spill indicator calculations. Put yet another way, it was assumed that the facilities of the composite scenario would behave as if they were in the Gulf of Mexico environment rather than in the Arctic environment. Figures 5.12, 5.13, and 5.14 show the

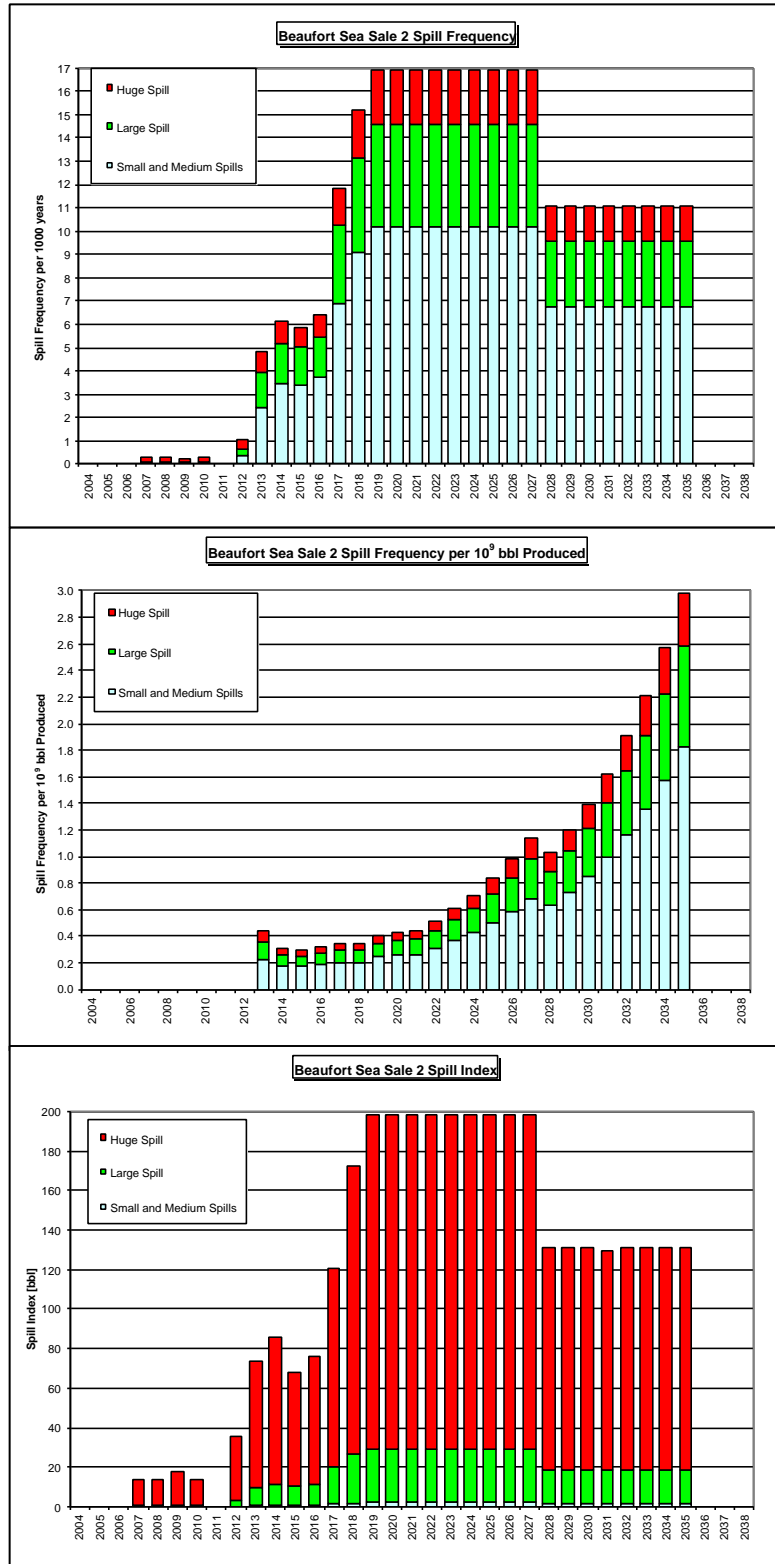


Figure 5.9
Beaufort Sea Sale 2 Indicators

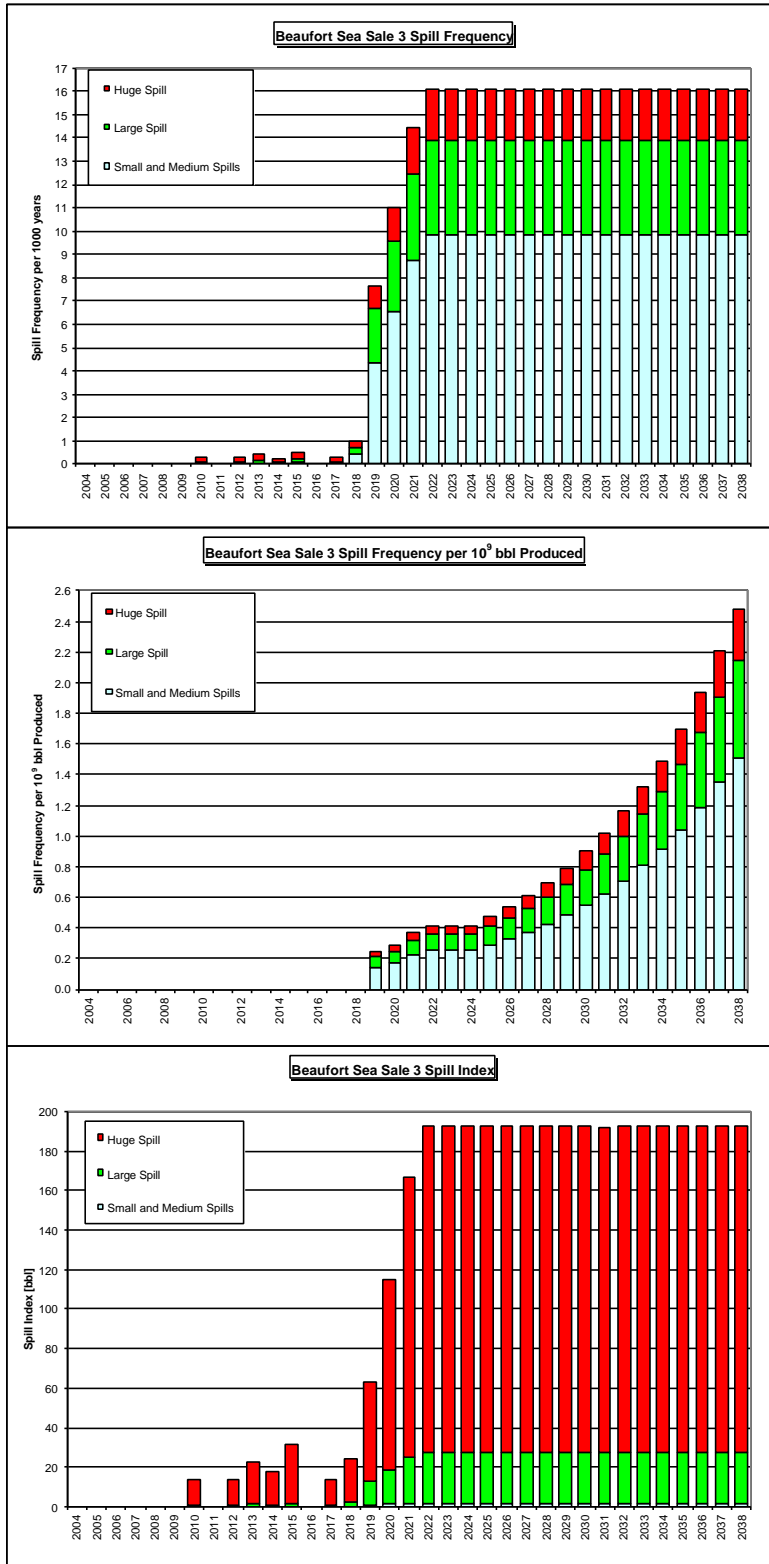


Figure 5.10
Beaufort Sea Sale 3 Indicators

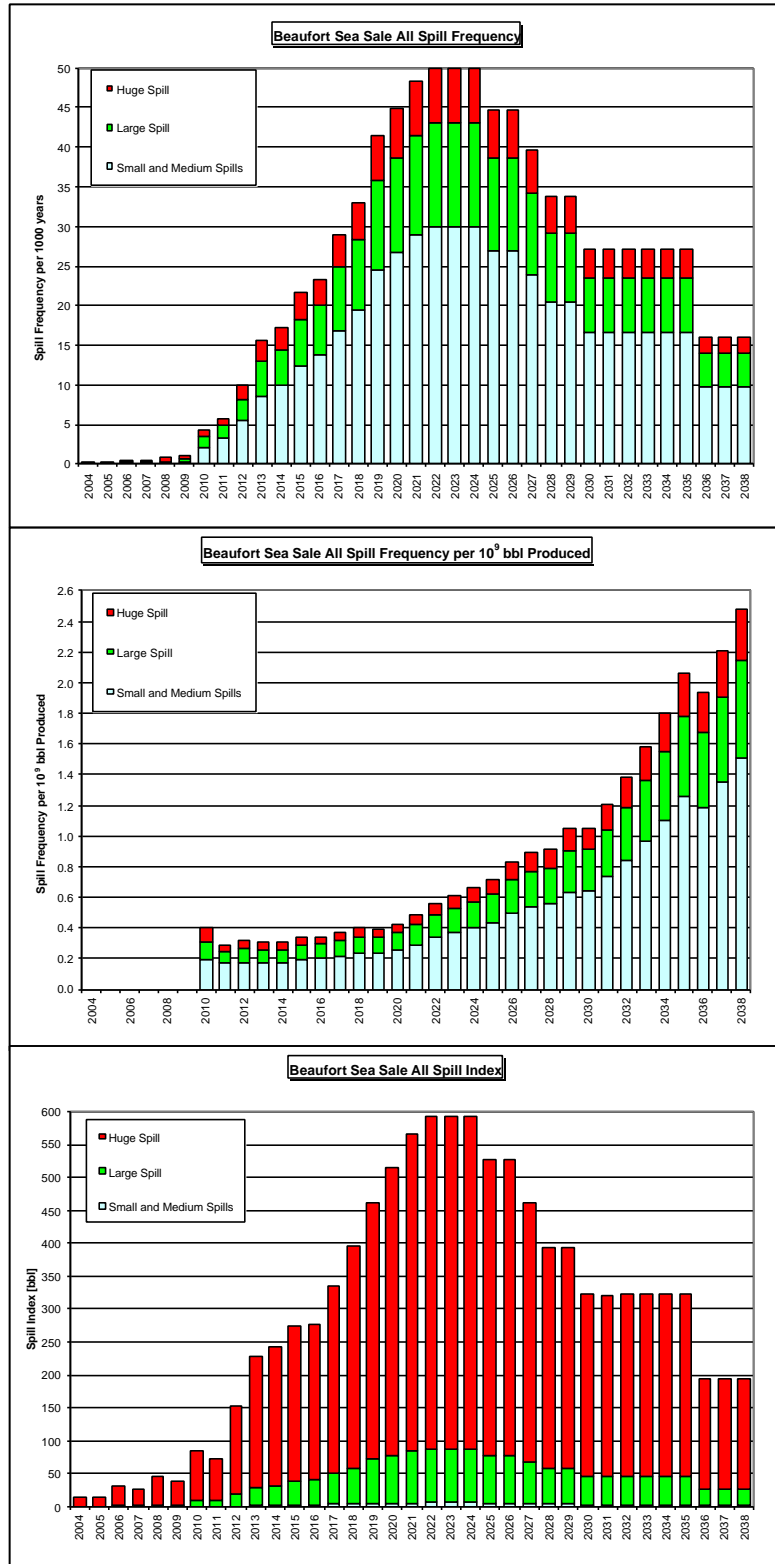


Figure 5.11
Beaufort Sea Sale All Indicators

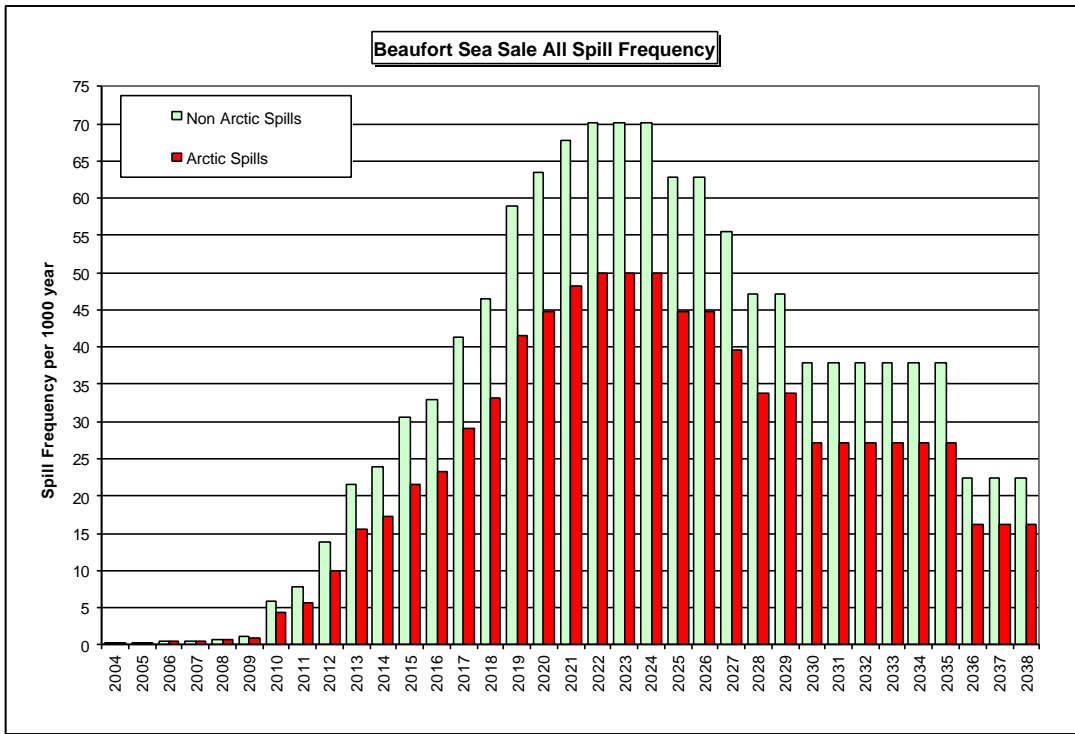


Figure 5.12
Beaufort Sea Sale All Spill Frequency – Arctic and Non-Arctic

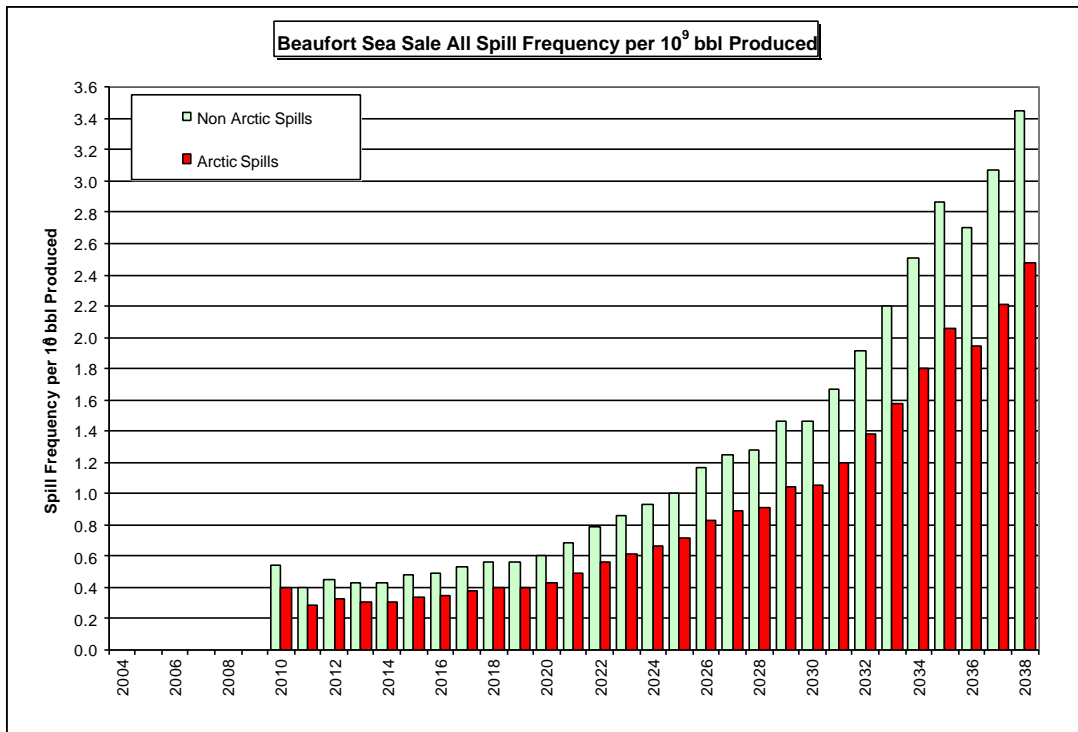


Figure 5.13
Beaufort Sea Sale All Spill Frequency per 10⁹ Barrels Produced – Arctic and Non-Arctic

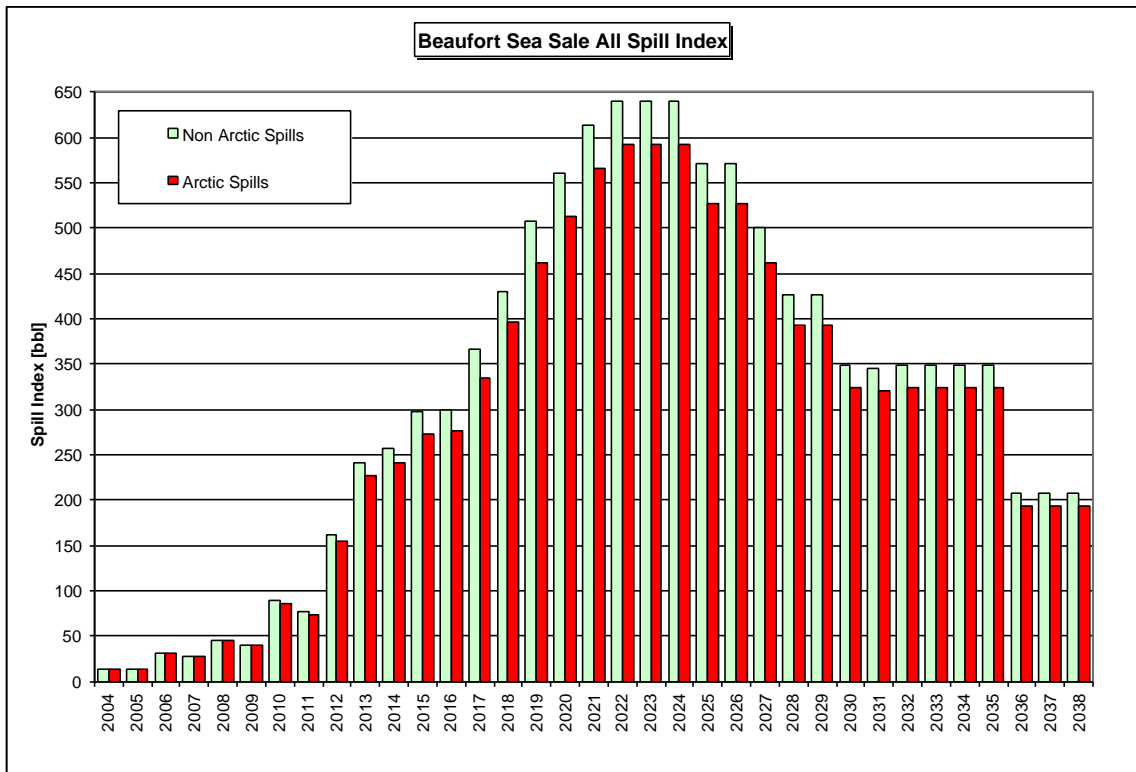


Figure 5.14
Beaufort Sea Sale All Spill Index – Arctic and Non-Arctic

total values calculated for each of the three spill indicators. The dark histogram bar on the right side corresponds to the Arctic spill indicator, while that, on the left, corresponds to the computation based on historical frequencies only. Spill frequency in an absolute sense is significantly reduced for the Arctic situation roughly by 30%. The spills per barrel produced are also significantly reduced, as can be seen in Figure 5.13. However, the spill index, because of the disproportionate effect of large spills, shows only a small reduction of less than 10%. What the comparison shows is that the Arctic development scenarios will have a lower oil spill occurrence than similar development scenarios in the GOM.

5.4 Summary of Chukchi Sea Oil Spill Occurrence Indicators

5.4.1 Chukchi Sea Base Case Oil Spill Occurrence Indicators

Chukchi Sea scenarios described in Chapter 3 span only 10 years. Figure 5.15 shows all of the Chukchi Sea Base Case midpoint oil spill occurrence indicators. The spill indicators tend to be higher than those for the Beaufort Sea individual lease sales, but are comparable to those of the composite Beaufort Sea case. Again, the details of the indicators are presented in Appendix C.

The variation shown by the cumulative distribution functions for each of the indicators is shown in Figure 5.16. The Chukchi Sea small and medium spill indicators exhibit a greater variance than their Beaufort Sea counterparts with value of lower bound (5%) and upper bound (95%) of 67% and 150% of the mean, respectively.

5.4.2 Chukchi Sea High Case Oil Spill Occurrence Indicators

Figure 5.17 shows the Chukchi Sea High Case midpoint oil spill occurrence indicators. Again, these indicators tend to be higher than those for the individual Beaufort Sea components, and in this case, even higher than those of the Beaufort Sea composite and the Chukchi Sea Base Case. This is clearly because the potential spill sources increase significantly with the increase in the extent of the facilities. Some affects of scale, however, can be noted in the reduction of the expected Chukchi Sea spill frequency per barrel produced as shown in the middle graph in Figure 5.17.

Finally, the Chukchi Sea High Case indicator cumulative distribution functions are illustrated in Figure 5.18. The same pattern of variance as for the Base Case is evident for the High Case CDFs.

5.4.3 Chukchi Sea High Case Comparative Non-Arctic Indicator Assessments

As was done for the Beaufort Sea (Section 5.3.5), a non-Arctic comparison was carried out for the Chukchi Sea. Figure 5.19 shows the comparative results of the calculation. Again, the non-Arctic scenario exhibits higher oil spill occurrences through higher values of all three oil spill indicators.

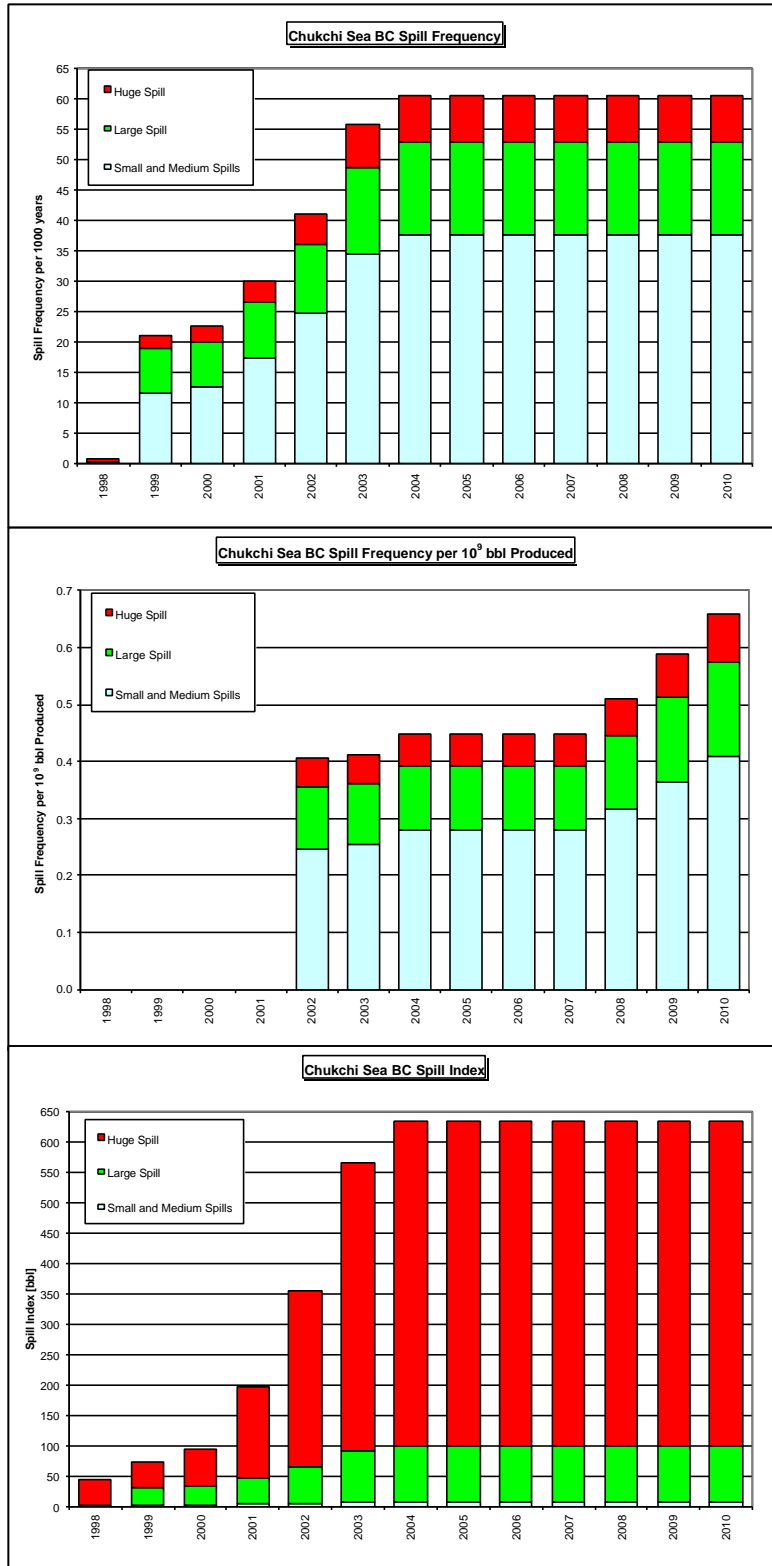


Figure 5.15
Chukchi Sea Base Case Indicators

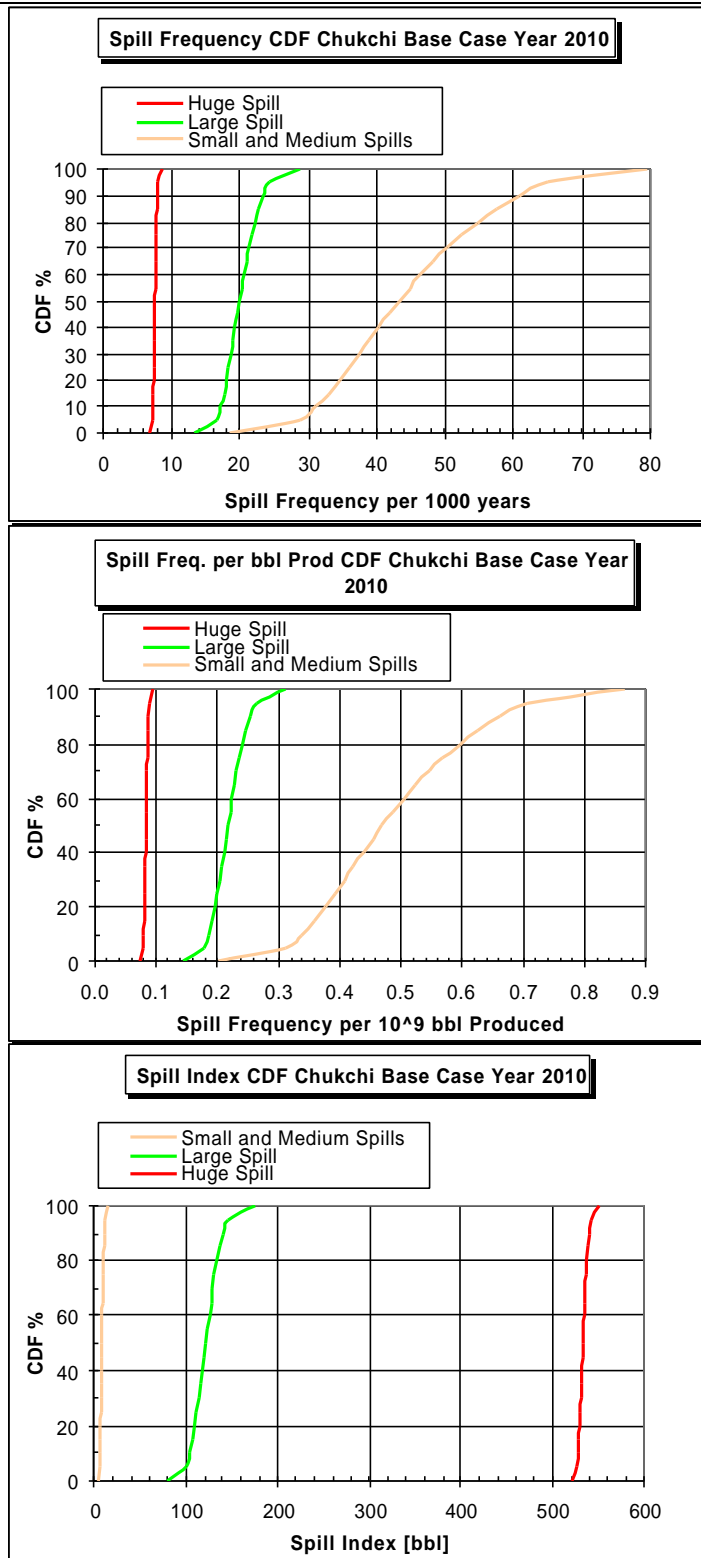


Figure 5.16
Chukchi Sea Base Case Indicator Distributions

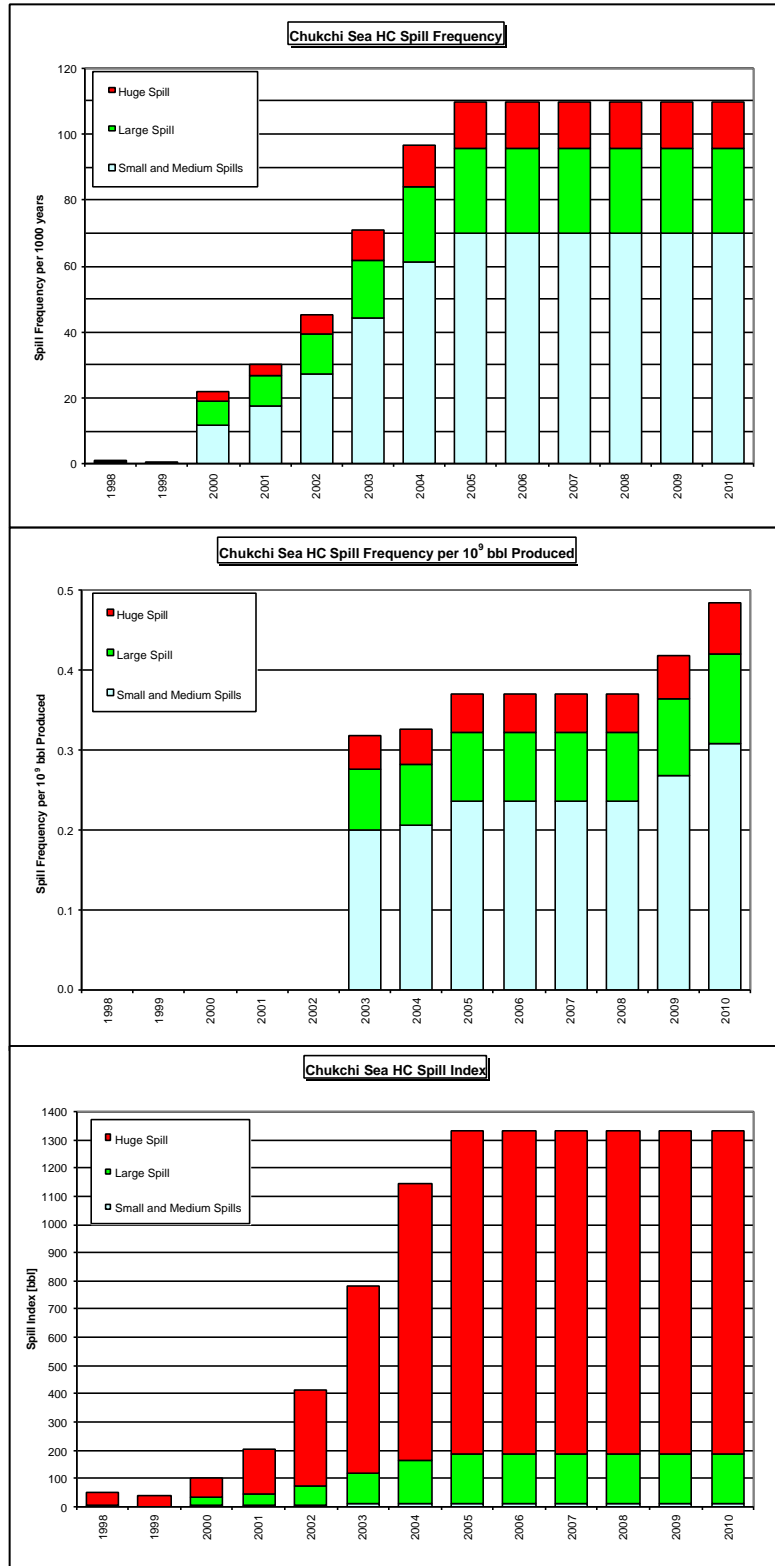


Figure 5.17
Chukchi Sea High Case Indicators

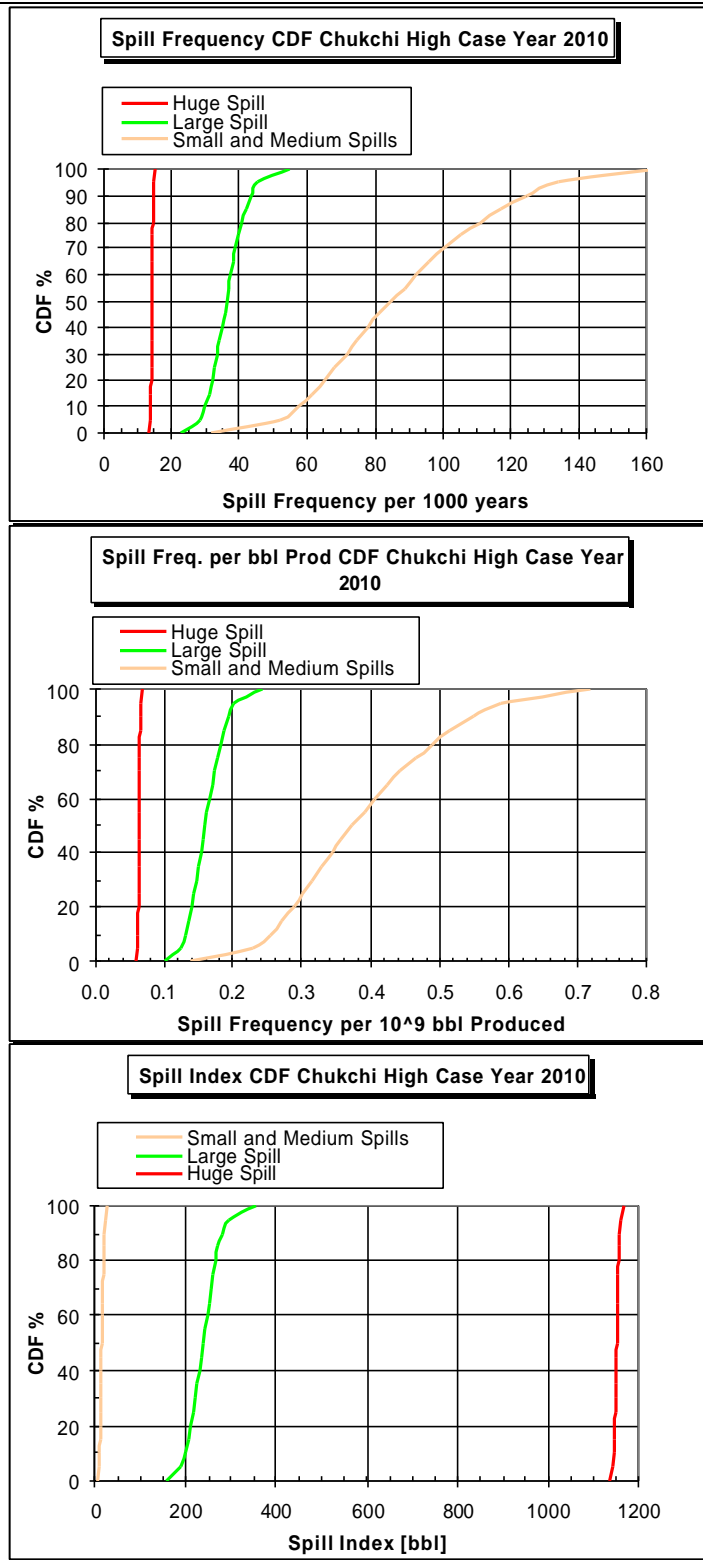


Figure 5.18
Chukchi Sea High Case Indicator Distributions

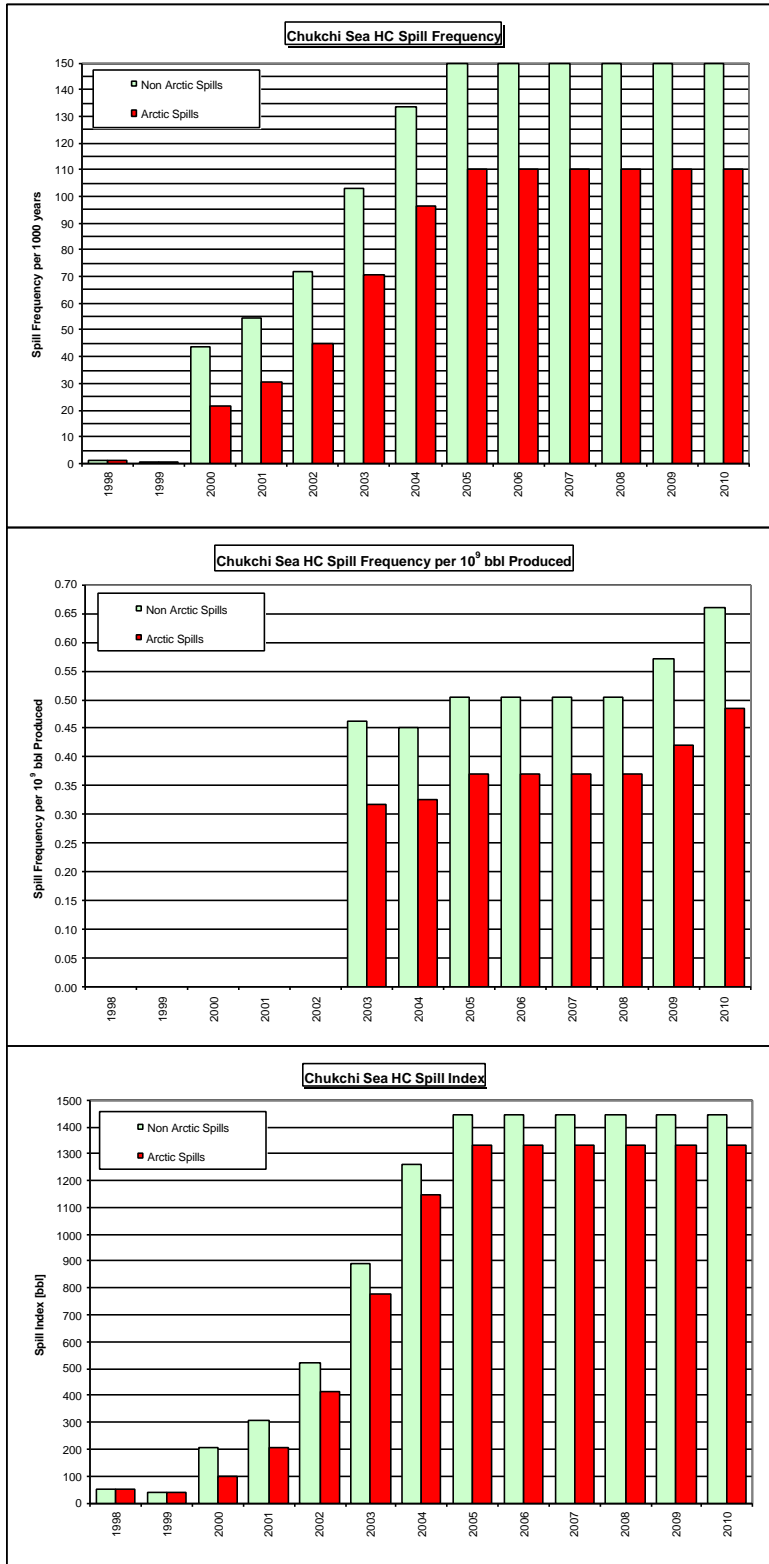


Figure 5.19

Comparative Chukchi Sea High Case Spill Indicators

5.5 Summary of Representative Oil Spill Occurrence Indicator Results

How do spill indicators for the different scenarios and for their non-Arctic counterparts vary by spill size location. Table 5.2 summarizes the spill indicator values for representative years. Except for the maximum spill frequency per barrel produced indicator, which occurs in the final year of the associated scenarios, representative years are chosen as the peak production years. The following can be observed from Table 5.2.

- Each spill indicator for Beaufort Sea Sale 1, 2, and 3 is similar in value. The indicators are higher for the composite “sale” scenario.
- Chukchi Sea spill indicators are all higher than Beaufort Sea indicators.
- Spill frequency per year and per barrel-year decreases significantly with increasing spill size for all scenarios.
- The spill index increases dramatically with spill size for all scenarios.
- All non-Arctic scenario spill indicators are greater than their Arctic counterparts. Non-Arctic spill frequencies are approximately 40% greater; spill indices are 8% greater for the non-Arctic scenarios.

How do the spill indicators vary by facility type for representative scenarios? The contributions of spill indicators by facility have also been summarized by representative scenario years. Table 5.3 gives the component contributions, in absolute value and percent, for each of the main facility types; namely, pipelines (P/L), platforms, and wells. The following may be noted from Table 5.3:

- For both the Beaufort and Chukchi scenarios, platforms contribute the most (50% and 61% respectively) to the two spill frequency indicators, but the least (5% and 6% respectively) to the spill index.
- Pipelines in the Beaufort scenarios are next in relative contribution to spill frequencies (31%) and intermediate in contribution to spill index (10%).
- The relative contributions of pipelines to spill frequencies in the Chukchi, however, are approximately the same (20%) as contributions of wells to spill frequencies in the Chukchi.
- Wells are by far (at 86% and 89% respectively) the highest contributors to spill index in the Beaufort and Chukchi Seas, while platforms and wells are responsible for 10% or less contribution to the spill index.
- It can be concluded that platforms are likely to have the most, but smaller spills, while wells will have the least number, but largest spills. Pipelines will be in between, with a tendency towards more spills than wells, but less or about the same number as platforms. Pipeline spill volumes will tend to be greater than (Beaufort) or similar in size (Chukchi) to platform spills.

Table 5.2
Summary of Spill Indicators for All Scenarios

SPILL INDICATORS	Spill Size	Beaufort Sea					Chukchi Sea		
		Year 2016	Year 2019	Year 2024	Year 2020	Year 2020	Year 2010	Year 2010	Year 2010
		Sale 1	Sale 2	Sale 3	Sale All	Sale All Non Arctic	Base Case	High Case	High C Non Arctic
Spill Frequency per 10 ³ years	SM	9.97	10.17	9.84	29.98	43.90	37.66	70.18	95.17
	L	4.53	4.42	4.07	13.02	17.83	15.23	25.34	36.70
	H	2.39	2.34	2.21	6.93	8.31	7.68	14.38	17.85
	All	16.88	16.93	16.12	49.93	70.04	60.58	109.91	149.72
Spill Frequency per 10 ⁹ bbl produced	SM	0.21	0.24	0.25	0.40	0.59	0.41	0.31	0.42
	L	0.10	0.11	0.11	0.17	0.24	0.17	0.11	0.16
	H	0.05	0.06	0.06	0.09	0.11	0.08	0.06	0.08
	All	0.36	0.40	0.42	0.67	0.94	0.66	0.48	0.66
Maximum Spill Frequency per 10 ⁹ bbl produced (year varies)	All	2.53	2.99	2.48	2.48	3.45	0.66	0.48	0.66
Spill Index [bbl]	SM	2	2	2	6	9	8	13	19
	L	28	27	26	81	102	92	171	218
	H	170	169	165	505	529	534	1150	1211
	All	200	199	193	592	640	633	1335	1448

Table 5.3
Composition of Spill Indicators

SPILL INDICATORS	Beaufort Sea				Chukchi Sea			
	Sale All - Year 2024				High Case - Year 2010			
	P/L	Platforms	Wells	TOTAL	P/L	Platforms	Wells	TOTAL
Spill Frequency per 10 ³ years	15.55	25.11	9.27	49.93	21.18	67.03	21.69	109.91
	31%	50%	19%	100%	19%	61%	20%	100%
Spill Frequency per 10 ⁹ bbl produced	0.21	0.34	0.12	0.67	0.09	0.30	0.10	0.48
	31%	50%	19%	100%	19%	61%	20%	100%
Spill Index [bbl]	56	29	507	592	73	76	1186	1335
	10%	5%	86%	100%	5%	6%	89%	100%

Figure 5.20 shows the CDFs for the Beaufort Sea Sale All spill indicators. The variability of these indicators is fairly representative of the trends in variability for spill indicators for all sales and locations studied. Generally, the following can be observed from Figure 5.20:

- The variance of the frequency spill indicators decreases as spill size increases. In other words, small and medium spills illustrate the largest variability; huge spills show the least variability.
- The variability of the spill index shows the same trend, but with a much smaller variability for the spill indices for all spill sizes.

Generally, in Figure 5.20, the slope of each line is an indicator of its variance. Specifically, it was found that for all spills the upper and lower bound (95th percentile and 5th percentile, respectively) ranged from 20% to 30%, with the smaller variances corresponding to the Beaufort Sea scenarios and the large ones to the Chukchi Sea scenarios. Upper (95%) and lower (5%) bounds, however, varied as much as 20 to 50% and 20 to 35% of the mean. Since many of the variations in the Arctic inputs ranged in excess of plus or minus 80% of the mean value, the relatively small variances suggest that the total model is quite robust; large variances in inputs cause only small variances in outputs. However, this small variance relates only to the Arctic effects; variance in historical spill size and frequency was considered to be zero. Thus, the variances discussed here characterize the uncertainties associated with the Arctic effects incorporated through the fault tree methodology in this study.

5.6 Comparison of Monte Carlo and Expected Value Results

As has been indicated, because of the upward skewness of the Arctic input value distributions, mean values of these distributions are generally greater than their expected values or modes. Hence, Monte Carlo results give higher occurrence indicators than the expected value results.

Skewness of the Arctic effect distributions results from the constraints on the lower bound. Clearly, physical quantities such as gouge flux cannot take on a value of less than zero; however, their upper bound is virtually unrestricted. Thus, lower bounds are restricted to less than 100% of the expected value, while upper bounds are unrestricted and can be several hundred percent of the expected value. If normal distributions had been chosen for the Arctic effects, then the Monte Carlo mean values and the expected values would have been numerically identical.

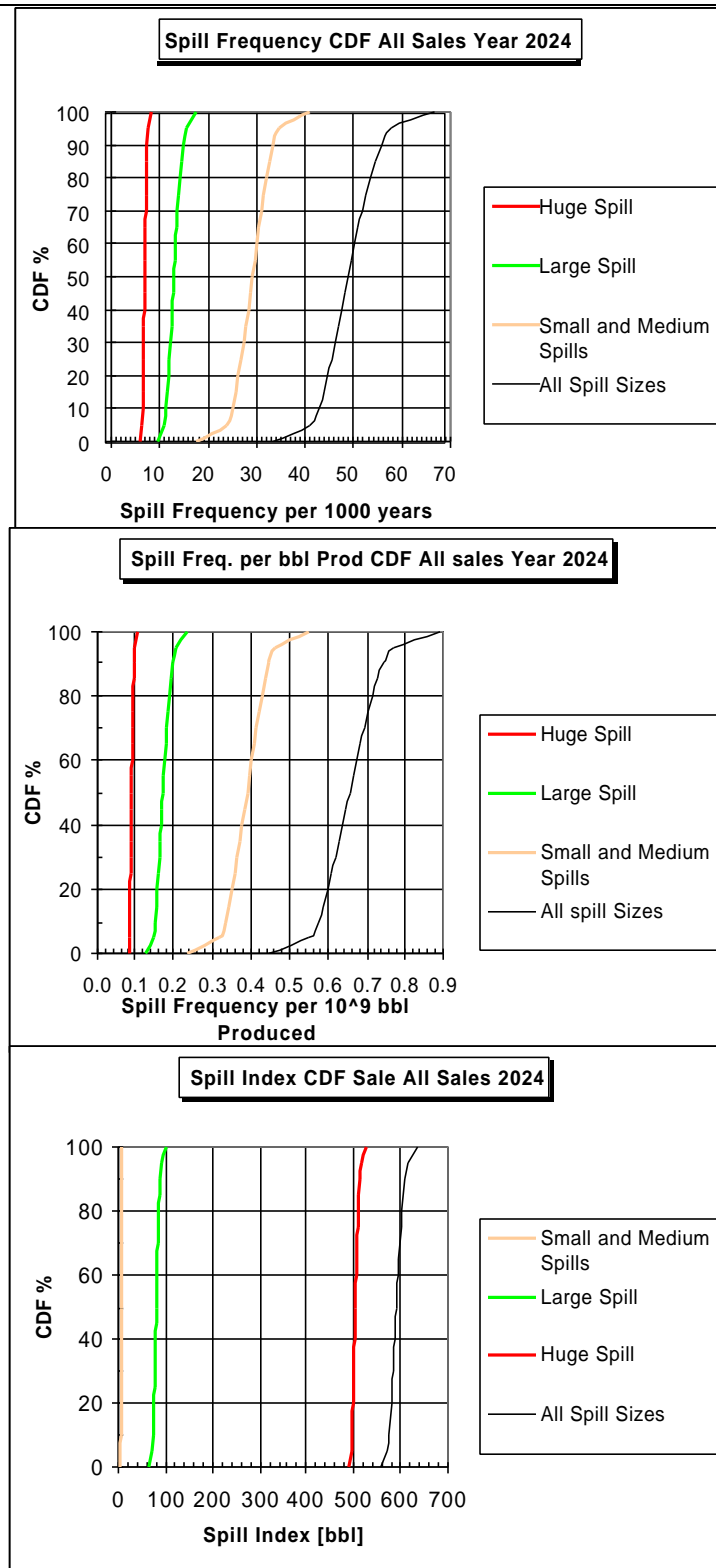


Figure 5.20
Typical Spill Occurrence Indicator Variance Graphs

Table 5.4 compares values of the spill occurrence indicators obtained by the two methods, and gives the difference as a percentage of the expected value result in each case. The percentage of the expected value result is taken so that if calculations are done using the expected value method, the simpler method, one has an idea of how much the expected value results should be increased to reach the levels of the Monte Carlo results. As can be seen from Table 5.4, except for wells for which no Arctic effects were included, the Monte Carlo values are greater by as much as 76%, and vary with facility type. The following observations can be made:

- Beaufort Sea pipeline Monte Carlo results for frequency calculations are in the order of 50% higher than the expected value calculations, and approximately 20% higher for the Chukchi Sea.
- Platform occurrence frequency indicators are in the order of 17% higher with Monte Carlo calculations for the Beaufort Sea, and roughly 28% higher for the Chukchi Sea.
- Wells, as indicated earlier, show no difference with calculation method, as no Arctic effects were introduced.
- On the average, total frequency indicators are roughly 20% higher calculated using the Monte Carlo method for both the Beaufort and Chukchi Seas.
- Pipeline spill indices are 76% and 32% higher for Beaufort and Chukchi Seas locations, respectively.
- Platform spill indices are 15% and 25% higher for Beaufort and Chukchi Seas locations, respectively.
- Because the average spill index under the total column is dominated by the well spill indices, which show no Arctic effects, their overall difference is quite low, in the order of 4%.

What the comparison demonstrates is that there is a significant difference between the Monte Carlo and expected value results. Generally, if total development scenario expected value results are to be used, they should be increased by at least 20% to account for the likely skewness in the input value distributions.

Table 5.4
Comparison of Monte Carlo and Expected Value Spill Indicators

SPILL INDICATORS	ITEM	Beaufort Sea				Chukchi Sea			
		Sale All - Year 2024				High Case - Year 2010			
		P/L	Platforms	Wells	TOTAL	P/L	Platforms	Wells	TOTAL
Spill Frequency per 10 ³ years	Monte Carlo	15.55	25.11	9.27	49.93	21.18	67.03	21.69	109.91
	Expected Value	10.15	21.72	9.27	41.14	17.43	52.77	21.69	91.89
	Difference	53%	16%		21%	22%	27%		20%
Spill Frequency per 10 ⁹ bbl produced	Monte Carlo	0.21	0.34	0.12	0.67	0.09	0.3	0.1	0.48
	Expected Value	0.14	0.29	0.12	0.55	0.08	0.23	0.10	0.41
	Difference	55%	17%		23%	17%	29%		17%
Spill Index [bbf]	Monte Carlo	56	29	507	592	73	76	1186	1335
	Expected Value	32	25	507	564	55	61	1186	1302
	Difference	76%	15%		5%	32%	25%	0%	3%

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

6.1.1 Conclusions on Spill Indicator Trends

The three spill occurrence indicators – annual frequency, annual frequency per barrel produced, and spill index – exhibit a wide range of values varying with location, scenario year, facility composition, and spill size. For the Beaufort Sea and Chukchi Sea locations, comparative non-Arctic scenarios were also postulated and analyzed.

6.1.1.1 Spill Occurrence Indicator Variations by Spill Size and Location

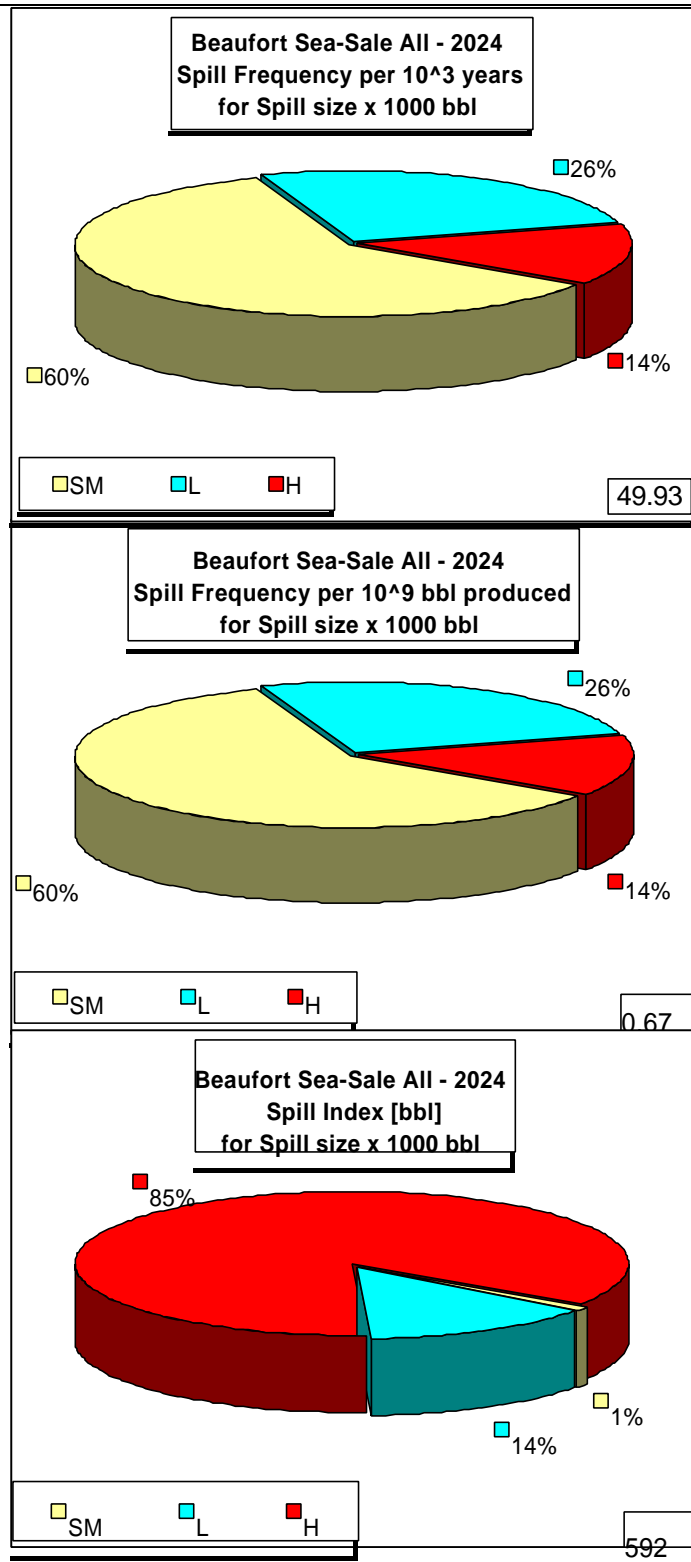
How do spill indicators for the different scenarios and for their non-Arctic counterparts vary by spill size and location? Table 6.1 summarizes the spill indicator values for representative years. Representative years are chosen as the peak production years. Figures 6.1 and 6.2 show the spill size composition associated with each scenario representative year chosen. The total values of each spill index are also given in a rectangle in the bottom right hand corner of each pie chart. The following can be observed from Figures 6.1 and 6.2 and Table 6.1.

- Each spill indicator for Beaufort Sea Sale 1, 2, and 3 is similar in value. The indicators are higher for the composite “Sale All” scenario (Table 6.1).
- Chukchi Sea spill indicators are all higher than Beaufort Sea indicators (Table 6.1).
- Spill frequency per year and per barrel produced decreases significantly with increasing spill size for all scenarios (Figures 6.1 and 6.2). The spill frequency and spill frequency per barrel proportions are the same for any given year. Their absolute value differs only because the latter is divided by the annual production volume.
- The spill index increases dramatically with spill size for all scenarios (Table 6.1 and Figures 6.1 and 6.2).
- All non-Arctic scenario spill indicators are greater than their Arctic counterparts. Non-Arctic spill frequencies are approximately 40% greater; spill indices, 8% greater for the non-Arctic scenarios (Table 6.1).

In addition, the unit Arctic oil spill frequencies for pipelines show a decrease with increasing water depth. That is, pipeline failures per km-yr are highest for shallow water and lowest for deep water. Thus, given the same size and length of pipeline in shallow and deep water, the spill indicators for deep water pipelines would be lower than those for shallow water pipelines. The opposite trend was observed to apply to platforms. No water depth effect was introduced for wells.

Table 6.1
Summary of Spill Indicators for All Scenarios

SPILL INDICATORS Spill Size bbl x 1000		Beaufort Sea					Chukchi Sea		
		Year 2016	Year 2019	Year 2024	Year 2020	Year 2020	Year 2010	Year 2010	Year 2010
		Sale 1	Sale 2	Sale 3	Sale All	Sale All Non Arctic	Base Case	High Case	High C Non Arctic
Spill Frequency per 10 ³ years	SM	9.97	10.17	9.84	29.98	43.90	37.66	70.18	95.17
	L	4.53	4.42	4.07	13.02	17.83	15.23	25.34	36.70
	H	2.39	2.34	2.21	6.93	8.31	7.68	14.38	17.85
	All	16.88	16.93	16.12	49.93	70.04	60.58	109.91	149.72
Spill Frequency per 10 ⁹ bbl produced	SM	0.21	0.24	0.25	0.40	0.59	0.41	0.31	0.42
	L	0.10	0.11	0.11	0.17	0.24	0.17	0.11	0.16
	H	0.05	0.06	0.06	0.09	0.11	0.08	0.06	0.08
	All	0.36	0.40	0.42	0.67	0.94	0.66	0.48	0.66
Spill Index [bbl] (Product of spill frequency and mean spill size)	SM	2	2	2	6	9	8	13	19
	L	28	27	26	81	102	92	171	218
	H	170	169	165	505	529	534	1150	1211
	All	200	199	193	592	640	633	1335	1448



**Figure 6.1
Beaufort Sea 'Sale All' Spill Indicators – Year 2024**

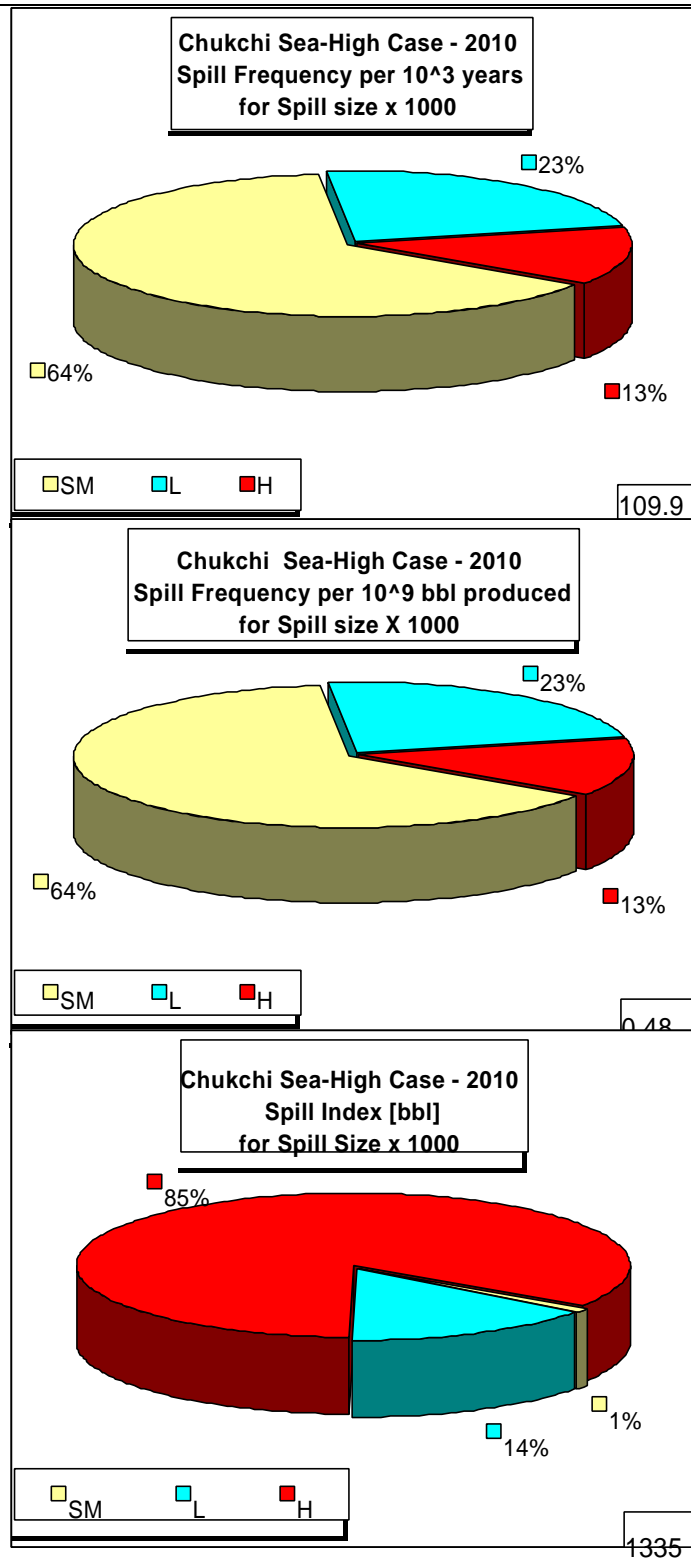


Figure 6.2
Chukchi Sea 'High Case' Spill Indicators – Year 2010

6.1.1.2 Facility Contributions to Spill Occurrence Indicators

How do the spill indicators vary by facility type for representative scenarios? The contributions of spill indicators by facility have also been summarized for representative scenario years. Figures 6.3 and 6.4 gives the relative component contributions, in absolute value and percent, for each of the main facility types; namely, pipelines (P/L), platforms, and wells. Platform spills do not include blowouts. Blowouts are the only spill events categorized under well spills. The following may be noted from these figures:

- For both the Beaufort and Chukchi scenarios, platforms contribute the most (50% and 61% respectively) to the two spill frequency indicators, but the least (5% and 6% respectively) to the spill index (Figure 6.3 and 6.4).
- Pipelines in the Beaufort scenarios are next in relative contribution to spill frequencies (31%) and intermediate in contribution to spill index (10%) (Figure 6.3).
- The relative contribution of pipelines to spill frequencies in the Chukchi, however, are approximately the same (19%) as contributions of wells (20%) (Figure 6.4).
- Wells are by far the highest contributors to spill index in the Beaufort and Chukchi Seas, at 85% and 89% respectively, while platforms and wells are each responsible for 10% or less contribution to the spill index (Figures 6.3 and 6.4).
- It can be concluded that platforms are likely to have the most, but smaller spills, while wells will have the least number, but largest spills. Pipelines will be in between, with a tendency towards more spills than wells, but less or about the same number as platforms. Pipeline spill volumes will tend to be greater than (in Beaufort) or similar in size (in Chukchi) to platform spills.

6.1.1.3 Projected Annual Variations of Spill Occurrence Indicators

How do spill indicators vary over the development life cycle? Figure 6.5 shows the composite Beaufort Sea scenario annual variation in spill indicators over the expected development lifetime. Generally, spill frequencies and the spill index can be seen to follow the facility build-up and phase-out, as they are directly proportional to facility quantities. Spill frequency per barrel produced, however, continues to rise beyond the peak production year. The lack of fall of spills per billion barrels produced in years after peak production is partially artificial. The development scenarios used by MMS in environmental analyses (and used in this report) assume pipelines, platforms, and wells are abandoned at a rate lower than the rate of decrease in production. This leads to the artifact that as production goes to zero, spills per barrel produced increase to infinity. The artifact disappears when spill rates are summed or normalized over the life of the fields.

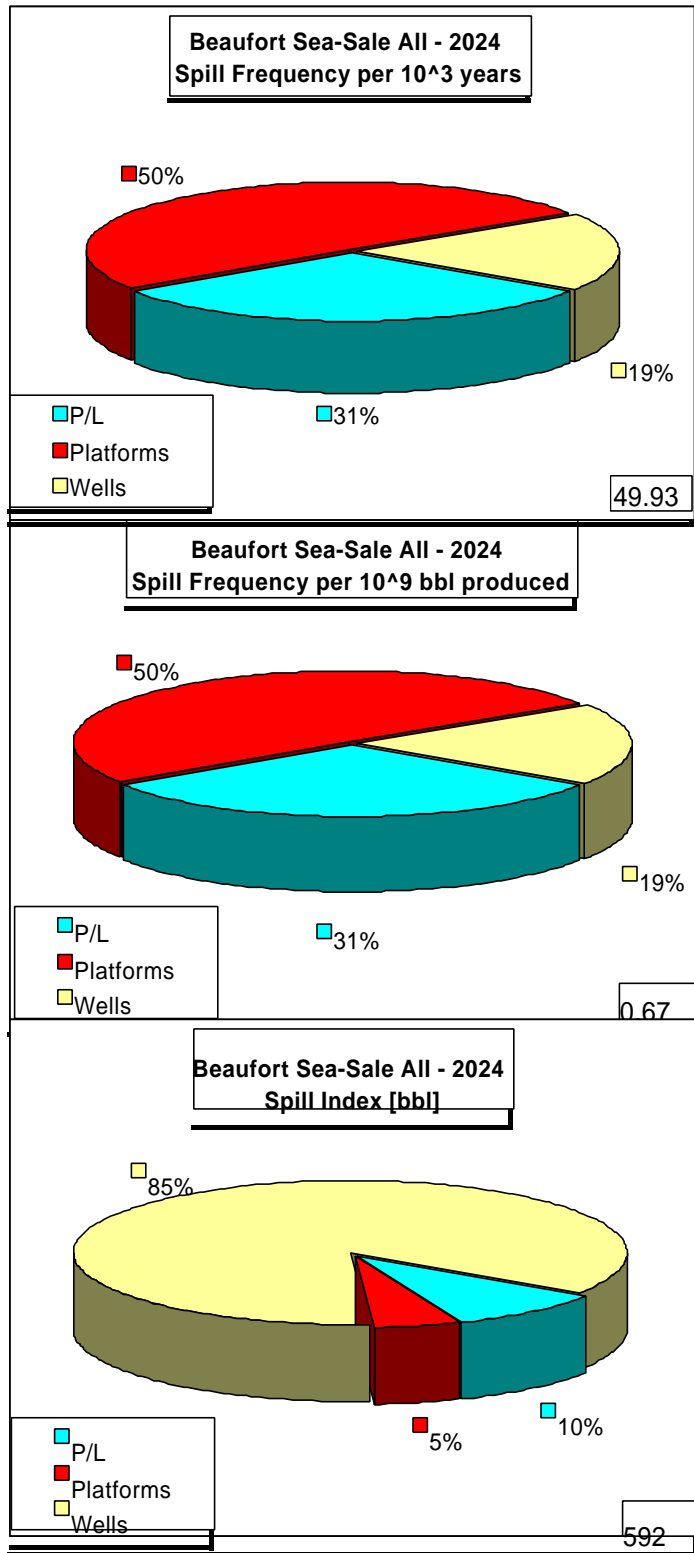


Figure 6.3
Beaufort Sea 'Sale All' Spill Indicators – Year 2024

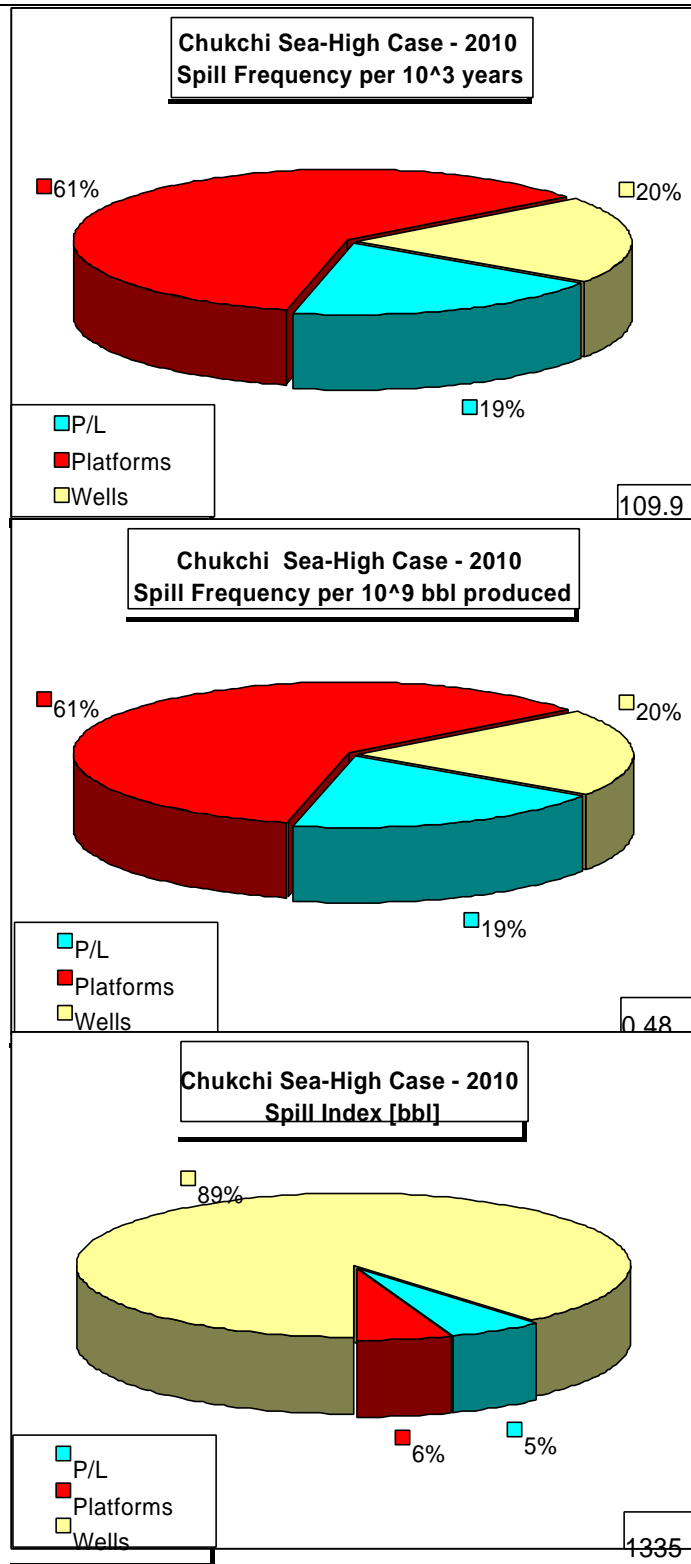


Figure 6.4
Chukchi Sea 'High Case' Spill Indicators – Year 2010

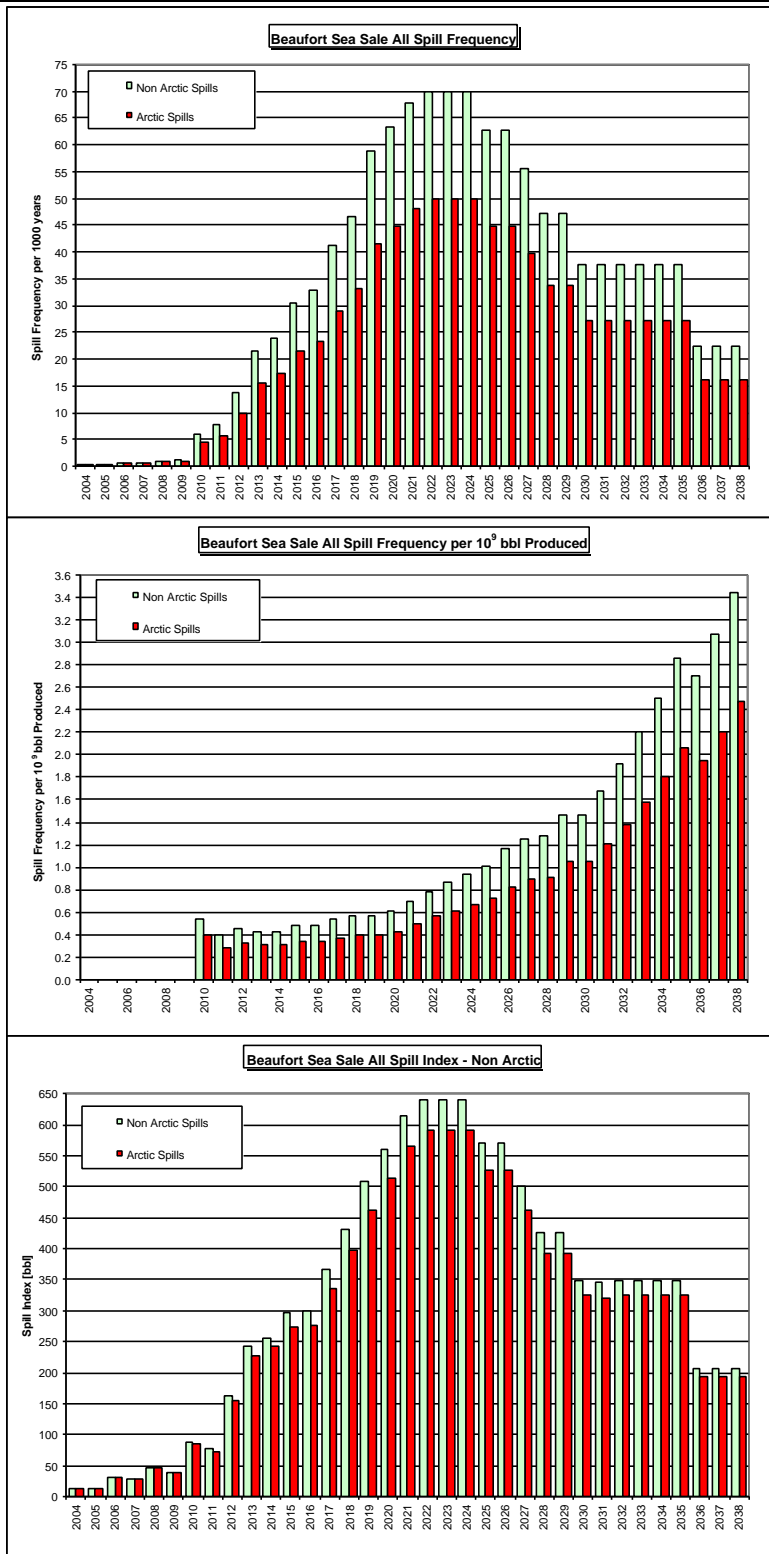


Figure 6.5
Beaufort Sea Composite Scenario Annual Variation
in Arctic and Non-Arctic Spill Occurrence Indicators

6.1.1.4 Spill Indicator Statistical Variance

The variance introduced into the spill occurrence indicators by the incorporation of Arctic effects was numerically evaluated. Figure 6.6 shows typical distributions of the resulting indicators, in this case for the Beaufort Sea composite (All Sales) scenario. The slope of each line is an indicator of its variance. Specifically, it was found that for all spills the standard deviation ranged from 12% to 15% of the mean, while the upper and lower bound (95th percentile and 5th percentile, respectively) ranged from 20% to 30%, with the smaller variances corresponding to the Beaufort Sea scenarios and the large ones to the Chukchi Sea scenarios. Upper (95%) and lower (5%) bounds, however, varied as much as 20 to 50% and 20 to 35% of the mean. Since many of the variations in the Arctic inputs ranged in excess of plus or minus 80% of the mean value, the relatively small variance of the indicators suggest that the total model is quite robust; large variances in inputs cause only small variances in outputs. However, this small variance relates only to the Arctic effects; variance in historical spill size and frequency was considered to be zero. Thus, the variances discussed here characterize the uncertainties associated with the Arctic effects incorporated through the fault tree methodology in this study.

6.1.2 Conclusions on the Methodology and Its Applicability

An analytical tool for the prediction of oil spill occurrence indicators for systems without history has been developed based on the utilization of fault tree methodology. Although the results generated are voluminous, they are essentially transparent, simple, and easy to understand. The analytical tool developed is also quite transparent, very efficient in terms of computer time and input-output capability, and user friendly for users that are generally familiar with the process. In addition, the basic model is setup so that any input variables can be entered as distributions; the model presented in this study only uses distributed values of the Arctic effect inputs.

A wealth of information that can be utilized for the optimal planning and regulation of future developments is generated by the analytical tool. Key aspects of the analytical tool capability may be summarized as follows:

- Ability to generate expected and mean values as well as their variability in rigorous numerical statistical format.
- Use of verifiable input data based on MMS historical spill data and statistics.
- Ability to independently vary the impacts of different causes on the spill occurrences as well as add new causes such as some of those that may be expected for the Arctic or other new environments.
- Ability to generate spill occurrence indicator characteristics such as annual variations, facility contributions, spill size distributions, and spill causes.

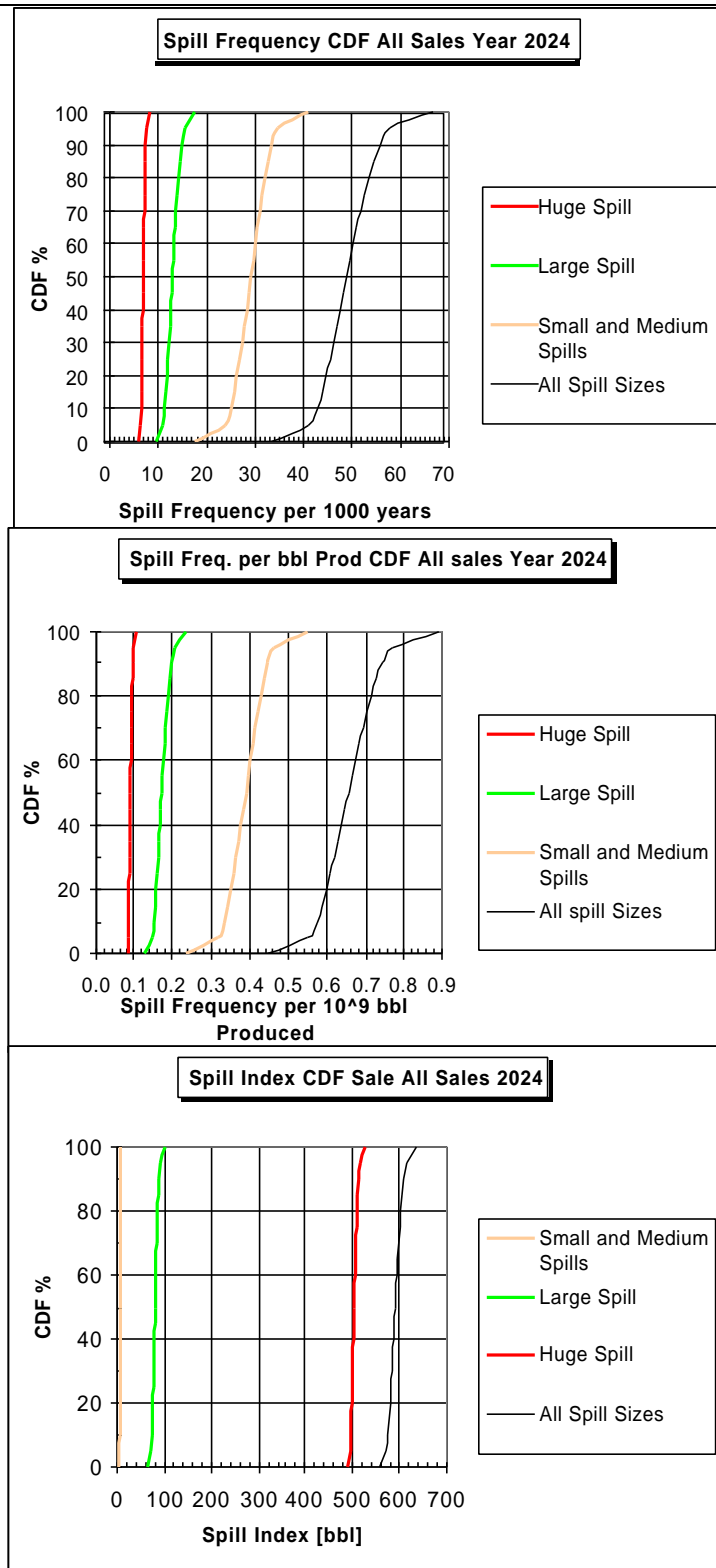


Figure 6.6
Typical Spill Occurrence Indicator Variance Graphs

- Ability to generate comparative spill occurrence indicators such as those of comparable scenarios in more temperate regions. The model developed provides a basis for estimating each Arctic effect's importance through sensitivity analysis as well as propagation of uncertainties.
- Capability to quantify uncertainties rigorously, together with their measures of variability.

6.2 Limitations of Methodology and Results

6.2.1 General Description of Limitations

During the work, a number of limitations in the input data, the scenarios, the application of the fault tree methodology, and finally the oil spill occurrence indicators themselves have been identified. These shortcomings are summarized in the following paragraphs.

6.2.2 Limitations of Input Data

Two categories of input data were used; namely the historical spill data and the Arctic effect data. Although a verifiable and optimal historical spill data set has been used, the following shortcomings may be noted:

- Gulf of Mexico (OCS) historical data bases were provided by MMS and used as a starting point for the fault tree analysis; however, some inconsistencies were identified in these databases as discussed in Appendix A, Section A.2.4.
- Only the historical spill frequency point value was utilized, since adequate data were not provided to create distributions of these frequencies.
- Several ranges of spill sizes were analyzed, but only the mean value of each spill size range was used to characterize representative spill size for each range. Spill size distribution data for each spill size range was available, but was not used in the interest of restricting the uncertainties to the Arctic effects.
- The assessment of the variability or statistical properties of the GOM historical data is a significant study in itself, which is expected to be carried out in the companion study being conducted in parallel with the present work
- The Arctic effects include modifications in causes associated with the historical data set as well as additions of spill causes unique to the Arctic environment. Quantification of existing causes for Arctic effects was done in a relative cursory way restricted to engineering judgement.
- A reproducible but relatively elementary analysis of gouging and scour effects was carried out.

- Upheaval buckling and thaw settlement effect assessments were included on the basis of an educated guess; no engineering analysis was carried out for the assessment of frequencies to be expected for these effects.
- No Arctic effects were estimated for the wells, which were considered to blowout with frequencies the same as those for the GOM.

6.2.3 Scenarios

The scenarios are those developed for use in the MMS Alaska OCS Region Environmental Impact Statements for Oil and Gas Lease Sales. As estimated they appear reasonable and were incorporated in the form provided. There are two possible shortcomings of the scenarios as follows:

- Distributed values for the key quantities were not provided, thus precluding their incorporation as distributions in the Monte Carlo analysis.
- The facility abandonment rate is significantly lower than the rate of decline in production.

6.2.4 Fault Tree Methodology

Generally, the fault tree methodology was limited primarily by the shortcomings in input data discussed above.

- The primary method for assessing uncertainties was restricted to the fault tree module, which incorporates the uncertainties or bounds assigned to the Arctic effects. The treatment of uncertainties could be expanded to incorporate distributions in volume of spills, and the original historical frequencies.
- The treatment of uncertainties was carried out utilizing a Monte Carlo process, which requires an add-in (called @Risk[®]) to the Excel spreadsheet within which the algorithms have been programmed. For some users, this might be slightly arcane; accordingly, it may be desirable to have two versions, the Monte Carlo version which gives more rigorous results and is used for results in the body of this report, and an expected value version, which may be utilized for rough estimates. Appendix C gives the detailed results and calculations for the Monte Carlo model; Appendix D gives those from the expected value model.
- The Monte Carlo results give higher oil spill occurrence indicators than the expected value results. This is due to the skewness of the Arctic effect distributed values, which are inputs to the Monte Carlo calculations.

6.2.5 Limitations of Indicators Generated

The following comments can be made on limitations associated with the indicators that have been generated.

- The indicators have inherited the deficiencies in the input and scenario data noted above. Indicators should be viewed primarily as trend indicators of the expected values and their distributions for Arctic developments.
- The indicator distribution shows relatively small variability – this is primarily because the only variability introduced is that of the Arctic effects.
- The model generating the indicators is fundamentally a linear model which ignores the effects of scale, of time variations such as the learning and wear-out curves (Bathtub curve), and production volume non-linear effects.
- The expected value (simpler) calculation results (given in Appendix D) should be used with caution since they underestimate the spill indicators. The underestimation ranges from 3 to 76%. Appendix D gives all the expected value calculations. The body of the report is based on the Monte Carlo results given in Appendix C.

6.3 Recommendations

6.3.1 Recommendations on Direct Application of Results from This Study

The results of this study can be applied directly in two principal ways; namely, on an annual per barrel produced basis, and on a total production volume basis.

On an annual basis, the peak production year oil spill frequency per barrel produced can be used to calculate corresponding annual spill frequencies for other annual production rate scenarios. This is done simply by multiplying the appropriate spill frequency per billion barrels produced from Table 6.1 by the subject annual production rate.

To apply the results on a total production volume basis, the following steps can be used:

- For the desired spill size range and facility component (or all facilities), add together the annual spill frequencies for each year of the production life.
- Divide the sum of the frequencies by the total production volume. This provides the number of spills per barrel produced for the entire development.
- For another development, multiply the above spills per barrel produced by the other development's total production volume.
- The resultant is the expected number of spills of the desired spill size range and for the desired facility component for the total production life of the other development.

6.3.2 *General Recommendations*

The following recommendations based on the work may be made:

- Utilize the oil spill occurrence indicator model to generate additional model validation information, including direct application to specific non-Arctic scenarios, such as GOM projects, which have an oil spill statistical history.
- Utilize the oil spill occurrence indicator model in a sensitivity mode to identify the importance of different Arctic effect variables introduced to provide a prioritized list of those items having the highest potential impact on Arctic oil spills.
- Use GOM historical data together with its measures of spill size variance and setup the Monte Carlo model to run with these measures of spill size variance.
- Generalize the model so that it can be run both in an expected value and a distributed value (Monte Carlo) form with the intent that expected value form can be utilized without the Monte Carlo add-in for preliminary estimates and sensitivity analyses, while for more comprehensive rigorous studies, the Monte Carlo version can be used. All calculations in this report are based on the Monte Carlo version.
- Finally, convert the current oil spill occurrence indicator model into a user friendly software package, which can be used for the assessment of oil spill occurrence indicators and their characteristics for any designated scenario. The software package should include the following:
 - Modular structure
 - User manual
 - Online help
 - Password protected parameters and algorithms
 - Extensive graphical outputs

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FINAL REPORT

VOLUME II

**Alternative Oil Spill Occurrence Estimators for the
Beaufort and Chukchi Seas – Fault Tree Method**

MMS Contract Number 01-00-PO-17199

August, 2002

By



Bercha International Inc.
Calgary, Alberta, Canada



U.S. Department of the Interior
Minerals Management Service
Alaska Outer Continental Shelf Region

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HISTORICAL DATA

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A.1 INTRODUCTION

A.1.1 General Introduction

Historical data and its statistical analysis are used as a starting point for the fault tree application to oil spill indicator quantification. In the present application only data on Gulf of Mexico (GOM) pipelines, platforms, and oil well spills are considered. The data utilized in this study and their analysis for the purposes of the fault tree application are summarized in Chapter 2 of Volume I of the Final Report. However, as part of Task 1 of the scope of work, a broader spectrum of oil spill data (including North Sea and tanker spill data) was assimilated and analyzed; the results of this data processing are reported in this Appendix A. The work described in this Appendix was substantially carried out and reported by S.L. Ross Environmental Research.

A.1.2 Summary of Data Files

The file names that follow refer to the files on the CD [11].

A.1.2.1 GOM Pipeline Analysis Files on CD: Original Data, DatedOilPPL.xls, GreaterThan5Obbl.xls, Pipeline Spills in the OCS of the GOM.doc

The first section is the analysis and report for the GOM pipeline work. This may be the most important part of the study inasmuch as pipeline spills are of significant interest on the Slope. The section contains a breakdown of pipeline spills in terms of pipe diameter, pipeline length, water depth, spill size, exposure period (1972 to 1999, and 1985 to 1999), and cause of accident. The work was restricted to pipelines carrying oil to correspond to the focus on oil spills.

It was not possible to complete a similar analysis for the North Sea situation because of lack of raw data. The main data available are those from E&P Forum 1996. This study contained some errors and lacked in crucial information (such as spill size and type [oil or gas] data). In any case, the data from E&P is summarized in the next section along with other spill-type data. It is difficult to compare the GOM statistics to the North Sea (NS) statistics shown in E&P Forum 1996 because breakdowns are different. The following, however, shows that both studies produce frequencies in the same order of magnitude.

Table A.1.1 summarizes the exposure factors and very high level results form the NS and GOM data.

Table A.1.1
North Sea and Gulf of Mexico Data Summary

AREA	TOTAL RISER AND PIPELINE EXPERIENCE (km-yrs)	NUMBER OF SPILLS	FREQUENCY (per 10,000 km-yrs)	COMMENTS
North Sea (NS)	130,000	48 gas and oil	3.7 (gas and oil)	No spill sizes provided, but probably < 50 bbl included.
Gulf of Mexico (GOM)	254,000	31 oil	1.3 (oil only)	For spills > 50 bbl

Considering that the North Sea data probably includes spills less than 50 bbl, the numbers may well compare favorably.

It should be pointed out that over the course of the analysis, it was noticed there is some discrepancy between the spills reported in the pipeline masters file provided to Bercha by MMS and the spills reported in the “events” database that Cheryl Anderson of MMS uses to calculate pipeline frequencies for the Gulf. The analysis presented here is based entirely on the pipeline masters database from MMS Alaska [11].

A.1.2.2 GOM Platform-based Spills (PlatformSpills.xls, Platform Spills in the OCS of the GOM.doc)

This two-page report summarizes data from MMS (Cheryl Anderson) on spills that have taken place on the platforms, including blowouts, storage tank ruptures, and other causes and sources.

A.1.2.3 E&P Forum Pipeline Analysis (Summary of Spill Frequency Statistics_no GOMpipelines.xls)

This is simply a copy of the statistics in the publication [6].

A.1.2.4 Crude Oil Tanker Summary

This is based on Anderson and LaBelle, 1994 [2] and 2001, and on various SL Ross analyses [13, 15, 18]. See section 9 below for a SL Ross internal report, which discusses the derivation of the statistics. This report has not been updated in view of the new, in-press Anderson and LaBelle 2001 study, but the table in the xls file was updated.

A.1.2.5 Offloading Spill Rates

These are taken from MMS 1997 [10] and the SL Ross report [13, 15].

A.1.2.6 Above Ground Storage Tanks (AST)

The data from E&P Forum does not have spill sizes, so original data was analyzed from IOSR annual summaries and the results and raw data are in the worksheets.

A.1.2.7 Gas and Oil Blowouts

Blowouts are covered extensively in E&P Forum and in the SL Ross study for BP Exploration Alaska [17]. The two sheets here cover the basics. The E&P Forum analysis seems detailed and complete. Again, spill sizes are not provided in the E&P Forum analysis, but they are in the sheets provided here.

A.2 PIPELINE SPILLS IN THE OCS OF THE GOM: ANALYSIS FOR 1972-1999 AND 1985-1999

A.2.1 Introduction

This chapter describes the steps taken in analyzing the historic risk of pipeline oil spills of size 50 bbls and greater.

The data for the analysis comes from two sources: the *PPL_MASTERS* database describing pipeline built and abandoned since 1948, published monthly (Mar 15, 2001 version used) on the MMS website at:

<http://www.gomr.mms.gov/homepg/pubinfo/freeasci/pipeline/zipped/ziped/PipelineMastersFixeddfn.html> [8] and the *PPL_REPAIRS* database, received from MMS on a CD labeled: US DOI, MMS Leaks Database (Copy – Feb 26/01) [11].

Note that Anderson and LaBelle [2] use a different list that contains 4 or 5 >100bbl spills not contained in *PPL_REPAIRS* and that *PPL_REPAIRS* has a similar number of spills not contained in *A&B's OCSPIPE.xls*.

A.2.2 Exposure to Risk

PPL_MASTERS is a database of ALL pipeline constructed in the GOM, containing details that are not needed for this current study. For our purposes, a report was generated from the database containing only records for "BLKO" Or "BLOH" Or "BO/H" Or "BO/S" Or "C/S" Or "COND" Or "OILH" Or "G/O" Or "GC/S" Or "OIL" Or "O/W" Or "G/C" pipeline, any pipeline used for Condensate or Oil. Fields relating to date, size, Federal length and water depth were retained. Table 2.1 summarizes the results of this compilation.

The dates included are the Static Test Date, Construction Date, Date of Application and Date Marked Abandoned. Many records did not contain all or, in fact, any dates. For purposes of analysis the Build Date was taken to be the Static Test Date OR Construction Date OR Date of Application, in that order. About 1,000km out of the total of about 20,000km of pipeline had no Build Date. The undated pipeline was distributed equally over the 53 years of built totals for use in the estimation of exposure.

Pipeline exposure was accumulated over two date ranges: 1972-1999 and 1985-1999 in order to match some other existing analyses. Exposure was accumulated for three different aspects of pipeline segments: Depth ranges, Diameter ranges and Length ranges. Where a pipeline segment record shows a Date Marked Abandoned, the segment was removed from that year's total of pipeline. The work and results can be found in *DatedOilPPL.xls*. The result sheets are shown here as Table A.2.1.

Table A.2.1
GOM Pipeline Exposure Data (1948-2001)
(a) Exposure to Risk by Depth of Pipeline in OCS

Exposure to Risk by Depth of Pipeline in OCS																			
Date	PPL Masters: Mar 15, 2001 Pipeline Built by Size (km)			Add about 2% of Undated to each year (1/53 years)			PPL Masters: Mar 15, 2001 Abandoned by Size (km)			Pipe Size Exposure Net Pipe (Built - Abandoned)		Cumulative, 1972 - 1999		Exposure, 1972 - 1999			Exposure, 1985 - 1999		
	Less than 10m	10m and Greater	Grand Total	Less than 10m	10m and Greater	Grand Total	Less than 10m	10m and greater	Grand Total	Less than 10m	10m and greater	Less than 10m	10m and greater	Less than 10m	10m and greater	All Depths (km-year 1972 - 1999)	Less than 10m	10m and greater	All Depths (km-year 1985 - 1999)
Undated	700	318	1019	ADD 13.2	ADD 6.0														
1948 - 1971	1940	441	2381	2125	525	2650				2117	525	2117	525						
1970 - 1971							8		8										
1972	372	44	416	385	50	435				385	50	2502	575	2502	575				
1973	294	11	305	307	17	324	1		1	306	17	2808	592	5309	1167				
1974	188	6	195	202	12	214				202	12	3009	604	8318	1772				
1975	175	163	339	189	169	358				189	169	3198	774	11516	2545				
1976	487	20	507	500	26	526				500	26	3698	800	15214	3345				
1977	315	39	354	328	45	373				328	45	4026	845	19240	4190				
1978	589	48	637	602	54	657				602	54	4628	899	23868	5089				
1979	310	10	320	323	16	339	0		0	323	16	4951	915	28819	6004				
1980	189	134	324	203	140	343	0		0	202	140	5154	1055	33972	7059				
1981	303	186	489	316	192	508	5		5	311	192	5465	1247	39437	8306				
1982	151	230	381	164	236	400	0	2	2	164	234	5629	1481	45066	9787				
1983	91	328	419	105	334	439	5		5	99	334	5728	1815	50794	11603				
1984	149	300	450	163	306	469	1		1	162	306	5890	2122	56683	13724				
1985	123	283	406	136	289	425		11	11	136	278	6026	2399	62709	16124		6026	2399	
1986	97	269	366	110	275	385	2		2	109	275	6135	2674	68844	18798		12160	5074	
1987	113	267	380	126	273	399				126	273	6261	2948	75104	21746		18421	8022	
1988	115	476	591	128	482	610	2		2	125	482	6386	3430	81490	25176		24807	11452	
1989	174	489	663	187	495	682	6		6	181	495	6567	3925	88057	29101		31373	15377	
1990	293	495	789	307	501	808	7	2	9	300	499	6866	4424	94923	33526		38240	19801	
1991	135	346	482	148	352	501	36	0	36	113	352	6979	4777	101902	38302		45219	24578	
1992	106	269	375	119	275	394	4	11	15	115	265	7094	5041	108997	43344		52313	29619	
1993	39	233	272	52	239	291	13	0	14	39	239	7133	5280	116129	48624		59446	34900	
1994	146	657	802	159	663	821	26	15	41	133	648	7266	5928	123395	54552		66712	40828	
1995	67	581	648	80	587	667	41	11	53	39	575	7305	6504	130700	61056		74016	47331	
1996	391	948	1339	405	954	1358	53	140	193	352	814	7656	7317	138356	68373		81672	54649	
1997	163	814	978	177	820	997	56	48	104	121	772	7777	8089	146133	76462		89449	62738	
1998	153	775	928	166	781	947	34	43	77	132	738	7909	8827	154041	85290		97358	71565	
1999	63	585	648	76	591	667	61	67	127	16	524	7924	9351	161966	94641	256607	105283	80917	186199
2000	67	841	908	80	847	927	70	19	89	10	828								
2001	29	119	147	42	125	166	2	9	11	40	116								
Grand Total	10636	8068	18704	8408	10675	19082	434	379	814	7974	10295								
Net Pipe										18269									



Table A.2.1
GOM Pipeline Exposure Data (1948-2001)
(b) Exposure to Risk by Size of Pipeline in OCS

Exposure to Risk by Size of Pipeline in OCS																								
Date	PPL Masters: Mar 15, 2001 Pipeline Built by Size (km)				Add about 2% of Undated to each year (1/53 years)				PPL Masters: Mar 15, 2001 Abandoned by Size (km)				Pipe Size Exposure Net Pipe (Built - Abandoned)			Cumulative, 1972 - 1999			Exposure, 1972 - 1999			Exposure, 1985 - 1999		
	Less than 10"	10" and Greater	Unknown Size Code	Grand Total	Less than 10"	10" and Greater	Unknown Size Code	Grand Total	Less than 10"	10" and greater	Unknown Size code	Grand Total	Less than 10"	10" and greater	Uncoded	Less than 10"	10" and greater	All Diameters (km-year 1972 - 1999)	Less than 10"	10" and greater	All Diameters (km-year 1985 - 1999)			
					ADD 16.0	ADD 3.2	ADD 0.01																	
Undated	848	170	1	1019																				
1948 - 1971	1129	1220	32	2381	1353	1265	32	2650					1345	1265										
1970 - 1971									8		8													
1972	321	89	6	416	337	93	6	435					337	93		1682	1357							
1973	141	164		305	157	167	0	324	1		1		156	167		1838	1524		1682	1357				
1974	156	35	4	195	172	38	4	214					172	38		2010	1562		5531	4443				
1975	141	186	12	339	157	189	12	358					157	189		2167	1751		7698	6194				
1976	178	326	2	507	194	329	2	526					194	329		2362	2080		10060	8274				
1977	134	216	4	354	150	219	4	373					150	219		2512	2299		12572	10574				
1978	223	415		637	239	418	0	657					239	418		2751	2717		15323	13291				
1979	218	99	3	320	234	102	3	339		0	0		234	102		2985	2819		18308	16110				
1980	202	119	3	324	218	122	3	343	0		0		218	122		3202	2941		21510	19051				
1981	339	150		489	355	153	0	508		5	5		355	149		3557	3090		25068	22141				
1982	265	116		381	281	119	0	400	2		2		279	119		3836	3209		28904	25350				
1983	267	131	22	419	283	134	22	439	5		5		277	134		4114	3343		33017	28693				
1984	356	93	1	450	372	96	1	469	1		1		371	96		4485	3439		37502	32132				
1985	327	75	4	406	343	78	4	425	11		11		332	78		4817	3517		42319	35648				
1986	165	187	14	366	181	190	14	385	2		2		180	190		4996	3707		47315	39355				
1987	229	151	0	380	245	154	0	399					245	154		5241	3861		52557	43216				
1988	304	286	0	591	320	289	0	610	2		2		318	289		5559	4150		58116	47366				
1989	277	364	21	663	293	367	21	682	6		6		288	367		5847	4517		63963	51883				
1990	509	279	1	789	525	282	1	808	9		9		516	282		6363	4799		70326	56682				
1991	434	44	4	482	450	47	4	501	18	18		36	432	30		6795	4829		77120	61511				
1992	313	57	5	375	329	60	5	394	15		15		314	60		7109	4889		84229	66400				
1993	190	81	2	272	206	84	2	291	13	0		14	192	83		7301	4972		91530	71372				
1994	428	372	2	802	444	375	2	821	40	1		41	403	375		7705	5347		99235	76719				
1995	375	272		648	391	276	0	667	46	6		53	345	269		8050	5616		107285	82335				
1996	519	821		1339	535	824	0	1358	128	65		193	407	758		8457	6375		115741	88710				
1997	351	627		978	367	630	0	997	98	4	2	104	268	626		8725	7001		124466	95711				
1998	385	540	3	928	401	543	3	947	74	4		77	328	539		9053	7540		133519	103251				
1999	419	229		648	435	232	0	667	114	12	1	127	321	220		9373	7760		142892	111011				
2000	361	141	406	908	377	144	406	927	79	11		89	298	133										
2001	130	17		147	146	20	0	166	2	9		11	144	11										
Grand Total	10636	8068	552	19255	10492	8039	552	19082	676	135	3	814	9816	7904										
Uncoded Built																				519				
Abandoned																								



Table A.2.1
GOM Pipeline Exposure Data (1948-2001)
(c) Exposure to Risk by Length of Pipeline in OCS

Exposure to Risk by Length of Pipeline in OCS																																				
Date	PPL Masters: Mar 15, 2001 Pipeline Built by Size (km)					Add about 2% of Undated to each year (1/53 years)					PPL Masters: Mar 15, 2001 Abandoned by Size (km)					Pipe Size Exposure Net Pipe (Built - Abandoned)				Cumulative, 1972 - 1999				Exposure, 1972 - 1999					Exposure, 1985 - 1999							
	< 0.5 km	0.5 - 2 km	2 - 5 km	> 5 km	Grand Total	< 0.5 km	0.5 - 2 km	2 - 5 km	> 5 km	Grand Total	< 0.5 km	0.5 - 2 km	2 - 5 km	> 5 km	Grand Total	< 0.5 km	0.5 - 2 km	2 - 5 km	> 5 km	< 0.5 km	0.5 - 2 km	2 - 5 km	> 5 km	< 0.5 km	0.5 - 2 km	2 - 5 km	> 5 km	All Lengths	< 0.5 km	0.5 - 2 km	2 - 5 km	> 5 km	All Lengths			
					ADD 1.3	ADD 7.4	ADD 3.6	ADD 6.8																												
Undated	71	394	191	362	1019																															
1948-1971	14	209	280	1878	2381	33	313	331	1973	2304																										
1970-1971											2		6		8																					
1972	6	47	72	291	416	7	54	76	298	373						7	54	76	298	38	367	400	2271	38	367	400	2271									
1973	3	36	34	232	305	5	43	38	239	276	1				1	3	43	38	239	42	410	438	2510	80	778	838	4781									
1974	1	12	20	162	195	2	19	23	169	192						2	19	23	169	44	430	461	2679	124	1208	1299	7459									
1975	1	20	24	294	339	2	27	27	301	328						2	27	27	301	46	457	488	2980	170	1665	1787	10439									
1976	4	38	59	407	507	5	45	62	414	476						5	45	62	414	51	502	551	3394	222	2167	2338	13833									
1977	3	31	52	269	354	4	38	55	276	331						4	38	55	276	55	540	606	3669	277	2707	2944	17502									
1978	2	33	35	567	637	4	41	38	574	612						4	41	38	574	59	581	644	4243	336	3288	3588	21745									
1979	4	48	60	208	320	5	56	63	215	278				0		5	56	63	215	64	637	708	4458	400	3924	4296	26203									
1980	4	22	76	222	324	5	29	79	229	308				0		5	29	79	229	69	666	787	4687	469	4590	5082	30890									
1981	5	35	87	363	489	6	42	90	370	460		5		5		6	37	90	370	75	703	877	5057	544	5294	5960	35947									
1982	4	45	73	259	381	5	52	77	266	343			2		5	50	77	264	80	753	954	5321	624	6047	6913	41268										
1983	4	51	64	301	419	5	58	68	308	375				5		5	58	62	308	85	811	1016	5629	709	6858	7929	46897									
1984	4	67	97	282	450	5	75	100	289	389	1			1		5	75	100	289	90	886	1117	5917	799	7744	9046	52814									
1985	7	54	127	218	406	9	61	130	225	356				11	11	9	61	119	214	98	947	1235	6131	897	8691	10281	58945	98	947	1235	6131					
1986	3	23	29	312	366	4	30	32	319	351	2			2		3	30	32	319	101	977	1268	6450	999	9668	11549	65395	200	1924	2503	12581					
1987	4	27	63	286	380	5	35	67	293	360				2		5	35	67	293	106	1012	1335	6742	1105	10679	12884	72137	306	2935	3838	19323					
1988	5	32	70	484	591	6	40	73	491	564		2		2		6	37	73	491	112	1049	1408	7233	1217	11728	14292	79371	419	3984	5246	26557					
1989	5	35	90	532	663	7	42	94	539	633	5			6		2	42	94	539	114	1091	1502	7773	1332	12819	15794	87143	533	5075	6748	34329					
1990	3	34	130	621	789	5	41	134	628	762	1	2	6	2	11	4	39	128	626	118	1130	1629	8399	1450	13949	17423	95542	651	6205	8377	42728					
1991	1	39	104	338	482	3	46	107	344	452	5		29	0	36	-2	46	78	344	116	1176	1707	8743	1566	15126	19130	104285	767	7382	10084	51471					
1992	2	15	87	271	375	4	22	90	278	369	1	6	6	11	25	2	16	84	268	118	1192	1792	9011	1684	16318	20922	113296	886	8574	11876	60482					
1993	2	36	67	167	272	4	43	70	174	245	1	3	8	0	14	3	40	63	174	121	1232	1854	9185	1806	17549	22776	122481	1007	9805	13730	69667					
1994	2	49	142	609	802	3	56	146	616	762	13	16	9	15	56	-10	40	138	601	112	1271	1992	9786	1917	18820	24768	132267	1119	11076	15722	79453					
1995	4	29	117	499	648	5	36	120	506	626	11	15	24	11	64	-6	21	96	495	105	1292	2088	10281	2023	20113	26856	142548	1224	12369	17810	89734					
1996	3	47	85	1205	1339	4	54	88	1211	1300	10	35	143	140	333	-6	20	-55	1071	99	1312	2033	11352	2122	21425	28889	153900	1323	13681	19843	101086					
1997	4	44	112	817	978	6	51	116	824	940	15	36	51	48	153	-10	15	65	775	90	1327	2098	12127	2212	22752	30987	166028	1413	15008	21941	113213					
1998	5	37	90	797	928	6	45	93	803	897	14	11	52	43	121	-8	34	42	760	82	1361	2140	12888	2294	24113	33127	178915	1495	16369	24081	126101					
1999	2	33	85	527	648	4	41	89	534	623	20	30	77	67	194	-16	11	12	467	66	1371	2152	13355	2359	25484	35279	192270	1561	17740	26233	139456					
2000	4	46	84	774	908	5	53	88	781	869	17	25	45	19	109	-12	28	43	762																	
2001	0	2	10	135	147	1	10	14	142	155					20	1	7	5	133																	
Grand Total	185	1666	2714	14690	19255	173	1599	2681	14629	19082	118	192	481	379	1193	55	1407	2201	14249									255393							165689	
Net Pipe																17912																			km-year	

A.2.3 Pipeline Spill Statistics

The *PPL_Repairs* database contains records of all spills from pipeline in the GOM. A report was generated from the database for *OIL and CONDENSATE* spills of 50bbl or larger size in the date range of Jan 1, 1972 to Dec 31, 1999. There were 31 spills that satisfied those criteria.

Those spills were further broken down, for the two date ranges, into volume ranges, pipeline diameter ranges, pipeline segment length ranges, pipeline segment depth ranges and by cause.

The work and results can be found in *GreaterThan50BBL.xls*. The result sheets are included here as follows:

- Table A.2.2 – GOM OCS Pipeline Spill Statistics (1972-1999)
- Table A.2.3 – GOM OCS Pipeline Spill Statistics (1985-1999)
- Table A.2.4 – Cause Distribution of Pipeline Spills, GOM OCS (1972-1999)

A.2.4 Deficiencies in MMS Pipeline Databases

Several reviews of MMS databases were initiated as a result of the database applications in the current project. Detailed discussion and information exchanges were conducted among MMS personnel and members of the Bercha consulting team in regard to possible inconsistencies, ambiguities, and errors in the databases. The following specific areas were identified as ones of possible deficiency in the MMS pipeline databases:

- Inadequate definition or application of pipeline product codes.
- Lack of clarity of pipeline segment definitions.
- Lack of clarity or ambiguity of information on pipeline lengths.
- Ambiguity on exposure categories of pipeline size, pipeline length, and water depth.
- Ambiguity of spill records, resulting in at least one potential additional spill, and possible ambiguities on spill sizes for other spills.

As it was not within the scope of work of the present study to rectify these deficiencies, the present report is restricted to the above references to them. It should be noted, however, that the rectification of these deficiencies is not expected to change the conclusions of the study, although some adjustments in the numerical results could occur without any significant impact on the trends predicted.

Table A.2.2
GOM OCS Pipeline Spill Statistics (1972-1999)

GOM OCS Pipeline Spills, Categorized 1972-99		Spill Statistics**			Exposure (km-years)	Frequency (spill per 10 ⁴ km-yr)
		Number of Spills	Average Volume (bbl)	Median Volume (bbl)		
By Pipe Diameter	<10"	16	2141	173	142,892	1.1197
	=10"	15	4070	1211	111,011	1.3512
By Pipeline Minimum Depth	Bad Depth Data*	14				
	< 10 m	6	2310	1211	161,966	0.3704
	= 10 m	11	3165	1040	94,641	1.1623
By Segment Length	< 0.5 km	0	0	0	2,359	0.0000
	= 0.5 < 2 km	2	2335	2335	25,484	0.7848
	= 2 < 5 km	7	820	100	35,279	1.9842
	= 5 km	22	3859	850	192,270	1.1442
By Spill Size***	Small	6	58	50	253,903	0.2363
	Medium	12	317	230	253,903	0.4726
	Large	10	4133	4267	253,903	0.3939
	Huge	3	16611	15576	253,903	0.1182
By Diameter, By Spill Size						
<10"	Small	4	58	50	142,892	0.2799
	Medium	7	266	135	142,892	0.4899
	Large	4	4436	4551	142,892	0.2799
	Huge	1	14423	14423	142,892	0.0700
= 10"	Small	2	58	58	111,011	0.1802
	Medium	5	387	312	111,011	0.4504
	Large	6	3932	3600	111,011	0.5405
	Huge	2	17705	17705	111,011	0.1802

* 14 of the 31 records have both MIN_WATER_DEPTH and MAX_WATER_DEPTH set to "0".

** Exposure comes from an analysis of PPL_MASTERS database as published on February 15, 2001.

*** Spill Size:

- Small (S) - = 50 < 100 bbl
- Medium (M) - = 100 < 1,000 bbl
- Large (L) - = 1,000 < 10,000 bbl
- Huge (H) - = 10,000 bbl

**Table A.2.3
GOM OCS Pipeline Spill Statistics (1985-1999)**

GOM OCS Pipeline Spills, Categorized 1985-99		Spill Statistics			Exposure (km-years)	Frequency (spill per 10 ⁴ km-yr)
		Number of Spills	Average Volume (bbl)	Median Volume (bbl)		
By Pipe Diameter	<10"	7	3425	2372	105,390	0.6642
	=10"	8	3924	1606	78,879	1.0142
By Pipeline Minimum Depth	Bad Depth Data	4				
	< 10 m	5	2070	1025	105,283	0.4749
	= 10 m	6	4718	3867	80,917	0.7415
By Segment Length	< 0.5 km	0	0	0	1,561	0.0000
	= 0.5 < 2 km	2	2320	4569	17,740	1.1274
	= 2 < 5 km	2	631	631	26,233	0.7624
	= 5 km	11	4497	2000	139,456	0.7888
By Spill Size*	Small	3	57	50	184,269	0.1628
	Medium	4	376	292	184,269	0.2171
	Large	6	3949	3867	184,269	0.3256
	Huge	2	15000	15000	184,269	0.1085
By Diameter, By Spill Size						
<10"	Small	2	60	60	105,390	0.1898
	Medium	2	165	165	105,390	0.1898
	Large	2	4551	4551	105,390	0.1898
	Huge	1	14423	14423	105,390	0.0949
= 10"	Small	1	50	50	78,879	0.1268
	Medium	2	587	587	78,879	0.2536
	Large	4	3648	2600	78,879	0.5071
	Huge	1	15576	15576	78,879	0.1268

* Spill Size:

- Small (S) - = 50 < 100 bbl
- Medium (M) - = 100 < 1,000 bbl
- Large (L) - = 1,000 < 10,000 bbl
- Huge (H) - = 10,000 bbl

Table A.2.4
Cause Distribution of Pipeline Spills, GOM OCS (1972-1999)

Cause		Spill Statistics		Frequency
Primary Cause	Secondary Cause	Number of Spills	Average Volume (BBLs)	spill / (10 ⁴ km- yrs)
Anchoring	Rig or Construction	1	2000	0.0394
	Supply Boat	1	50	0.0394
Total Anchoring		2	2050	0.0788
Corrosion	External	1	100	0.0394
	Internal	3	1838	0.1182
Total Corrosion		4	1938	0.1575
Impact	Anchor Drag	11	4027	0.4332
	Jackup Rig	2	1625	0.0788
	Trawl/Fishing Net	5	5525	0.1969
Total Impact		18	11177	0.7089
Natural Hazard	Mud Slide	3	2837	0.1182
	Storm/Hurricane	1	3500	0.0394
Total Natural Hazard		4	6337	0.1575
Structural	Connector Failure	1	135	0.0394
	Material Fatigue	1	210	0.0394
Total Structural		2	345	0.0788
Other		1	119	0.0394
Total Other		1	119	0.0394
Total		31	21966	1.2209

Note: Total exposure is 253,093 km-yr

A.3 PLATFORM SPILLS IN THE OCS AND THE GOM: ANALYSIS FOR 1972-1999 AND 1985-1999

A.3.1 Introduction on Platform Spills

This chapter describes the steps taken in analyzing the historical data on platform oil spills of size 50 bbls and greater.

The data for the analysis comes from two sources: Federal Offshore Statistics report, October 2000, on the MMS website [8] as:

<http://www.mms.gov/stats/xls/CH4ProdW-Ooperatorrank.xls> (sheet: 4-2. State-Fed Oil Prod) and,

<http://www.mms.gov/stats/xls/DevActOct2000.xls> (sheet: 3-4. Completions by YEAR) and the *OCS_PlatformSpills.xls* database, received from Cheryl Anderson in February 2001 (a list of platform spills)

A.3.2 Exposure to Risk

Exposure was determined from the Active Well count (Table 3-4) and the Oil Production (Table 4-2) of the Federal Offshore Statistics report, October 2000 [12]. Platform exposure was accumulated over two date ranges: 1972-1999 and 1985-1999 in order to match some other existing analyses. The work and results can be found in *PlatformSpills.xls*. The result sheet is included here as Table A.3.1.

A.3.3 Platform Spill Statistics

The *OCS_PlatformSpills.xls* database contains records of all spills related to platforms in the GOM. A report was generated from the database for *OIL and CONDENSATE* spills of 50 bbl or larger size in the date range of January 1, 1972 to December 31, 1999. There were 21 spills that satisfied those criteria. Those spills were further broken down, for the two date ranges, into volume ranges. The work and results can be found in *PlatformSpills.xls*. The result sheet is included here as Table A.3.2.

**Table A.3.1
Platform Spills – Exposure to Risk**

Well and Crude Oil Exposure of Platforms

Year	Active Oil Wells	Exposure		Crude Oil and Condensate (bbl)	Exposure			
		1972-99 Well-years	1985-99 Well-years		1972-99 (bbl)	1985-99 (bbl)	1972-99 Bbbl	1985-99 Bbbl
1972	3,744	3,744		395,869,226	395,869,226			
1973	3,814	7,558		384,794,041	780,663,267			
1974	3,686	11,244		354,922,586	1,135,585,853			
1975	3,477	14,721		325,273,941	1,460,859,794			
1976	3,555	18,276		314,523,413	1,775,383,207			
1977	3,747	22,023		295,929,333	2,071,312,540			
1978	3,648	25,671		287,949,081	2,359,261,621			
1979	2,781	28,452		334,235,468	2,693,497,089			
1980	5,375	33,827		274,729,436	2,968,226,525			
1981	4,522	38,349		282,896,851	3,251,123,376			
1982	4,734	43,083		314,535,001	3,565,658,377			
1983	4,142	47,225		350,776,930	3,916,435,307			
1984	4,138	51,363		385,125,576	4,301,560,883			
1985	4,321	55,684	4,321	379,961,697	4,681,522,580	379,961,697		
1986	4,406	60,090	8,727	384,310,840	5,065,833,420	764,272,537		
1987	4,543	64,633	13,270	358,638,660	5,424,472,080	1,122,911,197		
1988	4,627	69,260	17,897	332,717,807	5,757,189,887	1,455,629,004		
1989	4,507	73,767	22,404	323,703,458	6,080,893,345	1,779,332,462		
1990	4,515	78,282	26,919	304,394,527	6,385,287,872	2,083,726,989		
1991	4,549	82,831	31,468	326,338,234	6,711,626,106	2,410,065,223		
1992	4,612	87,443	36,080	347,515,732	7,059,141,838	2,757,580,955		
1993	4,774	92,217	40,854	359,153,993	7,418,295,831	3,116,734,948		
1994	4,846	97,063	45,700	372,265,212	7,790,561,043	3,489,000,160		
1995	4,950	102,013	50,650	417,435,444	8,207,996,487	3,906,435,604		
1996	5,040	107,053	55,690	433,144,661	8,641,141,148	4,339,580,265		
1997	4,727	111,780	60,417	465,944,624	9,107,085,772	4,805,524,889		
1998	4,731	116,511	65,148	490,528,140	9,597,613,912	5,296,053,029		
1999	3,203	119,714	68,351	534,174,140	10,131,788,052	5,830,227,169	10.13	5.83

**Table A.3.2
Platform Spill Statistics (1972-1999)**

GOM OCS Platform Spills

1972-99

	Spill Statistics			Exposure		Frequency	
	Number of Spills	Average Volume (BBL S)	Median Volume (BBL S)	(well-years)	Bbbls	spill/ (10^4well-years)	spill/ Bbbls
By Spill Size							
50-99bbls	8	64	62	119714	10.13	0.6683	0.7897
100-999bbls	10	254	185	119714	10.13	0.8353	0.9872
1,000-9,999bbls	3	6130	7000	119714	10.13	0.2506	0.2962
>10,000bbls	0	15000	0	119714	10.13	0.0000	0.0000
Total	21	1021	120	119714	10.13	1.7542	2.0731

GOM OCS Platform Spills

1985-99

	Spill Statistics			Exposure		Frequency	
	Number of Spills	Average Volume (BBL S)	Median Volume (BBL S)	(well-years)	Bbbls	spill/ (10^4well-years)	spill/ Bbbls
By Spill Size							
50-99bbls	4	64	63	68351	5.83	0.5852	0.6861
100-999bbls	6	331	340	68351	5.83	0.8778	1.0292
1,000-9,999bbls	0	0	0	68351	5.83	0.0000	0.0000
>10,000bbls	0	0	0	68351	5.83	0.0000	0.0000
Total	10	224	135	68351	5.83	1.4630	1.7153



A.4 NORTH SEA PIPELINE DATA

A.4.1 Risers and Pipeline in Platform Safety Zone

Tables A.4.1 and A.4.2 give spill frequency estimates for risers and pipelines damaged by anchoring and impacts in the platform safety zone.

Table A.4.3 gives spill frequencies for risers and pipelines damaged in the subsea well safety zone.

Table A.4.1
North Sea Spill Frequency (per 10,000 km-yrs) for risers

Area	Line Type	Diameter (inches)	Experience (pipeline-yrs)	No. of spills	Best Estimate of North Sea Spill Frequency	Source of data	Comments
North Sea	Steel	2 to 8	2083	1	4.80	E&P Forum [6]	No water depth or distance from land info for the North Sea data. The following was found to have no effect on frequency of spills from steel risers: length of pipeline that the riser is attached, riser diameter, riser contents, location of riser internal or external steel jacket.
		>10	5249.2	5	9.53		
	Flexible	all	404.1	2	49.49		

Table A.4.2
North Sea Spill Frequency (per 10,000 km-yrs) for risers and pipelines damaged by anchoring and impact incidents in the platform safety zone (within 500 m of platform)

Area	Line Type	Diameter inches	Experience (pipeline-yrs)	No. of spills	Best Estimate of North Sea Spill Frequency	Source of data	Comments
North Sea	Steel	2 to 8	2334	2	8.57	E&P Forum [6]	The table in E&P Forum 1996 does not indicate if the data is for risers only or for pipelines and risers. The experience numbers, which match closely to those in Table 1, suggest risers only.
		>10	5323.3	4	7.51		
	Flexible	all	550.8	0			

Table A.4.3
North Sea Spill Frequency (per 10,000 km-yrs) for risers and pipelines damaged by anchoring and impact incidents in the subsea well safety zone (within 500 m of subsea platform)

Area	Line Type	Diameter inches	Experience (pipeline-yrs)	No. of spills	Best Estimate of North Sea Spill Frequency	Source of data
North Sea	Steel	2 to 8	841.6	0		E&P Forum [6]
		>10	89.3	0		
	Flexible	all	657	3	45.66	

A.4.2 Pipeline Failure Frequencies for Different Conditions

Table A.4.4 gives pipeline spill frequencies for pipelines damaged by anchoring and impact incidents in mid-line areas. Table A.4.5 provides the same four pipelines less than 10 kilometers in length, while Table A.4.6 provides these for pipelines between 2 and 5 kilometers in length. Table A.4.7 gives spill frequencies resulting from corrosion and material defect damage to pipeline greater than 5 kilometers in length. It is expected, however, that these same corrosion and material defect frequencies should apply to pipelines less than 5 kilometers in length, as well as pipelines in the safety zone for platforms or subsea wells.

Table A.4.4
North Sea Spill Frequency (per 10,000 km-yrs) for pipelines
damaged by anchoring and impact incidents in the mid-line of
pipelines

Area	Line Type	Diameter inches	Experience (pipeline-yrs)	No. of spills	Best Estimate of North Sea Spill Frequency	Source of data
North Sea	Steel	2 to 8	13669.1	3	2.19	E&P Forum [6]
		>10	110084.1	1	0.09	
	Flexible	all	808.8	1	12.36	

Table A.4.5
North Sea Spill Frequency (per 10,000 km-yrs) for pipelines
damaged by corrosion and material defects for pipelines less
than 2 km in length

Area	Line Type/Contents	Diameter inches	Experience (pipeline-yrs)	No. of spills	Best Estimate of North Sea Spill Frequency	Source of data
North Sea	Steel/gas	all	254.9	1	39.23	E&P Forum [6]
	Steel/oil	all	280.6	6	213.83	
	Flexible	all	298.5	5	167.50	

Table A.4.6
North Sea Spill Frequency (per 10,000 km-yrs) for pipelines
damaged by corrosion and material defects for pipelines 2 to 5
km in length

Area	Line Type	Diameter inches	Experience (pipeline-yrs)	No. of spills	Best Estimate of North Sea Spill Frequency	Source of data
North Sea	Steel/gas	all	2280.8	0		E&P Forum [6]
	Steel/oil	all	1654.4	0		
	Flexible	all	609.3	2	32.82	

Table A.4.7
North Sea Spill Frequency (per 10,000 km-yrs) for pipelines
damaged by corrosion and material defects for pipelines greater
than 5 km in length

Area	Line Type	Diameter inches	Experience (pipeline-yrs)	No. of spills	Best Estimate of North Sea Spill Frequency	Source of data
North Sea	Steel/gas	all	78160.1	0		E&P Forum [6]
	Steel/oil	all	35026.9	3	0.856	
	Flexible	all	340.4	0		

A.5 CRUDE OIL TANKER SPILLS

Table A.5.1 gives a summary of worldwide and US tanker oil spill statistics.

All numbers represent the spill frequency for either inbound or outbound journeys for tankers. The numbers must be doubled to calculate the spill frequency of the tankers on a trip or voyage basis which would include both an outbound portion (when the tanker is loaded) and the inbound portion (when the cargo is unloaded). If, for example, 278 large (>1000 bbl) occurred on a worldwide basis from 1964 to 1999 and the volume of crude oil moved or transported during this period was 239.67 billion barrels, the spill frequency would be 278/239.67 or 1.16 spills per billion barrels, half of which would occur on outbound portions of journeys and half on the inbound.

A trip or a voyage includes the outbound and the inbound portions. The average size of worldwide crude oil tanker is 826,000 bbl.

All references in the table are Anderson and Labelle 2001 except where noted. Statistics based on the years 1974 to 1999.

Table A.5.1
Crude Oil Tanker Spills of Various Sizes and Locations

Location	Size Range(bbl)	Spills/ Billion bbl Loaded or Unloaded	Spills/10,000 Voyages or Trips	Average Spill Size (bbl)	Median Spill Size (bbl)	References:
Worldwide						
all locations	>200,000	0.05	0.83	539,000	382,000	[15]
all locations	>100,000	0.12	1.98	374,000	244,000	[2, 3]
all locations	>10,000	0.295	4.87	178,700	66,000	[2, 3]
in port	>10,000	0.09	1.49	175,500	49,500	[2, 3]
at sea	>10,000	0.205	3.39	180,200	71,400	[2, 3]
all locations	>1000	0.58	9.58	93,900	11,300	[2, 3]
in port	>1000	0.245	4.05	68,300	6,300	[2, 3]
"at Sea" total	>1000	0.335	5.53	112,400	17,000	[2, 3]
"at Sea"-open water >50 nmi	>1000	0.060	1.00			[2, 3]
"at Sea"-restricted water <50nmi	>1000	0.275	4.54			[2, 3]
	50 to 999	1.5	24.8	233	132	[13]
	1 to 49	7.8	129	10	5	[13]
US Coastal & Offshore						
all locations	>10,000	0.215	3.6	62,100	20,000	[2, 3, 17]
in port	>10,000	0.100	1.65	23,700	20,000	[2, 3]
at sea	>10,000	0.115	1.90	96,700	43,200	[2, 3]
all locations	>1000	0.515	8.51	28,000	7,000	[2, 3]
in port	>1000	0.335	5.53	10,000	6,000	[2, 3]
at sea	>1000	0.18	2.97	61,900	16,100	[19, 20]

A.6 OFFLOADING SPILL RATES

Table A.6.1 gives a summary of tankers/platform oil spills occurring tanker loading at the platform. Spills greater than 1,000 bbl data was based on UK experience, from 1975-1993, where two spills (4,000 bbl each) occurred from 3,409 liftings involving 1,700 million barrels and Statoil experience in Norway, from 1979-1995, where two spills (4,000 and 5,800 bbl) involved 5,000 liftings of 4 billion barrels.

Table A.6.1
Spills from offshore platforms lifting crude oil to tankers

Spill Size Range	Spills/ 10,000 Liftings	Spills/ Billion bbl	Average Spill Size (bbl)	References
all sizes	40.00	5.90		[10]
100 –1,000 bbl	10.00	1.47		[10]
>1,000 bbl *	4.76	0.70	4450	[6, 19, 20,]
>10,000 bbl	0			[17, 19]

A.7 SUMMARY OF ABOVE GROUND STORAGE TANK (AST) SPILL STATISTICS

This chapter presents a summary of above ground storage tank (AST) spill statistics. Tables A.7.1 and A.7.2 provide the exposure data. Table A.7.3 provides the causal distribution of AST releases. Table A.7.4 gives the spill frequencies for all ASTs.

Table A.7.1
Summary of AST Statistics [6]

API Segment	Surveyed Above Ground Tanks	Estimated National Total	Total Capacity	Average Age
Production	54,046	572,620	280,595	15.1

Table A.7.2
Number of ASTs by Capacity Range, Production, bbl [6]

25-500	500-1,000	1000 - 10,000	100,000 - 500,000	> 500,000	total
510,045	37,628	17,977	974	27	572,620

Table A.7.3
Production AST Release Frequency Distribution [6]

Causes (for all ASTs)	%
Corrosion	60
Improper Installation and tank failure	18
Loose fittings	12
Overfills and spills	10
TOTAL	100

Table A.7.4
Frequencies for all ASTs—no spill sizes given

Release	Description	Frequency	Spill Size (bbl)	
			Average	Median
small/medium leaks		1.1×10^{-2} to 3.9×10^{-2}	6500	700
serious release	(say, > 10,000 gallons) ?	9.6×10^{-5}		
major release	(say, >1000 bbl)	6.9×10^{-6}		

A.8 GAS BLOWOUTS

Based on the SL Ross Northstar study [17], Table A.8.1 gives a summary for gas blowouts associated with different well conditions ranging from drilling to production.

Table A.8.1
Gas Blowouts Statistical Summary

	Worldwide 1955-1980	US GOM 1955-1980	US OCS 1971-1990	Norwegian North Sea 1976-1980	UK North Sea 1955-1980	USGOM & North Sea combined, 1980-1992 (selected)	North Sea- Norway & UK Combined, 1980-1993
Wells Drilled	36633	17184	21425	11116	1559	15294	4704
Exploration Wells	11737	4794	6610	4175	838	5781	2315
Development Wells	24896	12390	14815	6941	721	9513	2389
Exploration Well Blowouts incl. Shallow Gas Blowouts	96	30	40	32	?	43	16
Development Well Blowouts incl. S.G. Blowouts	66	36	34	14	?	25	4
Production/workover Blowouts	52	32	36	?	?	43	4
Total Blowouts incl. S.G. & Production Blowouts	214	98	110	46	6	111	24
Shallow Gas Blowouts	54	29	?	?	0	46	?
Blowout Incidence: total exp.& dev. Blowouts / total drilled	one in 230	one in 260	one in 290	one in 240	one in 260	one in 230	one in 290
Blowout Incidence: Exploration Drilling Only only	one in 120	one in 160	one in 170	one in 130	-	one in 130	one in 170
Blowout Incidence: Development Drilling Only.	one in 380	one in 340	one in 440	one in 500	-	one in 380	one in 440

A.9 BLOWOUTS WITH OIL

Based on the same reference, the SL Ross Northstar study [17], Table A.9.1 gives oil blowout summary for a range of well types. The Figures cited are probabilities of blowouts as described in that table.

**Table A.9.1
Oil Blowout Data Summary**

Event	Historical Frequency	Experience
BLOWOUTS		
1. Gas blowout during development drilling	2.5×10^{-3} /wells drilled	US OCS, 1964-1995
2. Gas blowout during exploration drilling	5.4×10^{-3} /wells drilled	US OCS, 1964-1995
3. Blowout during production and workovers involving some oil discharge >1 bbl	6.5×10^{-5} /well-years	US OCS, 1964-1995
4. Development drilling blowout with oil spill > 10,000 bbl	7.8×10^{-5} /wells drilled	Worldwide, 1970-present
5. Exploration drilling blowout with oil spill > 10,000 bbl	1.5×10^{-4} /wells drilled	Worldwide, 1970-present
6. Development drilling blowout with oil spill > 150,000 bbl	3.9×10^{-5} /wells drilled	Worldwide, 1970-present
7. Exploration drilling blowout with oil spill > 150,000 bbl	5.5×10^{-5} /wells drilled	Worldwide, 1970-present
8. Production/workover blowout with oil spill > 10,000 bbl	2.5×10^{-5} /well-year	Worldwide, 1970-present
9. Production/workover blowout with oil spill > 150,000 bbl	1.0×10^{-5} /well-year	Worldwide, 1970-present
PLATFORM SPILLS (incl. blowouts)		
1. Oil spill > 10,000 bbl	1.3×10^{-5} /well-year	US OCS, 1964-1995
2. Oil spill > 1,000 bbl	3.6×10^{-5} /well-year	US OCS, 1964-1995
3. Oil spill > 50 bbl	8.3×10^{-4} /well-year	US OCS, 1964-1995
4. Oil spill 1-50 bbl	1.7×10^{-2} /well-year	US OCS, 1964-1995

A.10 OIL TANKER SPILLS

Table A.10.1 provides a summary of crude oil tanker spill characteristics including size ranges, tanker capacities, spill frequencies per trip, average spill size, and median spill size.

All numbers represent the spill frequency for either inbound or outbound journeys for tankers. The numbers must be doubled to calculate the spill frequency of the tankers on a trip or voyage basis which would include both an outbound portion (when the tanker is loaded) and an inbound portion (when the cargo is unloaded). If, for example, 278 large (>1,000 bbl) occurred on a worldwide basis from 1964 to 1999 (which is true) and the volume of crude oil moved or transported during this period was 239.67 billion barrels, the spill frequency would be 278/239.67 or 1.16 spills per billion barrels, half of which would occur on outbound portions of journeys and half on the inbound.

A trip or a voyage includes the outbound and the inbound portions. All references are Anderson and Labelle, 2001, except where noted. Statistics are based on the years 1974 to 1999.

Table A.10.1
Crude Oil Tanker Spills of Various Sizes and Locations

Location	Size Range (spills/bbl)	Billion bbl Loaded or Unloaded	Spills/10,000 Voyages or Trips	Average Spill Size (bbl)	Median Spill Size (bbl)	References
Worldwide						
All Locations	>200,000	0.05	0.83	539,000	382,000	[2]
All Locations	>100,000	0.12	1.98	373,800	243,600	[2, 3]
In Port	>100,000	0.35	5.78	310,300	251,000	[2, 3]
At Sea	>100,000	0.085	1.40	392,900	243,600	[2, 3]
All Locations	>10,000	0.295	4.87	178,700	66,000	[2, 3]
In Port	>10,000	0.09	1.49	175,500	49,500	[2, 3]
At Sea	>10,000	0.205	3.39	180,200	71,400	[2, 3]
All Locations	>1,000	0.58	9.58	93,900	11,300	[2, 3]
In Port	>1,000	0.245	4.05	68,300	6,300	[2, 3]
At Sea Total	>1,000	0.335	5.53	112,400	17,000	[2, 3]
At Sea – Open Water >50 nmi	>1,000	0.060	1.00	-	-	[2, 3]
At Sea – Restricted water < 50 nmi	>1,000	0.275	4.54	-	-	[13, 15]
	50 to 999	1.5	24.8	233	132	[13, 15]
1 to 49	7.8	129	10	5	[13, 15]	
US Coastal and Offshore						
All Locations	>10,000	0.215	3.6	62,100	20,000	[2, 3]
In Port	>10,000	0.100	1.65	23,700	20,000	[2, 3]
At Sea	>10,000	0.115	1.90	96,700	43,200	[2, 3]
All Locations	>1,000	0.515	8.51	28,000	7,000	[2, 3]
In Port	>1,000	0.335	5.53	10,000	6,000	[2, 3]
At Sea	>1,000	0.18	2.97	61,900	16,100	[2, 3]

A.11 SPILLS DURING TANKER LOADINGS AT OFFSHORE PLATFORMS

A.11.1 Introduction

Spills are possible when crude oil is transferred from production platforms to shuttle tankers. Developing predictions of frequencies for such spills is difficult at this time because the design of the loading/lifting system has not been finalized. As well, the technologies involved in offshore tanker loadings have changed significantly over the last few years, making questionable the use of historical spill statistics for predicting future spill frequencies; the literature seems to indicate a dramatic drop in spill frequencies over the last few years as better technologies have been adopted. The issue is discussed in three different ways below. Table A.11.1 summarizes offshore loading incidents.

A.11.2 Experience in the U.K. Sector of the North Sea

The area that has the most experience with the use of tankers to lift offshore oil is the North Sea. The U.K. sector has been using tankers since 1976 to transport oil from the offshore production facilities to shore using both Single Buoy Mooring (SBM) and Single Point Mooring (SPM) systems. There are two separate reports on this experience which provide somewhat different results, as described below.

A.11.3 Experience during 1976-1979 as reported in Gulf 1981

The breakdown of statistics from 1976 (when production began) to 1979 is available in Gulf (1981) [7]. Of all spills during E&P activities in the U.K. sector of the North Sea twenty three percent, that is 34 spills, involved offloading accidents and accounted for 73 percent of the total oil spilled. Ninety-four percent of these 34 spills were less than 100 barrels each, with an average spill size of 18 barrels.

There were two large spills (> 1000 barrels), each having a volume of 4000 barrels. The volume of oil lifted during 1976 to 1979 inclusive was 870 million barrels; therefore, the frequency of large spills was $2/0.87$ or 2.3 spills per billion barrels offloaded.

A.11.4 Experience During 1975-1993 as Reported by E&P Forum 1996

It is noted in E&P Forum 1996 [6] that pollution incidents associated with liftings should be grouped according to the lifting system. Table 8 mainly covers non-CALM (Catenary Anchor Leg Mooring) systems, as the CALM system was a first generation system and have been phased out. The table uses offshore loading statistics from the UK Department of Trade and Industry (DTI) pollution reports over the years 1977-93 (*Offshore Pollution Reports from Field Operators, 1977-93*) [21].

Table A.11.1
Pollution Incidents - UK Offshore Loading 1975-93 (non-CALM systems)

Spill Source	Total Number	Total Volume (bbl)	Minimum Size (bbl)	Maximum Size (bbl)	Average Size (bbl)
Storage	36	4,343	0.1	4,000	121
Pipeline	1	19	19	19	19
System	10	9,455	0.25	9,400	946
Hose	14	1088	0.5	500	78
Tanker	2	7	2	5	4
TOTALS	63	14,912	0.1	9,400	237

Definitions:

- Storage - storage containment, either on production installation or loading facility
- Pipeline - pipelines between production, storage and loading facilities
- System - loading buoy or facility, e.g. pipework, swivels etc. but excluding storage
- Hose - hose system from loading facility to tanker, including coupler
- Tanker - on board tanker

The total volume loaded over the above systems between 1977 and end-1993 is about 1700 million barrels, via 3409 liftings. There are two large spills (> 1000 barrels) shown in Table 8 (4000 bbl and 9,400 bbl). Therefore, the frequency of large spills was 2/1.7 or **1.2 spills per billion barrels offloaded.**

A.11.5 Statoil Experience in the North Sea, 1979-1995

Statoil, the national oil company of Norway, has more than 15 years of experience with offshore loading in the North Sea, starting with the Statfjord A platform in 1979. Initially, the operation was based on an articulated loading platform (ALP) and modified conventional tankers, but has evolved into today's submerged turret loading (STL) system and a large fleet of specialized vessels. A Statoil paper on the subject [4] indicates that 5000 cargoes of crude oil, involving about 4 billion barrels, have been lifted by Statoil-operated tankers up to May 1994. In that time only two large spills have occurred: a 4000-barrel spill in 1980 and a 5800-barrel spill in 1992¹. This gives a spill frequency of $2/4 \times 10^9$ or 0.5 large spills per billion barrels offloaded

In terms of smaller spills, Breivik [4] indicates that only two have occurred, each less than 150 barrels.

A.11.6 Conclusion

The existing data suggest that in the earlier days of offloading, the frequency of large spills was relatively high (2.3 spills per billion barrels produced) and very high for smaller spills, but has been reduced lately (to 0.5 large spills per billion barrels produced) as a result of better technologies. This change is clearly shown in the UK data [21] from 1975 to 1993, where the number of 1.2 spills per billion barrels is about the average of the other two numbers. If it is assumed that current projects will take advantage of these latest technologies and systems and operate them as well as Statoil claims to be doing, then a large-spill frequency of 0.5 spills / 10^9 bbl produced might be a reasonable predictor. If not, a higher number, perhaps 2.3 spills/ 10^9 bbl, should be used. For want of further information, the middle number is recommended for current projects, i.e., 1.2 large spills (>1000 bbl) for every billion barrels offloaded.

¹ This latter spill, the second largest in Norwegian waters, was not referenced in the Breivik 1995 paper. According to the Oil Spill Intelligence Report (International Spill Statistics: 1992), the spill took place on July 9, 1992 at the Statfjord offshore oil field, 140 km offshore at Lat: 61.00N and Lon: 002.00E. The spill was suspected to be caused by workers who left a valve open while transferring oil from the platform to the oil tanker.

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APPENDIX B
FUTURE DEVELOPMENT SCENARIOS

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Table B.1
Beaufort Sea Sale 1 Development Scenarios

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Production Wells		In-use Pipeline Length [miles]						Production MMbbl
				Incr.	Cum.	Incr.	Cum.	Sum<10"		Sum >=10"		Sum All		
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2004	Shallow	1												
	Medium													
	Deep													
	Total	1												
2005	Shallow	1												
	Medium													
	Deep													
	Total	1												
2006	Shallow	1	2											
	Medium													
	Deep													
	Total	1	2											
2007	Shallow	1												
	Medium													
	Deep													
	Total	1												
2008	Shallow		2											
	Medium	1												
	Deep													
	Total	1	2											
2009	Shallow			1	1	3	3							
	Medium	1												
	Deep													
	Total	1		1	1	3	3							
2010	Shallow				1	10	13			10	10	10	10	10.9
	Medium		2											
	Deep													
	Total		2		1	10	13			10	10	10	10	10.9
2011	Shallow			1	2	13	26			10		10		19.9
	Medium													
	Deep													
	Total			1	2	13	26			10		10		19.9
2012	Shallow				2	10	36			10	20	10	20	30.8
	Medium													
	Deep													
	Total				2	10	36			10	20	10	20	30.8
2013	Shallow				2	10	46			20		20		39.8
	Medium													
	Deep													
	Total				2	10	46			20		20		39.8
2014	Shallow				2		46			20		20		36.3
	Medium			1	1	3	3							
	Deep													
	Total			1	3	3	49			20		20		36.3

Table B.1 - continued

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Production Wells		In-use Pipeline Length [miles]				Production MMbbl			
				Incr.	Cum.	Incr.	Cum.	Sum<10"		Sum >=10"			Sum All		
								Incr.	Cum.	Incr.	Cum.		Incr.	Cum.	
2015	Shallow				2		46			10	30	10	30	33.4	
	Medium				1	10	13			10	10	10	10	10.9	
	Deep														
	Total				3	10	59			20	40	20	40	44.3	
2016	Shallow				2		46				30		30	27.6	
	Medium				1	10	23				10		10	19.9	
	Deep														
	Total				3	10	69			40	40	40	40	47.5	
2017	Shallow				2		46				30		30	22.7	
	Medium				1		23				10		10	19.9	
	Deep														
	Total				3		69			40	40	40	40	42.6	
2018	Shallow				2		46				30		30	18.8	
	Medium				1		23				10		10	19.9	
	Deep														
	Total				3		69			40	40	40	40	38.7	
2019	Shallow				2		46				30		30	15.5	
	Medium				1		23				10		10	16.4	
	Deep														
	Total				3		69			40	40	40	40	31.9	
2020	Shallow				2		46				30		30	12.8	
	Medium				1		23				10		10	13.5	
	Deep														
	Total				3		69			40	40	40	40	26.3	
2021	Shallow				2		46				30		30	10.5	
	Medium				1		23				10		10	11.2	
	Deep														
	Total				3		69			40	40	40	40	21.7	
2022	Shallow				2		46				30		30	8.7	
	Medium				1		23				10		10	9.2	
	Deep														
	Total				3		69			40	40	40	40	17.9	
2023	Shallow				2		46				30		30	7.3	
	Medium				1		23				10		10	7.6	
	Deep														
	Total				3		69			40	40	40	40	14.9	
2024	Shallow				2		46				30		30	6.1	
	Medium				1		23				10		10	6.3	
	Deep														
	Total				3		69			40	40	40	40	12.4	
2025	Shallow				-1	1	-23	23			-10	20	-10	20	3.0
	Medium					1		23				10		10	5.2
	Deep														
	Total				-1	2	-23	46			-10	30	-10	30	8.2
2026	Shallow					1		23				20		20	2.6
	Medium					1		23				10		10	4.3
	Deep														
	Total					2		46			30	30	30	6.9	
2027	Shallow					-1		-23			-10	10	-10	10	
	Medium					1		23				10		10	3.5
	Deep														
	Total					-1	1	-23	23			-10	20	-10	20
2028	Shallow											10		10	
	Medium					1		23				10		10	3.0
	Deep														
	Total					1		23			20	20	20	3.0	3.0



Table B.1 - continued

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Production Wells		In-use Pipeline Length [miles]						Production MMbbl
				Incr.	Cum.	Incr.	Cum.	Sum <10"		Sum >=10"		Sum All		
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2029	Shallow											10	10	
	Medium				1		23					10	10	2.6
	Deep													
	Total				1		23					20	20	2.6
2030	Shallow											-10	-10	
	Medium				-1		-23					-10	-10	
	Deep													
	Total				-1		-23					-20	-20	
2031	Shallow													
	Medium													
	Deep													
	Total													
2032	Shallow													
	Medium													
	Deep													
	Total													
2033	Shallow													
	Medium													
	Deep													
	Total													
2034	Shallow													
	Medium													
	Deep													
	Total													
2035	Shallow													
	Medium													
	Deep													
	Total													
2036	Shallow													
	Medium													
	Deep													
	Total													
2037	Shallow													
	Medium													
	Deep													
	Total													
2038	Shallow													
	Medium													
	Deep													
	Total													

**Table B.2
Beaufort Sea Sale 2 Development Scenarios**

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Production Wells		In-use Pipeline Length [miles]				Production MMbbl		
				Incr.	Cum.	Incr.	Cum.	Sum <10"		Sum >=10"			Sum All	
								Incr.	Cum.	Incr.	Cum.		Incr.	Cum.
2004	Shallow													
	Medium													
	Deep													
	Total													
2005	Shallow													
	Medium													
	Deep													
	Total													
2006	Shallow													
	Medium													
	Deep													
	Total													
2007	Shallow	1												
	Medium													
	Deep													
	Total	1												
2008	Shallow	1												
	Medium													
	Deep													
	Total	1												
2009	Shallow		2											
	Medium													
	Deep													
	Total		2											
2010	Shallow													
	Medium	1												
	Deep													
	Total	1												
2011	Shallow													
	Medium													
	Deep													
	Total													
2012	Shallow			1	1	3	3							
	Medium	1												
	Deep	1												
	Total	2		1	1	3	3							
2013	Shallow				1	10	13			15	15	15	15	10.9
	Medium		2											
	Deep	1												
	Total	1	2		1	10	13			15	15	15	15	10.9
2014	Shallow				1	10	23							19.9
	Medium		2											
	Deep													
	Total		2		1	10	23					15	15	19.9

Table B.2 - continued

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Production Wells		In-use Pipeline Length [miles]						Production MMbbl
				Incr.	Cum.	Incr.	Cum.	Sum<10"		Sum >=10"		Sum All		
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2015	Shallow				1		23					15	15	19.9
	Medium													
	Deep													
	Total				1		23					15	15	19.9
2016	Shallow				1		23					15	15	19.9
	Medium			1	1	3	3							
	Deep													
	Total			1	2	3	26					15	15	19.9
2017	Shallow				1		23			10	25	10	25	16.4
	Medium			1	2	13	16	5	5	10	10	15	15	18.4
	Deep													
	Total			1	3	13	39	5	5	20	35	25	40	34.8
2018	Shallow				1		23				25	25	25	13.5
	Medium				2	20	36		5	10		15	15	30.7
	Deep													
	Total				3	20	59		5	35		40	40	44.2
2019	Shallow				1		23				25	25	25	11.2
	Medium				2	10	46		5	10		15	15	30.7
	Deep													
	Total				3	10	69		5	35		40	40	41.9
2020	Shallow				1		23				25	25	25	9.2
	Medium				2		46		5	10		15	15	30.7
	Deep													
	Total				3		69		5	35		40	40	39.9
2021	Shallow				1		23				25	25	25	7.6
	Medium				2		46		5	10		15	15	30.7
	Deep													
	Total				3		69		5	35		40	40	38.3
2022	Shallow				1		23				25	25	25	6.3
	Medium				2		46		5	10		15	15	26.4
	Deep													
	Total				3		69		5	35		40	40	32.7
2023	Shallow				1		23				25	25	25	5.2
	Medium				2		46		5	10		15	15	22.7
	Deep													
	Total				3		69		5	35		40	40	27.9
2024	Shallow				1		23				25	25	25	4.3
	Medium				2		46		5	10		15	15	19.5
	Deep													
	Total				3		69		5	35		40	40	23.8
2025	Shallow				1		23				25	25	25	3.5
	Medium				2		46		5	10		15	15	16.8
	Deep													
	Total				3		69		5	35		40	40	20.3
2026	Shallow				1		23				25	25	25	2.9
	Medium				2		46		5	10		15	15	14.4
	Deep													
	Total				3		69		5	35		40	40	17.3
2027	Shallow				1		23				25	25	25	2.4
	Medium				2		46		5	10		15	15	12.4
	Deep													
	Total				3		69		5	35		40	40	14.8
2028	Shallow				-1		-23			-15	10	-15	10	
	Medium				2		46		5	10		15	15	10.7
	Deep													
	Total				-1	2	-23	46		5	-15	20	-15	25



Table B.2 - continued

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Production Wells		In-use Pipeline Length [miles]						Production MMbbl
				Incr.	Cum.	Incr.	Cum.	Sum<10"		Sum >=10"		Sum All		
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2029	Shallow										10		10	
	Medium				2	46			5		10		15	9.2
	Deep													
	Total				2	46			5		20		25	9.2
2030	Shallow										10		10	
	Medium				2	46			5		10		15	7.9
	Deep													
	Total				2	46			5		20		25	7.9
2031	Shallow										10		10	
	Medium				2	46			5		10		15	6.8
	Deep													
	Total				2	46			5		20		25	6.8
2032	Shallow										10		10	
	Medium				2	46			5		10		15	5.8
	Deep													
	Total				2	46			5		20		25	5.8
2033	Shallow										10		10	
	Medium				2	46			5		10		15	5.0
	Deep													
	Total				2	46			5		20		25	5.0
2034	Shallow										10		10	
	Medium				2	46			5		10		15	4.3
	Deep													
	Total				2	46			5		20		25	4.3
2035	Shallow										10		10	
	Medium				2	46			5		10		15	3.7
	Deep													
	Total				2	46			5		20		25	3.7
2036	Shallow										-10		-10	
	Medium				-2	-46			-5		-10		-15	
	Deep													
	Total				-2	-46			-5		-20		-25	
2037	Shallow													
	Medium													
	Deep													
	Total													
2038	Shallow													
	Medium													
	Deep													
	Total													

**Table B.3
Beaufort Sea Sale 3 Development Scenarios**

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Production Wells		In-use Pipeline Length [miles]						Production MMbbl	
				Incr.	Cum.	Incr.	Cum.	Sum<10"		Sum >=10"		Sum All			
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		
2004	Shallow														
	Medium														
	Deep														
	Total														
2005	Shallow														
	Medium														
	Deep														
	Total														
2006	Shallow														
	Medium														
	Deep														
	Total														
2007	Shallow														
	Medium														
	Deep														
	Total														
2008	Shallow														
	Medium														
	Deep														
	Total														
2009	Shallow														
	Medium														
	Deep														
	Total														
2010	Shallow	1													
	Medium														
	Deep														
	Total	1													
2011	Shallow														
	Medium														
	Deep														
	Total														
2012	Shallow														
	Medium	1													
	Deep														
	Total	1													
2013	Shallow														
	Medium	1	1												
	Deep														
	Total	1	1												
2014	Shallow														
	Medium		2												
	Deep														
	Total		2												

Table B.3 - continued

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Production Wells		In-use Pipeline Length [miles]						Production MMbbl	
				Incr.	Cum.	Incr.	Cum.	Sum<10"		Sum >=10"		Sum All			
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		
2015	Shallow														
	Medium		2												
	Deep	1													
	Total	1	2												
2016	Shallow														
	Medium														
	Deep														
	Total														
2017	Shallow														
	Medium														
	Deep	1													
	Total	1													
2018	Shallow														
	Medium			1	1	4	4								
	Deep	1													
	Total	1		1	1	4	4								
2019	Shallow									15	15	15	15		
	Medium			1	2	14	18	5	5	15	15	20	20	30.8	
	Deep														
	Total			1	2	14	18	5	5	30	30	35	35	30.8	
2020	Shallow									15		15			
	Medium				2	20	38		5	15		20		38.6	
	Deep														
	Total				2	20	38		5	30		35		38.6	
2021	Shallow									15		15			
	Medium				2	20	58		5	15		20		38.6	
	Deep														
	Total				2	20	58		5	30		35		38.6	
2022	Shallow									15		15			
	Medium				2	10	68		5	15		20		38.6	
	Deep														
	Total				2	10	68		5	30		35		38.6	
2023	Shallow									15		15			
	Medium				2		68		5	15		20		38.6	
	Deep														
	Total				2		68		5	30		35		38.6	
2024	Shallow									15		15			
	Medium				2		68		5	15		20		38.6	
	Deep														
	Total				2		68		5	30		35		38.6	
2025	Shallow									15		15			
	Medium				2		68		5	15		20		34.0	
	Deep														
	Total				2		68		5	30		35		34.0	
2026	Shallow									15		15			
	Medium				2		68		5	15		20		29.9	
	Deep														
	Total				2		68		5	30		35		29.9	
2027	Shallow									15		15			
	Medium				2		68		5	15		20		26.3	
	Deep														
	Total				2		68		5	30		35		26.3	
2028	Shallow									15		15			
	Medium				2		68		5	15		20		23.2	
	Deep														
	Total				2		68		5	30		35		23.2	



Table B.3 - continued

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Production Wells		In-use Pipeline Length [miles]						Production MMbbl
				Incr.	Cum.	Incr.	Cum.	Sum<10"		Sum >=10"		Sum All		
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2029	Shallow										15	15		
	Medium				2		68		5		15	20		20.4
	Deep													
	Total				2		68		5		30	35		20.4
2030	Shallow										15	15		
	Medium				2		68		5		15	20		17.9
	Deep													
	Total				2		68		5		30	35		17.9
2031	Shallow										15	15		
	Medium				2		68		5		15	20		15.8
	Deep													
	Total				2		68		5		30	35		15.8
2032	Shallow										15	15		
	Medium				2		68		5		15	20		13.9
	Deep													
	Total				2		68		5		30	35		13.9
2033	Shallow										15	15		
	Medium				2		68		5		15	20		12.2
	Deep													
	Total				2		68		5		30	35		12.2
2034	Shallow										15	15		
	Medium				2		68		5		15	20		10.8
	Deep													
	Total				2		68		5		30	35		10.8
2035	Shallow										15	15		
	Medium				2		68		5		15	20		9.5
	Deep													
	Total				2		68		5		30	35		9.5
2036	Shallow										15	15		
	Medium				2		68		5		15	20		8.3
	Deep													
	Total				2		68		5		30	35		8.3
2037	Shallow										15	15		
	Medium				2		68		5		15	20		7.3
	Deep													
	Total				2		68		5		30	35		7.3
2038	Shallow										15	15		
	Medium				2		68		5		15	20		6.5
	Deep													
	Total				2		68		5		30	35		6.5

**Table B.4
Beaufort Sea All Sale Development Scenarios**

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Production Wells		In-use Pipeline Length [miles]						Production MMbbl
				Incr.	Cum.	Incr.	Cum.	Sum<10"		Sum >=10"		Sum All		
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2004	Shallow	1												
	Medium													
	Deep													
	Total	1												
2005	Shallow	1												
	Medium													
	Deep													
	Total	1												
2006	Shallow	1	2											
	Medium													
	Deep													
	Total	1	2											
2007	Shallow	2												
	Medium													
	Deep													
	Total	2												
2008	Shallow	1	2											
	Medium	1												
	Deep													
	Total	2	2											
2009	Shallow		2	1	1	3	3							
	Medium	1												
	Deep													
	Total	1	2	1	1	3	3							
2010	Shallow	1			1	10	13			10	10	10	10	10.9
	Medium	1	2											
	Deep													
	Total	2	2		1	10	13			10	10	10	10	10.9
2011	Shallow			1	2	13	26			10		10		19.9
	Medium													
	Deep													
	Total			1	2	13	26			10		10		19.9
2012	Shallow			1	3	13	39			10	20	10	20	30.8
	Medium	2												
	Deep	1												
	Total	3		1	3	13	39			10	20	10	20	30.8
2013	Shallow				3	20	59			15	35	15	35	50.7
	Medium	1	3											
	Deep	1												
	Total	2	3		3	20	59			15	35	15	35	50.7
2014	Shallow				3	10	69			35		35		56.2
	Medium		4	1	1	3	3							
	Deep													
	Total		4	1	4	13	72			35		35		56.2

Table B.4 - continued

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Production Wells		In-use Pipeline Length [miles]						Production MMbbl
				Incr.	Cum.	Incr.	Cum.	Sum<10"		Sum >=10"		Sum All		
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2015	Shallow				3		69			10	45	10	45	53.3
	Medium		2		1	10	13			10	10	10	10	10.9
	Deep	1												
	Total	1	2		4	10	82			20	55	20	55	64.2
2016	Shallow				3		69				45		45	47.5
	Medium			1	2	13	26			10			10	19.9
	Deep													
	Total			1	5	13	95			55			55	67.4
2017	Shallow				3		69			10	55	10	55	39.1
	Medium			1	3	13	39	5	5	10	20	15	25	38.3
	Deep	1												
	Total	1		1	6	13	108	5	5	20	75	25	80	77.4
2018	Shallow				3		69				55		55	32.3
	Medium			1	4	24	63		5		20		25	50.6
	Deep	1												
	Total	1		1	7	24	132		5		75		80	82.9
2019	Shallow				3		69			15	70	15	70	26.7
	Medium			1	5	24	87	5	10	15	35	20	45	77.9
	Deep													
	Total			1	8	24	156	5	10	30	105	35	115	104.6
2020	Shallow				3		69				70		70	22.0
	Medium				5	20	107		10		35		45	82.8
	Deep													
	Total				8	20	176		10		105		115	104.8
2021	Shallow				3		69				70		70	18.1
	Medium				5	20	127		10		35		45	80.5
	Deep													
	Total				8	20	196		10		105		115	98.6
2022	Shallow				3		69				70		70	15.0
	Medium				5	10	137		10		35		45	74.2
	Deep													
	Total				8	10	206		10		105		115	89.2
2023	Shallow				3		69				70		70	12.5
	Medium				5		137		10		35		45	68.9
	Deep													
	Total				8		206		10		105		115	81.4
2024	Shallow				3		69				70		70	10.4
	Medium				5		137		10		35		45	64.4
	Deep													
	Total				8		206		10		105		115	74.8
2025	Shallow			-1	2	-23	46			-10	60	-10	60	6.5
	Medium				5		137		10		35		45	56.0
	Deep													
	Total			-1	7	-23	183		10	-10	95	-10	105	62.5
2026	Shallow				2		46				60		60	5.5
	Medium				5		137		10		35		45	48.6
	Deep													
	Total				7		183		10		95		105	54.1
2027	Shallow			-1	1	-23	23			-10	50	-10	50	2.4
	Medium				5		137		10		35		45	42.2
	Deep													
	Total			-1	6	-23	160		10	-10	85	-10	95	44.6
2028	Shallow			-1		-23				-15	35	-15	35	
	Medium				5		137		10		35		45	36.9
	Deep													
	Total			-1	5	-23	137		10	-15	70	-15	80	36.9

Table B.4 - continued

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Production Wells		In-use Pipeline Length [miles]						Production MMbbl
				Incr.	Cum.	Incr.	Cum.	Sum<10"		Sum >=10"		Sum All		
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2029	Shallow										35		35	
	Medium				5		137		10		35		45	32.2
	Deep													
	Total				5		137		10		70		80	32.2
2030	Shallow									-10	25	-10	25	
	Medium			-1	4	-23	114		10	-10	25	-10	35	25.8
	Deep													
	Total			-1	4	-23	114		10	-20	50	-20	60	25.8
2031	Shallow										25		25	
	Medium				4		114		10		25		35	22.6
	Deep													
	Total				4		114		10		50		60	22.6
2032	Shallow										25		25	
	Medium				4		114		10		25		35	19.7
	Deep													
	Total				4		114		10		50		60	19.7
2033	Shallow										25		25	
	Medium				4		114		10		25		35	17.2
	Deep													
	Total				4		114		10		50		60	17.2
2034	Shallow										25		25	
	Medium				4		114		10		25		35	15.1
	Deep													
	Total				4		114		10		50		60	15.1
2035	Shallow										25		25	
	Medium				4		114		10		25		35	13.2
	Deep													
	Total				4		114		10		50		60	13.2
2036	Shallow									-10	15	-10	15	
	Medium			-2	2	-46	68	-5	5	-10	15	-15	20	8.3
	Deep													
	Total			-2	2	-46	68	-5	5	-20	30	-25	35	8.3
2037	Shallow										15		15	
	Medium				2		68		5		15		20	7.3
	Deep													
	Total				2		68		5		30		35	7.3
2038	Shallow										15		15	
	Medium				2		68		5		15		20	6.5
	Deep													
	Total				2		68		5		30		35	6.5

Table B.5a
Chuckchi Sea Base Case MidPoint Development Scenarios

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Prod./Serv. Wells		Pipeline Length [miles]						Production MMbbl	
				Incr.	Cum.	Incr.	Cum.	Sum<10"		Sum >=10"		Sum All			
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		
1998	Shallow														
	Medium														
	Deep	2	2												
	Total	2	2												0
1999	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep									135	135	135	135		
	Total									200	200	200	200		0
2000	Shallow										5	5	5		
	Medium										60	60	60		
	Deep			2	2	8	8					135	135		
	Total			2	2	8	8					200	200		0
2001	Shallow										5	5	5		
	Medium										60	60	60		
	Deep			2	4	40	48					135	135		
	Total			2	4	40	48					200	200		0
2002	Shallow										5	5	5		
	Medium										60	60	60		
	Deep			2	6	60	108					135	135		
	Total			2	6	60	108					200	200		101.0
2003	Shallow										5	5	5		
	Medium										60	60	60		
	Deep				6	80	188					135	135		
	Total				6	80	188					200	200		135.0
2004	Shallow										5	5	5		
	Medium										60	60	60		
	Deep				6	26	214					135	135		
	Total				6	26	214					200	200		135.0
2005	Shallow										5	5	5		
	Medium										60	60	60		
	Deep				6		214					135	135		
	Total				6		214					200	200		135.0
2006	Shallow										5	5	5		
	Medium										60	60	60		
	Deep				6		214					135	135		
	Total				6		214					200	200		135.0
2007	Shallow										5	5	5		
	Medium										60	60	60		
	Deep				6		214					135	135		
	Total				6		214					200	200		135.0
2008	Shallow										5	5	5		
	Medium										60	60	60		
	Deep				6		214					135	135		
	Total				6		214					200	200		119.0
2009	Shallow										5	5	5		
	Medium										60	60	60		
	Deep				6		214					135	135		
	Total				6		214					200	200		103.0
2010	Shallow										5	5	5		
	Medium										60	60	60		
	Deep				6		214					135	135		
	Total				6		214					200	200		92.0

Table B.5b
Chuckchi Sea High Case MidPoint Development Scenarios

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Prod./Serv. Wells		Pipeline Length [miles]						Production MMbbl	
				Incr.	Cum.	Incr.	Cum.	Sum<10"		Sum >=10"		Sum All			
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		
1998	Shallow														
	Medium														
	Deep	3	1												
	Total	3	1												0
1999	Shallow														
	Medium														
	Deep	2	1												
	Total	2	1												0
2000	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep	2		2	2					135	135	135	135		
	Total	2		2	2					200	200	200	200		0
2001	Shallow										5		5		
	Medium										60		60		
	Deep			6	8	50	50				135		135		
	Total			6	8	50	50				200		200		0
2002	Shallow										5		5		
	Medium										60		60		
	Deep			4	12	80	130				135		135		
	Total			4	12	80	130				200		200		0
2003	Shallow										5		5		
	Medium										60		60		
	Deep				12	140	270				135		135		
	Total				12	140	270				200		200		223.0
2004	Shallow										5		5		
	Medium										60		60		
	Deep				12	140	410				135		135		
	Total				12	140	410				200		200		297.0
2005	Shallow										5		5		
	Medium										60		60		
	Deep				12	72	482				135		135		
	Total				12	72	482				200		200		297.0
2006	Shallow										5		5		
	Medium										60		60		
	Deep				12		482				135		135		
	Total				12		482				200		200		297.0
2007	Shallow										5		5		
	Medium										60		60		
	Deep				12		482				135		135		
	Total				12		482				200		200		297.0
2008	Shallow										5		5		
	Medium										60		60		
	Deep				12		482				135		135		
	Total				12		482				200		200		297.0
2009	Shallow										5		5		
	Medium										60		60		
	Deep				12		482				135		135		
	Total				12		482				200		200		262.0
2010	Shallow										5		5		
	Medium										60		60		
	Deep				12		482				135		135		
	Total				12		482				200		200		227.0

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MONTE CARLO CALCULATIONS AND RESULTS

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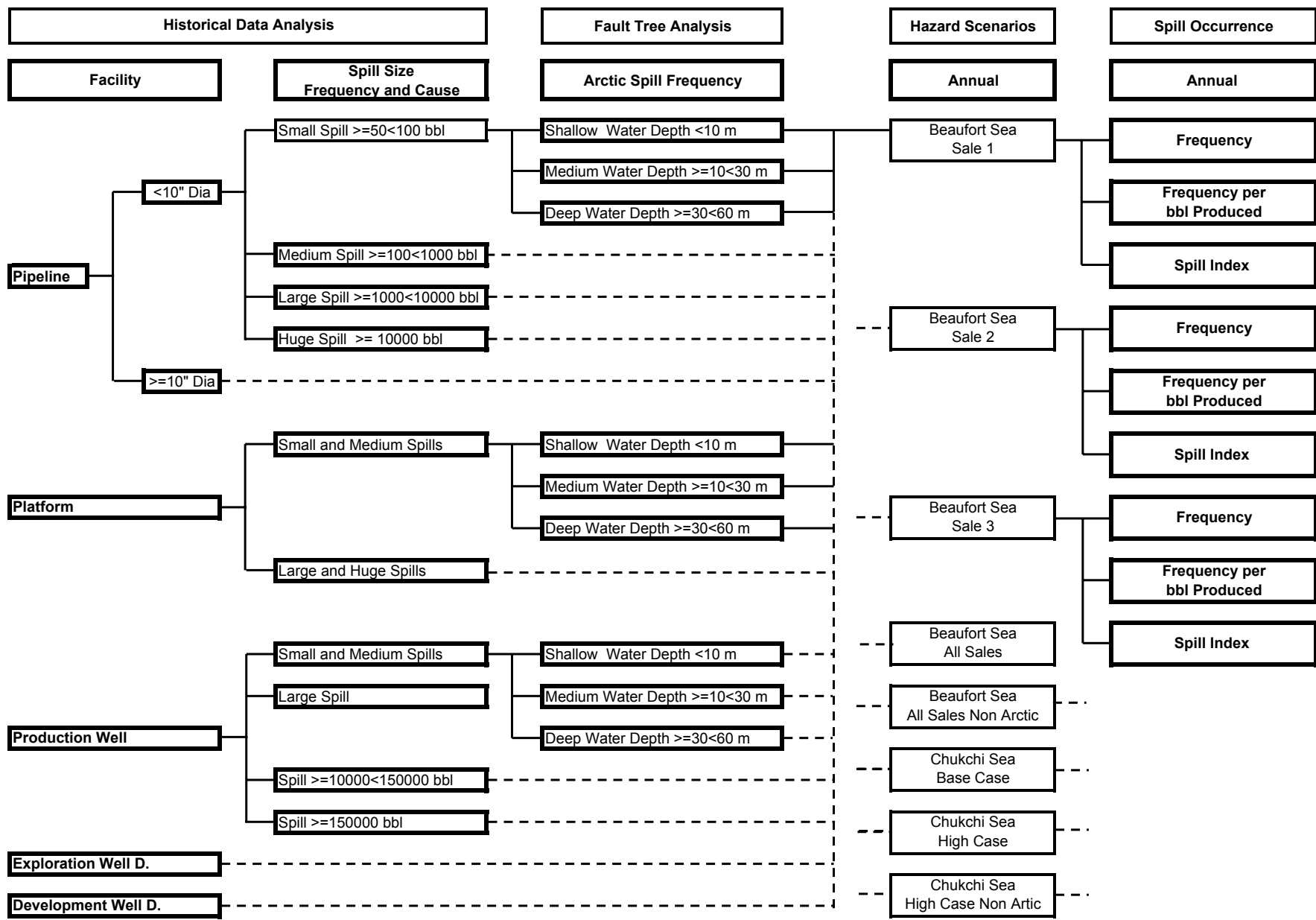
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Figure T.0 Flow Chart



**Table 1.1
Analysis of Historical Spills - P/L**

CAUSE CLASSIFICATION	NUMBER OF SPILLS	SPILL SIZE BBL										NUMBER OF SPILLS						
		1	2	3	4	5	6	7	8	9	10	S	M	L	H	SM	LH	
CORROSION	4												1	2	1		3	1
External	1	80											1				1	
Internal	3	100	5000	414										2	1		2	1
THIRD PARTY IMPACT	16												2	5	6	3	7	9
Anchor Impact	10	19833	65	50	300	900	323	15576	2000	800	1211		2	4	2	2	6	4
Jackup Rig or Spud Barge	1	3200													1			1
Trawl/Fishing Net	5	4000	100	14423	4569	4533							1	3	1	1	1	4
OPERATION IMPACT	4												3		1		3	1
Rig Anchoring	1	50											1				1	
Work Boat Anchoring	3	50	5100	50									2		1		2	1
MECHANICAL	2												2				2	
Connection Failure	1	135												1			1	
Material Failure	1	210												1			1	
NATURAL HAZARD	4												1	1	2		2	2
Mud Slide	3	250	80	8212									1	1	1		2	1
Storm/ Hurricane	1	3500													1			1
ARCTIC																		
Ice Gouging																		
Strudel Scour																		
Upheaval Buckling																		
Thaw Settlement																		
Other																		
UNKNOWN	1	119												1			1	
TOTALS	31												7	11	10	3	18	13

**Table 1.2
Distribution and Frequency of Historical Spills - P/L**

CAUSE CLASSIFICATION	Small and Medium Spills				Large and Huge Spills				
	HIST. DISTRIBUTION %	NUMBER OF SPILLS	EXPOSURE [km-years]	FREQUENCY spill per 10 ⁴ km-year	HIST. DISTRIBUTION %	NUMBER OF SPILLS	EXPOSURE [km-years]	FREQUENCY spill per 10 ⁴ km-year	
CORROSION	16.67	3	253903	0.1182	7.69	1	253903	0.0394	
External	5.56	1		0.0394					
Internal	11.11	2		0.0788	7.69	1			0.0394
THIRD PARTY IMPACT	38.89	7		0.2757	69.23	9			0.3545
Anchor Impact	33.33	6		0.2363	30.77	4			0.1575
Jackup Rig or Spud Barge					7.69	1			0.0394
Trawl/Fishing Net	5.56	1		0.0394	30.77	4			0.1575
OPERATION IMPACT	16.67	3		0.1182	7.69	1			0.0394
Rig Anchoring	5.56	1		0.0394					
Work Boat Anchoring	11.11	2		0.0788	7.69	1			0.0394
MECHANICAL	11.11	2		0.0788					
Connection Failure	5.56	1		0.0394					
Material Failure	5.56	1		0.0394					
NATURAL HAZARD	11.11	2		0.0788	15.38	2			0.0788
Mud Slide	11.11	2		0.0788	7.69	1			0.0394
Storm/ Hurricane					7.69	1			0.0394
ARCTIC									
Ice Gouging									
Strudel Scour									
Upheaval Buckling									
Thaw Settlement									
Other									
UNKNOWN	5.56	1	0.0394						
TOTALS	100.00	18		0.7089	100.00	13		0.5120	

**Table 1.2A
Historical Spills Data - Pipeline**

GOM OCS Pipeline Spills, Categorized 1972-99		Spill Statistics			Exposure**	Frequency
		Number of Spills	Average Volume bbl	Median Volume bbl	km-years	spill per 10 ⁴ km-years
By Pipe Diameter						
	<10"	16	2141	173	142,892	1.1197
	>=10"	15	4070	1211	111,011	1.3512
By Pipeline Minimum Depth						
	Bad Depth Data*	14				
	<10m	6	2310	1211	161,966	0.3704
	>=10m	11	3165	1040	94,641	1.1623
By Segment Length						
	<0.5km	0	0	0	2,359	0.0000
	>=0.5<2km	2	2335	2335	25,484	0.7848
	>=2<5km	7	820	100	35,279	1.9842
	>=5km	22	3859	850	192,270	1.1442
By Spill Size						
	Small	6	58	50	253,903	0.2363
	Medium	12	317	230	253,903	0.4726
	Large	10	4133	4267	253,903	0.3939
	Huge	3	16611	15576	253,903	0.1182
By Diameter, By Spill Size						
<10"	Small	4	58	50	142,892	0.2799
	Medium	7	266	135	142,892	0.4899
	Large	4	4436	4551	142,892	0.2799
	Huge	1	14423	14423	142,892	0.0700
>=10"	Small	2	58	58	111,011	0.1802
	Medium	5	387	312	111,011	0.4504
	Large	6	3932	3600	111,011	0.5405
	Huge	2	17705	17705	111,011	0.1802

*14 of the 31 records have both MIN_WATER_DEPTH and MAX_WATER_DEPTH set to "0".

**Exposure comes from an analysis of PPL_MASTERS database as published on Feb 15, 2001.

**Table 1.3
Analysis of Historical Spills - Platforms**

CAUSE CLASSIFICATION	NUMBER OF SPILLS	SPILL SIZE BBL													NUMBER OF SPILLS					
		1	2	3	4	5	6	7	8	9	10	11	12	13	S	M	L	H	SM	LH
PROCESS FACILITY RLS.	13	130	50	120	104	60	1456	125	50	50	55	400	280	75	6	6	1		12	1
STORAGE TANK RLS.	3	9935	7000	435												1	2		1	2
STRUCTURAL FAILURE	1	58													1				1	
HURRICANE/STORM	2	75	66												2				2	
COLLISION	2	600	108													2			2	
ARCTIC																				
Ice Force																				
Facility Low Temperature																				
Other																				
TOTALS	21														9	9	3		18	3

Table 1.4
Distribution and frequency of Historical Spills - Platforms

CAUSE CLASSIFICATION	Small and Medium Spills				Large and Huge Spills			
	HIST. DISTRIBUTION %	NUMBER OF SPILLS	EXPOSURE [well-years]	FREQUENCY spill per 10 ⁴ well-year	HIST. DISTRIBUTION %	NUMBER OF SPILLS	EXPOSURE [well-years]	FREQUENCY spill per 10 ⁴ well-year
PROCESS FACILITY RLS.	66.67	12	119714	1.0024	33.33	1	119714	0.0835
STORAGE TANK RLS.	5.56	1		0.0835	66.67	2		0.1671
STRUCTURAL FAILURE	5.56	1		0.0835				
HURRICANE/STORM	11.11	2		0.1671				
COLLISION	11.11	2		0.1671				
ARCTIC								
Ice Force								
Facility Low Temperature								
Other								
TOTALS	100.00	18			1.5036	100.00		3

**Table 1.5
Frequency of Historical Spills - Wells**

EVENT	FREQUENCY UNIT	Small and Medium Spills	Large Spill	Small, Medium, and Large Spills	Spill ≥ 10000 < 150000 bbl	Spill ≥ 150000 bbl
		HISTORICAL FREQUENCY				
PRODUCTION WELL	spill per 10^5 well-year	0.50	3.50	4.00	1.50	1.00
EXPLORATION WELL DRILLING	spill per 10^5 wells	3.16	22.11	25.27	9.50	5.50
DEVELOPMENT WELL DRILLING	spill per 10^5 wells	1.30	9.08	10.38	3.90	3.90

**Table 1.5A
Historical Spills Data - Wells**

Event	Historical Frequency	Experience	Reference
Development drilling blowout with oil spill > 10,000 bbl	7.8 x 10 ⁻⁵ /wells drilled	worldwide, 1970 - present	SL Ross 1998
Exploration drilling blowout with oil spill > 10,000 bbl	1.5 x 10 ⁻⁴ /wells drilled	worldwide, 1970 - present	SL Ross 1998
Development drilling blowout with oil spill > 150,000 bbl	3.9 x 10 ⁻⁵ /wells drilled	worldwide, 1970 - present	SL Ross 1998
Exploration drilling blowout with oil spill > 150,000 bbl	5.5 x 10 ⁻⁵ /wells drilled	worldwide, 1970 - present	SL Ross 1998

Blowout during production and workovers involving some oil discharge >1 bbl	6.5 x 10 ⁻⁵ /well-years	U.S. OCS, 1964 - 1995	SL Ross 1998 and MMS 1997
Production/workover blowout with oil spill > 10,000 bbl	2.5 x 10 ⁻⁵ /well-year	worldwide, 1970 - present	SL Ross 1998
Production/workover blowout with oil spill > 150,000 bbl	1.0 x 10 ⁻⁵ /well-year	worldwide, 1970 - present	SL Ross 1998

Table 2.1
Fault Tree Analysis Input Rationalization - P/L

CAUSE CLASSIFICATION	Spill Size	Shallow	Medium	Deep	Reason
		Frequency Change %			
CORROSION					
External	All	(50)	(50)	(50)	Low temperature and bio effects. Extra smart pigging.
Internal	All	(30)	(30)	(30)	Extra smart pigging.
THIRD PARTY IMPACT					
Anchor Impact	All	(90)	(90)	(90)	Low traffic.
Jackup Rig or Spud Barge	All	(50)	(50)	(50)	Low facility density.
Trawl/Fishing Net	All	(90)	(90)	(90)	Low fishing activity.
OPERATION IMPACT					
Rig Anchoring	All	(20)	(20)	(20)	No marine traffic during ice season (8 months).
Work Boat Anchoring	All	(20)	(20)	(20)	No work boat traffic during ice season (8 months).
MECHANICAL					
Connection Failure	All				
Material Failure	All				
NATURAL HAZARD					
Mud Slide	All	(80)	(60)	(40)	Gradient low. Mud slide potential (gradient) increases with water depth.
Storm/ Hurricane	All	(50)	(50)	(50)	Fewer severe storms.
		Freq. Increment per 10 ⁵ km-year			
		Median	Median	Median	
		Expected	Expected	Expected	
ARCTIC					
Ice Gouging	S	0.3495	0.1747		Ice gouge failure rate calculated using exponential failure distribution for 2.5-m cover, 0.2-m average gouge depth, 4 gouges per km-yr flux. Spill size Distribution explained in text Section 2.5.2
		0.0680	0.0340		
		0.6178	0.3089		
		0.1210	0.0605		
		1.3438	0.6719		
	M	0.2610	0.1305		
		0.3762	0.1881		
		0.0730	0.0365		
		0.0021			
		0.0012			
Strudel Scour	L	0.0038			Only in shallow water. Average frequency of 4 scours/mile ² and 100 ft of bridge length with 10% conditional P/L failure probability. The same spill size distribution as above.
		0.0020			
		0.0082			
		0.0045			
		0.0023			
	H	0.0012			
		0.0004	0.0004	0.0004	
		0.0002	0.0002	0.0002	
		0.0008	0.0008	0.0008	
		0.0004	0.0004	0.0004	
Upheaval Buckling	M	0.0016	0.0016	0.0016	All water depth. The failure frequency is 20% of that of Strudel Scour.
		0.0009	0.0009	0.0009	
		0.0005	0.0005	0.0005	
		0.0002	0.0002	0.0002	
		0.0002	0.0002	0.0002	
Thaw Settlement	S	0.0002	0.0002	0.0002	All water depth. The failure frequency is 10% of that of Strudel Scour.
		0.0001	0.0001	0.0001	
		0.0004	0.0004	0.0004	
		0.0002	0.0002	0.0002	
		0.0008	0.0008	0.0008	
Other	M	0.0004	0.0004	0.0004	To be assessed as 25% of above.
		0.0002	0.0002	0.0002	
		0.0008	0.0008	0.0008	
		0.0004	0.0004	0.0004	
		0.0002	0.0002	0.0002	
	L	0.0001	0.0001	0.0001	
		0.0881	0.0438	0.0002	
		0.0174	0.0086	0.0001	
		0.1557	0.0775	0.0003	
		0.0309	0.0153	0.0002	
	H	0.3386	0.1686	0.0006	
		0.0667	0.0330	0.0003	
		0.0948	0.0472	0.0002	
		0.0187	0.0092	0.0001	

**Table 2.1A
Input - Pipeline**

CAUSE CLASSIFICATION	Spill Size	Shallow			Medium			Deep		
		Frequency Change %								
		Low	Expected	High	Low	Expected	High	Low	Expected	High
CORROSION										
External	All	(25)	(50)	(75)	(25)	(50)	(75)	(25)	(50)	(75)
Internal	All	(15)	(30)	(45)	(15)	(30)	(45)	(15)	(30)	(45)
THIRD PARTY IMPACT										
Anchor Impact	All	(60)	(90)	(95)	(60)	(90)	(95)	(60)	(90)	(95)
Jackup Rig or Spud Barge	All	(25)	(50)	(75)	(25)	(50)	(75)	(25)	(50)	(75)
Trawl/Fishing Net	All	(60)	(90)	(95)	(60)	(90)	(95)	(60)	(90)	(95)
OPERATION IMPACT										
Rig Anchoring	All	(10)	(20)	(30)	(10)	(20)	(30)	(10)	(20)	(30)
Work Boat Anchoring	All	(10)	(20)	(30)	(10)	(20)	(30)	(10)	(20)	(30)
MECHANICAL										
Connection Failure	All									
Material Failure	All									
NATURAL HAZARD										
Mud Slide	All	(50)	(80)	(90)	(30)	(60)	(90)	(20)	(40)	(60)
Storm/ Hurricane	All	(25)	(50)	(75)	(25)	(50)	(75)	(25)	(50)	(75)
Frequency Increment per 10⁵km-year										
ARCTIC										
Ice Gouging	S	0.0060	0.0680	0.8290	0.0030	0.0340	0.4145			
	M	0.0090	0.1210	1.4670	0.0045	0.0605	0.7335			
	L	0.0210	0.2610	3.1900	0.0105	0.1305	1.5950			
	H	0.0060	0.0730	0.8930	0.0030	0.0365	0.4465			
Strudel Scour	S	0.0004	0.0012	0.0044						
	M	0.0006	0.0020	0.0078						
	L	0.0014	0.0045	0.0170						
	H	0.0004	0.0012	0.0048						
Upheaval Buckling	S	0.00007	0.00023	0.00088	0.00007	0.00023	0.00088	0.00007	0.00023	0.00088
	M	0.00013	0.00041	0.00156	0.00013	0.00041	0.00156	0.00013	0.00041	0.00156
	L	0.00028	0.00089	0.00340	0.00028	0.00089	0.00340	0.00028	0.00089	0.00340
	H	0.00008	0.00025	0.00095	0.00008	0.00025	0.00095	0.00008	0.00025	0.00095
Thaw Settlement	S	0.00004	0.00012	0.00044	0.00004	0.00012	0.00044	0.00004	0.00012	0.00044
	M	0.00006	0.00020	0.00078	0.00006	0.00020	0.00078	0.00006	0.00020	0.00078
	L	0.00014	0.00045	0.00170	0.00014	0.00045	0.00170	0.00014	0.00045	0.00170
	H	0.00004	0.00012	0.00048	0.00004	0.00012	0.00048	0.00004	0.00012	0.00048
Other	S	0.00162	0.01738	0.20869	0.00078	0.00859	0.10396	0.00003	0.00009	0.00033
	M	0.00246	0.03092	0.36929	0.00117	0.01528	0.18396	0.00005	0.00015	0.00059
	L	0.00571	0.06670	0.80303	0.00273	0.03296	0.40003	0.00011	0.00033	0.00128
	H	0.00163	0.01865	0.22480	0.00078	0.00922	0.11198	0.00003	0.00009	0.00036

Table 2.2
FTA Input Rationalization Platforms

CAUSE CLASSIFICATION	Spill Size	Frequency Change %			Reason
		Shallow	Medium	Deep	
PROCESS FACILITY RLS.	All	(50)	(50)	(50)	State of the art now, High QC, High Inspection and Maintenance Requirements
STORAGE TANK RLS.	All	(30)	(30)	(30)	State of the art now, High QC, High Inspection and Maintenance Requirements
STRUCTURAL FAILURE	All	(30)	(30)	(30)	High safety factor, Monitoring Programs
HURRICANE/STORM	All	(80)	(80)	(80)	Less severe storms.
COLLISION	All	(90)	(90)	(90)	Very low traffic density.
		Freq. Increment per 10 ⁴ well-year			
		Median	Median	Median	
		Expected	Expected	Expected	
ARCTIC					
Ice Force	SM	0.1447	0.2170	0.3256	Assumed 1/10000 years ice force causes spill. 85% of the spills are SM.
		0.0340	0.0510	0.0765	
	LH	0.0255	0.0383	0.0575	
		0.0060	0.0090	0.0135	
Facility Low Temperature	SM	0.1000	0.1000	0.1000	Assumed 10% of Historical Process Facilities release frequency and corresponding spill size distribution.
		0.1000	0.1000	0.1000	
	LH	0.0080	0.0080	0.0080	
		0.0080	0.0080	0.0080	
Other	SM	0.0244	0.0316	0.0424	10% of above.
		0.0134	0.0151	0.0177	
	LH	0.0033	0.0046	0.0065	
		0.0014	0.0017	0.0022	

**Table 2.2A
Input - Platforms**

CAUSE CLASSIFICATION	Spill Size	Shallow			Medium			Deep		
		Frequency Change %								
		Low	Expected	High	Low	Expected	High	Low	Expected	High
PROCESS FACILITY RLS.	AII	(30)	(50)	(80)	(30)	(50)	(80)	(30)	(50)	(80)
STORAGE TANK RLS.	AII	(20)	(30)	(40)	(20)	(30)	(40)	(20)	(30)	(40)
STRUCTURAL FAILURE	AII	(20)	(30)	(40)	(20)	(30)	(40)	(20)	(30)	(40)
HURRICANE/STORM	AII	(25)	(50)	(75)	(25)	(50)	(75)	(25)	(50)	(75)
COLLISION	AII	(60)	(90)	(95)	(60)	(90)	(95)	(60)	(90)	(95)
Frequency Increment per 10⁴ well-year										
ARCTIC										
Ice Force	SM	0.003	0.034	0.340	0.005	0.051	0.510	0.008	0.077	0.765
	LH	0.001	0.006	0.060	0.001	0.009	0.090	0.001	0.014	0.135
Facility Low Temperature	SM	0.050	0.100	0.150	0.050	0.100	0.150	0.050	0.100	0.150
	LH	0.004	0.008	0.012	0.004	0.008	0.012	0.004	0.008	0.012
Other	SM	0.005	0.013	0.049	0.006	0.015	0.066	0.006	0.018	0.092
	LH	0.000	0.001	0.007	0.000	0.002	0.010	0.001	0.002	0.015

**Table 2.3
Arctic Spill Distribution and Frequency P/L -Small Spills**

CAUSE CLASSIFICATION	HIST. DISTRIBUTION %	SMALL SPILL																			
		P/L Dia <10"									P/L Dia >=10"										
		FREQUENCY spill per 10 ⁵ km-year	Shallow			Medium			Deep			FREQUENCY spill per 10 ⁵ km-year	Shallow			Medium			Deep		
			Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %		Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
CORROSION	16.67	0.467	(0.1711)	0.2955	21.21	(0.1711)	0.2955	20.93	(0.1711)	0.2955	20.65	0.300	(0.1101)	0.1902	20.50	(0.110)	0.190	20.59	(0.110)	0.190	20.64
External	5.56	0.156	(0.0778)	0.0778	5.58	(0.0778)	0.0778	5.51	(0.0778)	0.0778	5.43	0.100	(0.0500)	0.0500	5.39	(0.050)	0.050	5.42	(0.050)	0.050	5.43
Internal	11.11	0.311	(0.0933)	0.2177	15.63	(0.0933)	0.2177	15.43	(0.0933)	0.2177	15.21	0.200	(0.0601)	0.1401	15.11	(0.060)	0.140	15.17	(0.060)	0.140	15.21
THIRD PARTY IMPACT	38.89	1.089	(0.9798)	0.1089	7.81	(0.9798)	0.1089	7.71	(0.9798)	0.1089	7.61	0.701	(0.6306)	0.0701	7.55	(0.631)	0.070	7.58	(0.631)	0.070	7.61
Anchor Impact	33.33	0.933	(0.8398)	0.0933	6.70	(0.8398)	0.0933	6.61	(0.8398)	0.0933	6.52	0.601	(0.5405)	0.0601	6.47	(0.540)	0.060	6.50	(0.540)	0.060	6.52
Jackup Rig or Spud Barge																					
Trawl/Fishing Net	5.56	0.156	(0.1400)	0.0156	1.12	(0.1400)	0.0156	1.10	(0.1400)	0.0156	1.09	0.100	(0.0901)	0.0100	1.08	(0.090)	0.010	1.08	(0.090)	0.010	1.09
OPERATION IMPACT	16.67	0.467	(0.0933)	0.3732	26.79	(0.0933)	0.3732	26.44	(0.0933)	0.3732	26.08	0.300	(0.0601)	0.2402	25.90	(0.060)	0.240	26.01	(0.060)	0.240	26.07
Rig Anchoring	5.56	0.156	(0.0311)	0.1244	8.93	(0.0311)	0.1244	8.81	(0.0311)	0.1244	8.69	0.100	(0.0200)	0.0801	8.63	(0.020)	0.080	8.67	(0.020)	0.080	8.69
Work Boat Anchoring	11.11	0.311	(0.0622)	0.2488	17.86	(0.0622)	0.2488	17.63	(0.0622)	0.2488	17.39	0.200	(0.0400)	0.1601	17.26	(0.040)	0.160	17.34	(0.040)	0.160	17.38
MECHANICAL	11.11	0.311		0.3110	22.32		0.3110	22.04		0.3110	21.73	0.200		0.2002	21.58		0.200	21.67		0.200	21.73
Connection Failure	5.56	0.156		0.1555	11.16		0.1555	11.02		0.1555	10.87	0.100		0.1001	10.79		0.100	10.84		0.100	10.86
Material Failure	5.56	0.156		0.1555	11.16		0.1555	11.02		0.1555	10.87	0.100		0.1001	10.79		0.100	10.84		0.100	10.86
NATURAL HAZARD	11.11	0.311	(0.2488)	0.0622	4.46	(0.1866)	0.1244	8.81	(0.1244)	0.1866	13.04	0.200	(0.1601)	0.0400	4.32	(0.120)	0.080	8.67	(0.080)	0.120	13.04
Mud Slide	11.11	0.311	(0.2488)	0.0622	4.46	(0.1866)	0.1244	8.81	(0.1244)	0.1866	13.04	0.200	(0.1601)	0.0400	4.32	(0.120)	0.080	8.67	(0.080)	0.120	13.04
Storm/ Hurricane																					
ARCTIC			0.0869	0.0869	6.24	0.0429	0.0429	3.04	0.0004	0.0004	0.03		0.0869	0.0869	9.37	0.043	0.043	4.65	0.000	0.000	0.05
Ice Gouging			0.0680	0.0680	4.88	0.0340	0.0340	2.41					0.0680	0.0680	7.33	0.0340	0.0340	3.68			
Strudel Scour			0.0012	0.0012	0.08								0.0012	0.0012	0.12						
Upheaval Buckling			0.0002	0.0002	0.02	0.0002	0.0002	0.02	0.0002	0.0002	0.02		0.0002	0.0002	0.02	0.0002	0.0002	0.03	0.0002	0.0002	0.03
Thaw Settlement			0.0001	0.0001	0.01	0.0001	0.0001	0.01	0.0001	0.0001	0.01		0.0001	0.0001	0.01	0.0001	0.0001	0.01	0.0001	0.0001	0.01
Other			0.0174	0.0174	1.25	0.0086	0.0086	0.61	0.0001	0.0001	0.01		0.0174	1.87	0.0086	0.0086	0.93	0.0001	0.0001	0.0001	0.01
UNKNOWN	5.56	0.156		0.1555	11.16		0.1555	11.02		0.1555	10.87	0.100		0.1001	10.79		0.100	10.84		0.100	10.86
TOTALS	100.00	2.799	(1.406)	1.393	100.00	(1.388)	1.411	100.00	(1.368)	1.431	100.00	1.802	(0.874)	0.928	100.00	(0.878)	0.924	100.00	(0.880)	0.921	100.00

**Table 2.4
Arctic Spill Distribution and Frequency P/L - Medium Spills**

CAUSE CLASSIFICATION	HIST. DISTRIBUTION %	MEDIUM SPILL																			
		P/L Dia <10"										P/L Dia >=10"									
		Shallow			Medium			Deep			Shallow			Medium			Deep				
		FREQUENCY spill per 10 ⁶ km-year	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	FREQUENCY spill per 10 ⁶ km-year	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
CORROSION	16.67	0.816	(0.2994)	0.5171	21.19	(0.2994)	0.5171	20.92	(0.2994)	0.5171	20.65	0.751	(0.2752)	0.4754	21.07	(0.2752)	0.4754	20.87	(0.2752)	0.4754	20.65
External	5.56	0.272	(0.1361)	0.1361	5.58	(0.1361)	0.1361	5.51	(0.1361)	0.1361	5.43	0.250	(0.1251)	0.1251	5.54	(0.1251)	0.1251	5.49	(0.1251)	0.1251	5.43
Internal	11.11	0.544	(0.1633)	0.3810	15.61	(0.1633)	0.3810	15.42	(0.1633)	0.3810	15.21	0.500	(0.1501)	0.3503	15.52	(0.1501)	0.3503	15.38	(0.1501)	0.3503	15.21
THIRD PARTY IMPACT	38.89	1.905	(1.7146)	0.1905	7.81	(1.7146)	0.1905	7.71	(1.7146)	0.1905	7.61	1.752	(1.5764)	0.1752	7.76	(1.5764)	0.1752	7.69	(1.5764)	0.1752	7.61
Anchor Impact	33.33	1.633	(1.4696)	0.1633	6.69	(1.4696)	0.1633	6.61	(1.4696)	0.1633	6.52	1.501	(1.3512)	0.1501	6.65	(1.3512)	0.1501	6.59	(1.3512)	0.1501	6.52
Jackup Rig or Spud Barge																					
Trawl/Fishing Net	5.56	0.272	(0.2449)	0.0272	1.12	(0.2449)	0.0272	1.10	(0.2449)	0.0272	1.09	0.250	(0.2252)	0.0250	1.11	(0.2252)	0.0250	1.10	(0.2252)	0.0250	1.09
OPERATION IMPACT	16.67	0.816	(0.1633)	0.6532	26.76	(0.1633)	0.6532	26.43	(0.1633)	0.6532	26.08	0.751	(0.1501)	0.6005	26.61	(0.1501)	0.6005	26.36	(0.1501)	0.6005	26.08
Rig Anchoring	5.56	0.272	(0.0544)	0.2177	8.92	(0.0544)	0.2177	8.81	(0.0544)	0.2177	8.69	0.250	(0.0500)	0.2002	8.87	(0.0500)	0.2002	8.79	(0.0500)	0.2002	8.69
Work Boat Anchoring	11.11	0.544	(0.1089)	0.4354	17.84	(0.1089)	0.4354	17.62	(0.1089)	0.4354	17.39	0.500	(0.1001)	0.4004	17.74	(0.1001)	0.4004	17.57	(0.1001)	0.4004	17.39
MECHANICAL	11.11	0.544		0.5443	22.30		0.5443	22.02		0.5443	21.73	0.500		0.5005	22.18		0.5005	21.97		0.5005	21.73
Connection Failure	5.56	0.272		0.2722	11.15		0.2722	11.01		0.2722	10.87	0.250		0.2502	11.09		0.2502	10.98		0.2502	10.87
Material Failure	5.56	0.272		0.2722	11.15		0.2722	11.01		0.2722	10.87	0.250		0.2502	11.09		0.2502	10.98		0.2502	10.87
NATURAL HAZARD	11.11	0.544	(0.4354)	0.1089	4.46	(0.3266)	0.2177	8.81	(0.2177)	0.3266	13.04	0.500	(0.4004)	0.1001	4.44	(0.3003)	0.2002	8.79	(0.2002)	0.3003	13.04
Mud Slide	11.11	0.544	(0.4354)	0.1089	4.46	(0.3266)	0.2177	8.81	(0.2177)	0.3266	13.04	0.500	(0.4004)	0.1001	4.44	(0.3003)	0.2002	8.79	(0.2002)	0.3003	13.04
Storm/ Hurricane																					
ARCTIC			0.1546	0.1546	6.33	0.0764	0.0764	3.09	0.0008	0.0008	0.03		0.1546	0.1546	6.85	0.0764	0.0764	3.35	0.0008	0.0008	0.03
Ice Gouging			0.1210	0.1210	4.96	0.0605	0.0605	2.45					0.1210	0.1210	5.36	0.0605	0.0605	2.66			
Strudel Scour			0.0020	0.0020	0.08								0.0020	0.0020	0.09						
Upheaval Buckling			0.0004	0.0004	0.02	0.0004	0.0004	0.02	0.0004	0.0004	0.02		0.0004	0.0004	0.02	0.0004	0.0004	0.02	0.0004	0.0004	0.02
Thaw Settlement			0.0002	0.0002	0.01	0.0002	0.0002	0.01	0.0002	0.0002	0.01		0.0002	0.0002	0.01	0.0002	0.0002	0.01	0.0002	0.0002	0.01
Other			0.0309	0.0309	1.27	0.0153	0.0153	0.62	0.0002	0.0002	0.01		0.0309	0.0309	1.37	0.0153	0.0153	0.67	0.0002	0.0002	0.01
UNKNOWN	5.56	0.272		0.2722	11.15		0.2722	11.01		0.2722	10.87	0.250		0.2502	11.09		0.2502	10.98		0.2502	10.87
TOTALS	100.00	4.899	(2.458)	2.441	100.00	(2.427)	2.471	100.00	(2.394)	2.505	100.00	4.504	(2.248)	2.256	100.00	(2.226)	2.278	100.00	(2.201)	2.303	100.00

**Table 2.5
Arctic Spill Distribution and Frequency P/L - Large Spills**

CAUSE CLASSIFICATION	HIST. DISTRIBUTION %	LARGE SPILL																			
		P/L Dia <10"									P/L Dia >=10"										
		FREQUENCY spill per 10 ⁵ km-year	Shallow			Medium			Deep			FREQUENCY spill per 10 ⁵ km-year	Shallow			Medium			Deep		
			Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %		Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
CORROSION	7.69	0.215	(0.065)	0.151	13.86	(0.065)	0.151	15.68	(0.065)	0.151	17.91	0.416	(0.125)	0.291	16.27	(0.125)	0.291	17.09	(0.125)	0.291	17.93
External																					
Internal	7.69	0.215	(0.065)	0.151	13.86	(0.065)	0.151	15.68	(0.065)	0.151	17.91	0.416	(0.125)	0.291	16.27	(0.125)	0.291	17.09	(0.125)	0.291	17.93
THIRD PARTY IMPACT	69.23	1.938	(1.658)	0.280	25.75	(1.658)	0.280	29.11	(1.658)	0.280	33.27	3.742	(3.201)	0.540	30.22	(3.201)	0.540	31.74	(3.201)	0.540	33.30
Anchor Impact	30.77	0.861	(0.775)	0.086	7.92	(0.775)	0.086	8.96	(0.775)	0.086	10.24	1.663	(1.497)	0.166	9.30	(1.497)	0.166	9.76	(1.497)	0.166	10.25
Jackup Rig or Spud Barge	7.69	0.215	(0.108)	0.108	9.90	(0.108)	0.108	11.20	(0.108)	0.108	12.80	0.416	(0.208)	0.208	11.62	(0.208)	0.208	12.21	(0.208)	0.208	12.81
Trawl/Fishing Net	30.77	0.861	(0.775)	0.086	7.92	(0.775)	0.086	8.96	(0.775)	0.086	10.24	1.663	(1.497)	0.166	9.30	(1.497)	0.166	9.76	(1.497)	0.166	10.25
OPERATION IMPACT	7.69	0.215	(0.043)	0.172	15.85	(0.043)	0.172	17.92	(0.043)	0.172	20.47	0.416	(0.083)	0.333	18.60	(0.083)	0.333	19.53	(0.083)	0.333	20.49
Rig Anchoring																					
Work Boat Anchoring	7.69	0.215	(0.043)	0.172	15.85	(0.043)	0.172	17.92	(0.043)	0.172	20.47	0.416	(0.083)	0.333	18.60	(0.083)	0.333	19.53	(0.083)	0.333	20.49
MECHANICAL																					
Connection Failure																					
Material Failure																					
NATURAL HAZARD	15.38	0.431	(0.280)	0.151	13.86	(0.237)	0.194	20.16	(0.194)	0.237	28.15	0.832	(0.540)	0.291	16.27	(0.457)	0.374	21.97	(0.374)	0.457	28.18
Mud Slide	7.69	0.215	(0.172)	0.043	3.96	(0.129)	0.086	8.96	(0.086)	0.129	15.35	0.416	(0.333)	0.083	4.65	(0.249)	0.166	9.76	(0.166)	0.249	15.37
Storm/ Hurricane	7.69	0.215	(0.108)	0.108	9.90	(0.108)	0.108	11.20	(0.108)	0.108	12.80	0.416	(0.208)	0.208	11.62	(0.208)	0.208	12.21	(0.208)	0.208	12.81
ARCTIC			0.333	0.333	30.68	0.165	0.165	17.14	0.002	0.002	0.20		0.333	0.333	18.64	0.165	0.165	9.68	0.002	0.002	0.10
Ice Gouging			0.2610	0.2610	24.01	0.1305	0.1305	13.57					0.2610	0.2610	14.59	0.1305	0.1305	7.66			
Strudel Scour			0.0045	0.0045	0.41								0.0045	0.0045	0.25						
Upheaval Buckling			0.0009	0.0009	0.08	0.0009	0.0009	0.09	0.0009	0.0009	0.11		0.0009	0.0009	0.05	0.0009	0.0009	0.05	0.0009	0.0009	0.05
Thaw Settlement			0.0004	0.0004	0.04	0.0004	0.0004	0.05	0.0004	0.0004	0.05		0.0004	0.0004	0.02	0.0004	0.0004	0.03	0.0004	0.0004	0.03
Other			0.0667	0.0667	6.14	0.0330	0.0330	3.43	0.0003	0.0003	0.04		0.0667	0.0667	3.73	0.0330	0.0330	1.94	0.0003	0.0003	0.02
UNKNOWN																					
TOTALS	100.00	2.799	(1.712)	1.087	100.00	(1.838)	0.962	100.00	(1.958)	0.841	100.00	5.405	(3.616)	1.789	100.00	(3.702)	1.703	100.00	(3.782)	1.623	100.00

**Table 2.6
Arctic Spill Distribution and Frequency P/L - Huge Spills**

CAUSE CLASSIFICATION	HIST. DISTRIBUTION %	HUGE SPILL																			
		P/L Dia <10"									P/L Dia >=10"										
		FREQUENCY spill per 10 ⁵ km-year	Shallow			Medium			Deep			FREQUENCY spill per 10 ⁵ km-year	Shallow			Medium			Deep		
			Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %		Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
CORROSION	7.69	0.054	(0.016)	0.038	13.38	(0.016)	0.038	15.36	(0.016)	0.038	17.91	0.139	(0.042)	0.097	16.77	(0.042)	0.097	17.36	(0.042)	0.097	17.93
External																					
Internal	7.69	0.054	(0.016)	0.038	13.38	(0.016)	0.038	15.36	(0.016)	0.038	17.91	0.139	(0.042)	0.097	16.77	(0.042)	0.097	17.36	(0.042)	0.097	17.93
THIRD PARTY IMPACT	69.23	0.484	(0.415)	0.070	24.84	(0.415)	0.070	28.53	(0.415)	0.070	33.26	1.247	(1.067)	0.180	31.15	(1.067)	0.180	32.24	(1.067)	0.180	33.30
Anchor Impact	30.77	0.215	(0.194)	0.022	7.64	(0.194)	0.022	8.78	(0.194)	0.022	10.23	0.554	(0.499)	0.055	9.59	(0.499)	0.055	9.92	(0.499)	0.055	10.25
Jackup Rig or Spud Barge	7.69	0.054	(0.027)	0.027	9.56	(0.027)	0.027	10.97	(0.027)	0.027	12.79	0.139	(0.069)	0.069	11.98	(0.069)	0.069	12.40	(0.069)	0.069	12.81
Trawl/Fishing Net	30.77	0.215	(0.194)	0.022	7.64	(0.194)	0.022	8.78	(0.194)	0.022	10.23	0.554	(0.499)	0.055	9.59	(0.499)	0.055	9.92	(0.499)	0.055	10.25
OPERATION IMPACT	7.69	0.054	(0.011)	0.043	15.29	(0.011)	0.043	17.56	(0.011)	0.043	20.47	0.139	(0.028)	0.111	19.17	(0.028)	0.111	19.84	(0.028)	0.111	20.50
Rig Anchoring																					
Work Boat Anchoring	7.69	0.054	(0.011)	0.043	15.29	(0.011)	0.043	17.56	(0.011)	0.043	20.47	0.139	(0.028)	0.111	19.17	(0.028)	0.111	19.84	(0.028)	0.111	20.50
MECHANICAL																					
Connection Failure																					
Material Failure																					
NATURAL HAZARD	15.38	0.108	(0.070)	0.038	13.38	(0.059)	0.048	19.75	(0.048)	0.059	28.14	0.277	(0.180)	0.097	16.77	(0.152)	0.125	22.32	(0.125)	0.152	28.18
Mud Slide	7.69	0.054	(0.043)	0.011	3.82	(0.032)	0.022	8.78	(0.022)	0.032	15.35	0.139	(0.111)	0.028	4.79	(0.083)	0.055	9.92	(0.055)	0.083	15.37
Storm/ Hurricane	7.69	0.054	(0.027)	0.027	9.56	(0.027)	0.027	10.97	(0.027)	0.027	12.79	0.139	(0.069)	0.069	11.98	(0.069)	0.069	12.40	(0.069)	0.069	12.81
ARCTIC			0.093	0.093	33.11	0.046	0.046	18.79	0.000	0.000	0.22		0.093	0.093	16.13	0.046	0.046	8.25	0.000	0.000	0.09
Ice Gouging			0.0730	0.0730	25.92	0.0365	0.0365	14.88					0.0730	0.0730	12.62	0.0365	0.0365	6.53			
Strudel Scour			0.0012	0.0012	0.44								0.0012	0.0012	0.22						
Upheaval Buckling			0.0002	0.0002	0.09	0.0002	0.0002	0.10	0.0002	0.0002	0.12		0.0002	0.0002	0.04	0.0002	0.0002	0.04	0.0002	0.0002	0.05
Thaw Settlement			0.0001	0.0001	0.04	0.0001	0.0001	0.05	0.0001	0.0001	0.06		0.0001	0.0001	0.02	0.0001	0.0001	0.02	0.0001	0.0001	0.02
Other			0.0187	0.0187	6.62	0.0092	0.0092	3.76	0.0001	0.0001	0.04		0.0187	0.0187	3.23	0.0092	0.0092	1.65	0.0001	0.0001	0.02
UNKNOWN																					
TOTALS	100.00	0.700	(0.418)	0.282	100.00	(0.455)	0.245	100.00	(0.489)	0.210	100.00	1.802	(1.223)	0.578	100.00	(1.243)	0.559	100.00	(1.261)	0.541	100.00

**Table 2.7
Arctic Spill Distribution and Frequency Platforms -Small and Medium Spills**

CAUSE CLASSIFICATION	HIST. DISTRIBUTION %	SMALL AND MEDIUM SPILLS									
		FREQUENCY spill per 10 ⁴ well-year	Shallow			Medium			Deep		
			Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
PROCESS FACILITY RLS.	66.67	1.002	(0.501)	0.501	57.89	(0.501)	0.5012	56.67	(0.501)	0.5012	54.92
STORAGE TANK RLS.	5.56	0.084	(0.025)	0.058	6.75	(0.025)	0.0585	6.61	(0.025)	0.0585	6.41
STRUCTURAL FAILURE	5.56	0.084	(0.025)	0.058	6.75	(0.025)	0.0585	6.61	(0.025)	0.0585	6.41
HURRICANE/STORM	11.11	0.167	(0.084)	0.084	9.65	(0.084)	0.0835	9.44	(0.084)	0.0835	9.15
COLLISION	11.11	0.167	(0.150)	0.017	1.93	(0.150)	0.0167	1.89	(0.150)	0.0167	1.83
ARCTIC			0.147	0.147	17.03	0.166	0.1661	18.78	0.194	0.1942	21.28
Ice Force			0.034	0.034	3.93	0.051	0.0510	5.77	0.077	0.0765	8.38
Facility Low Temperature			0.100	0.100	11.55	0.100	0.1000	11.31	0.100	0.1000	10.96
Other			0.013	0.013	1.55	0.015	0.0151	1.71	0.018	0.0177	1.93
TOTALS	100.00	1.504	(0.638)	0.866	100.00	(0.619)	0.8845	100.00	(0.591)	0.9125	100.00

Table 2.8
Arctic Spill Distribution and Frequency Platforms -Large and Huge Spills

CAUSE CLASSIFICATION	HIST. DISTRIBUTION %	LARGE AND HUGE SPILLS									
		FREQUENCY spill per 10 ⁴ well-year	Shallow			Medium			Deep		
			Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
PROCESS FACILITY RLS.	33.33	0.0835	(0.042)	0.0418	23.99	(0.042)	0.0418	23.54	(0.042)	0.0418	22.90
STORAGE TANK RLS.	66.67	0.1671	(0.050)	0.1169	67.17	(0.050)	0.1169	65.92	(0.050)	0.1169	64.13
STRUCTURAL FAILURE											
HURRICANE/STORM											
COLLISION											
ARCTIC			0.015	0.0154	8.84	0.019	0.0187	10.54	0.024	0.0237	12.97
Ice Force			0.006	0.0060	3.45	0.009	0.0090	5.07	0.014	0.0135	7.40
Facility Low Temperature			0.008	0.0080	4.59	0.008	0.0080	4.51	0.008	0.0080	4.39
Other			0.001	0.0014	0.80	0.002	0.0017	0.96	0.002	0.0022	1.18
TOTALS	100.00	0.2506	(0.076)	0.1741	100.00	(0.073)	0.1774	100.00	(0.068)	0.1824	100.00

**Table 2.9
Arctic Frequency - Wells**

EVENT	FREQUENCY UNIT	Small and Medium Spills						Large Spill						Spill >=10000 <150000 bbl						Spill >=150000 bbl											
		HISTORICAL FREQUENCY	Shallow		Medium		Deep		HISTORICAL FREQUENCY	Shallow		Medium		Deep		HISTORICAL FREQUENCY	Shallow		Medium		Deep		HISTORICAL FREQUENCY	Shallow		Medium		Deep			
			Frequency Change	New Frequency	Frequency Change	New Frequency	Frequency Change	New Frequency		Frequency Change	New Frequency	Frequency Change	New Frequency	Frequency Change	New Frequency		Frequency Change	New Frequency	Frequency Change	New Frequency	Frequency Change	New Frequency		Frequency Change	New Frequency	Frequency Change	New Frequency	Frequency Change	New Frequency		
PRODUCTION WELL	spill per 10 ⁵ well-year	0.500		0.500		0.500		0.500	3.500		3.500		3.500		3.500	1.500		1.500		1.500		1.500		1.500	1.000		1.000		1.000		1.000
EXPLORATION WELL DRILLING	spill per 10 ⁵ wells	3.160		3.160		3.160		3.160	22.110		22.110		22.110		22.110	9.500		9.500		9.500		9.500		9.500	5.500		5.500		5.500		5.500
DEVELOPMENT WELL DRILLING	spill per 10 ⁵ wells	1.300		1.300		1.300		1.300	9.080		9.080		9.080		9.080	3.900		3.900		3.900		3.900		3.900	3.900		3.900		3.900		3.900

**Table 2.10
Average Spill Distribution**

PIPELINE SPILLS																
Spill Size	Small Spill				Medium Spill				Large Spill				Huge Spill			
Spill Expectation	Low	Most Likely	High	Expected	Low	Expected	High	Expected	Low	Most Likely	High	Expected	Low	Most Likely	High	Expected
P/L Dia <10" Spill	1	58	99	52	100	226	999	485	1000	4436	9999	5279	10000	14423	20000	14880
P/L Dia > 10" Spill	1	58	99	52	100	387	999	516	1000	3932	9999	5176	10000	17705	20000	15552
PLATFORM SPILLS																
Spill Size	Small and Medium Spills				Large and Huge Spills											
Spill Expectation	Low	Most Likely	High	Expected	Low	Most Likely	High	Expected								
Platform Spill	1	158	999	431	1000	6130	10000	5631								
WELL BLOWOUT SPILLS																
Spill Size	Small and Medium Spills				Large Spill				Spill >=10000 <150000 bbl				Spill >=150000 bbl			
Spill Expectation	Low	Most Likely	High	Expected	Low	Most Likely	High	Expected	Low	Most Likely	High	Expected	Low	Most Likely	High	Expected
Well Blowout Spill	1	500	999	500	1000	4500	9999	5292	10000	20000	150000	68349	150000	200000	250000	200000

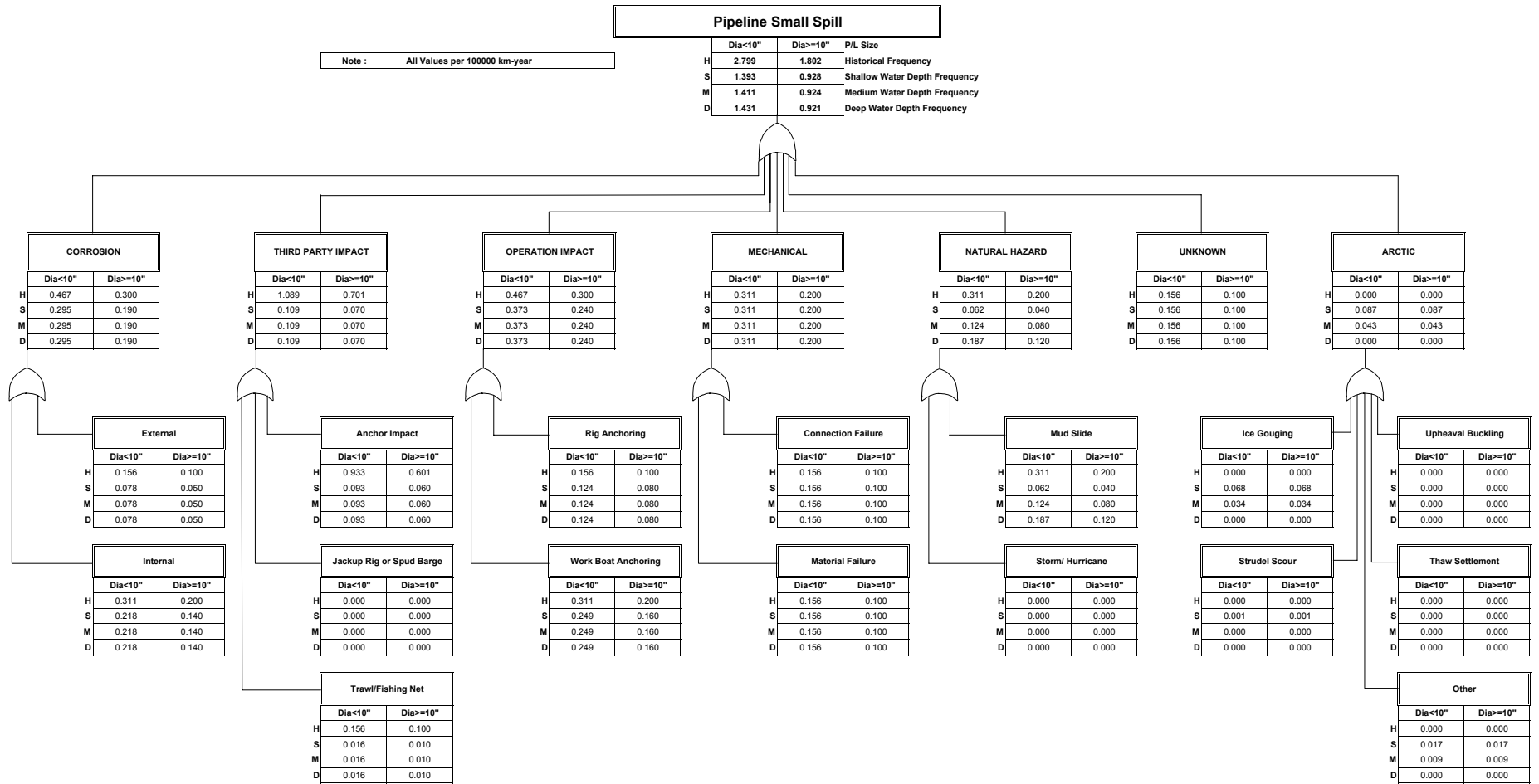


Figure 2.1 Fault Tree - Pipeline - Small Spill

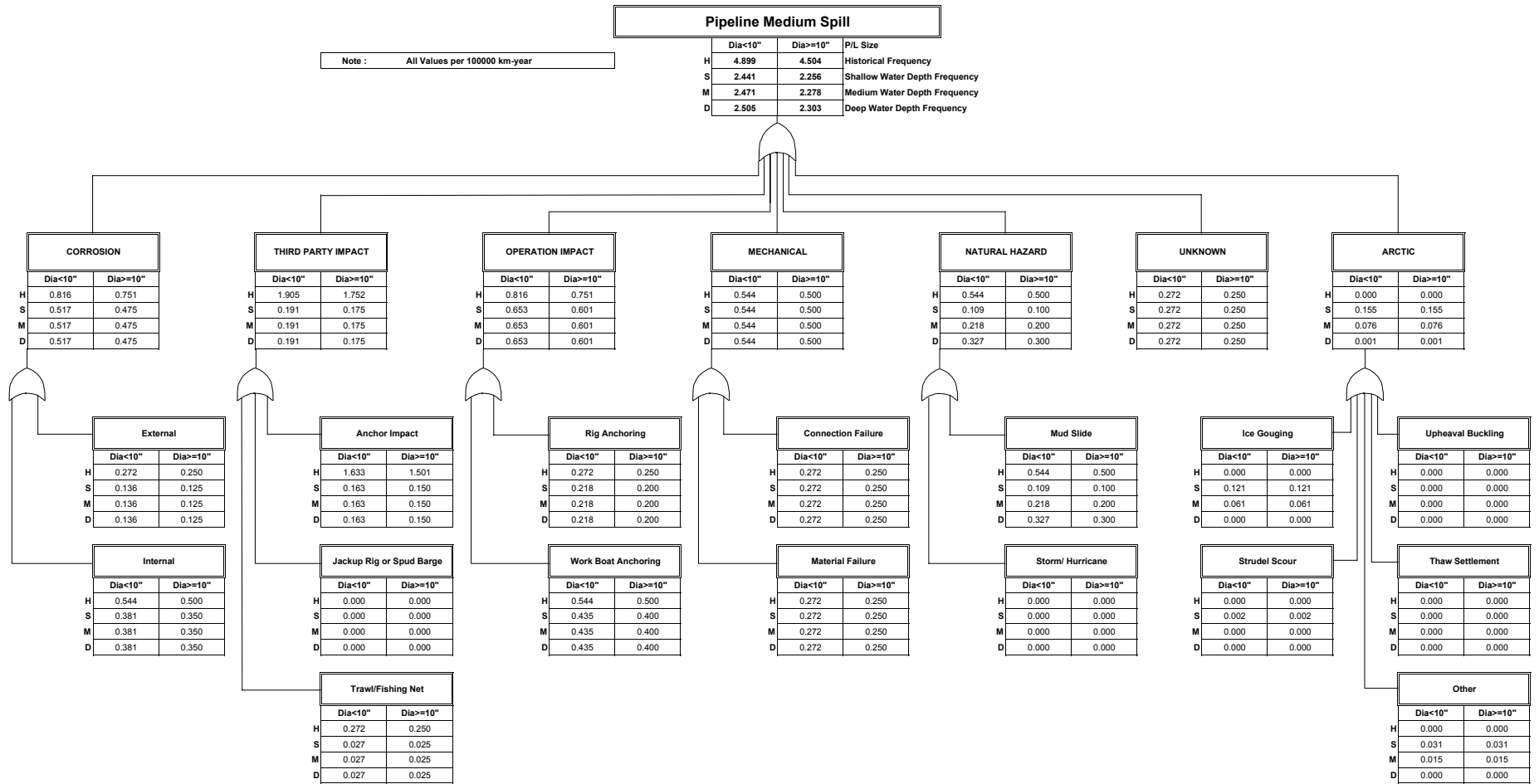


Figure 2.2 Fault Tree - Pipeline - Medium Spill

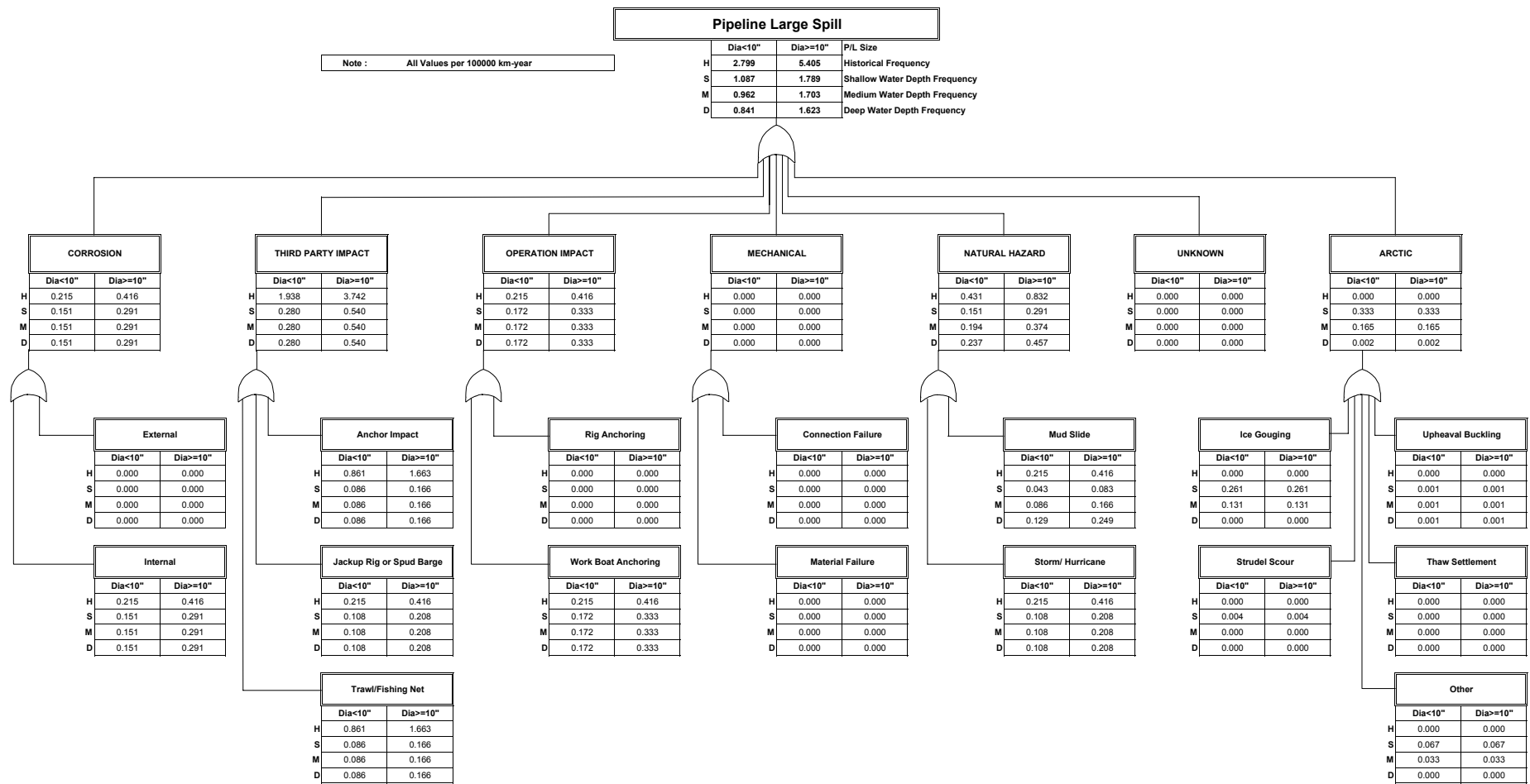


Figure 2.3 Fault Tree - Pipeline - Large Spill

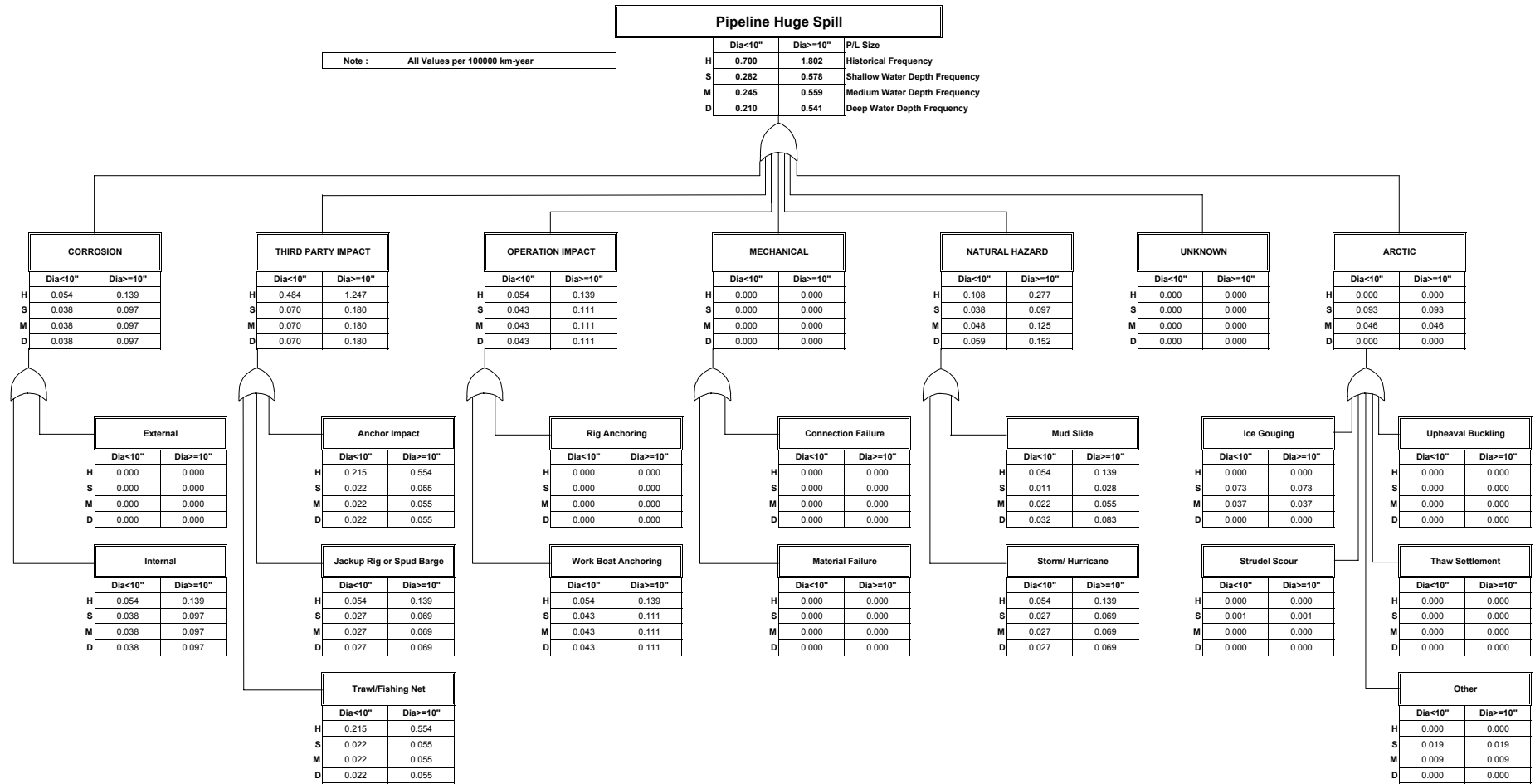


Figure 2.4 Fault Tree - Pipeline - Huge Spill

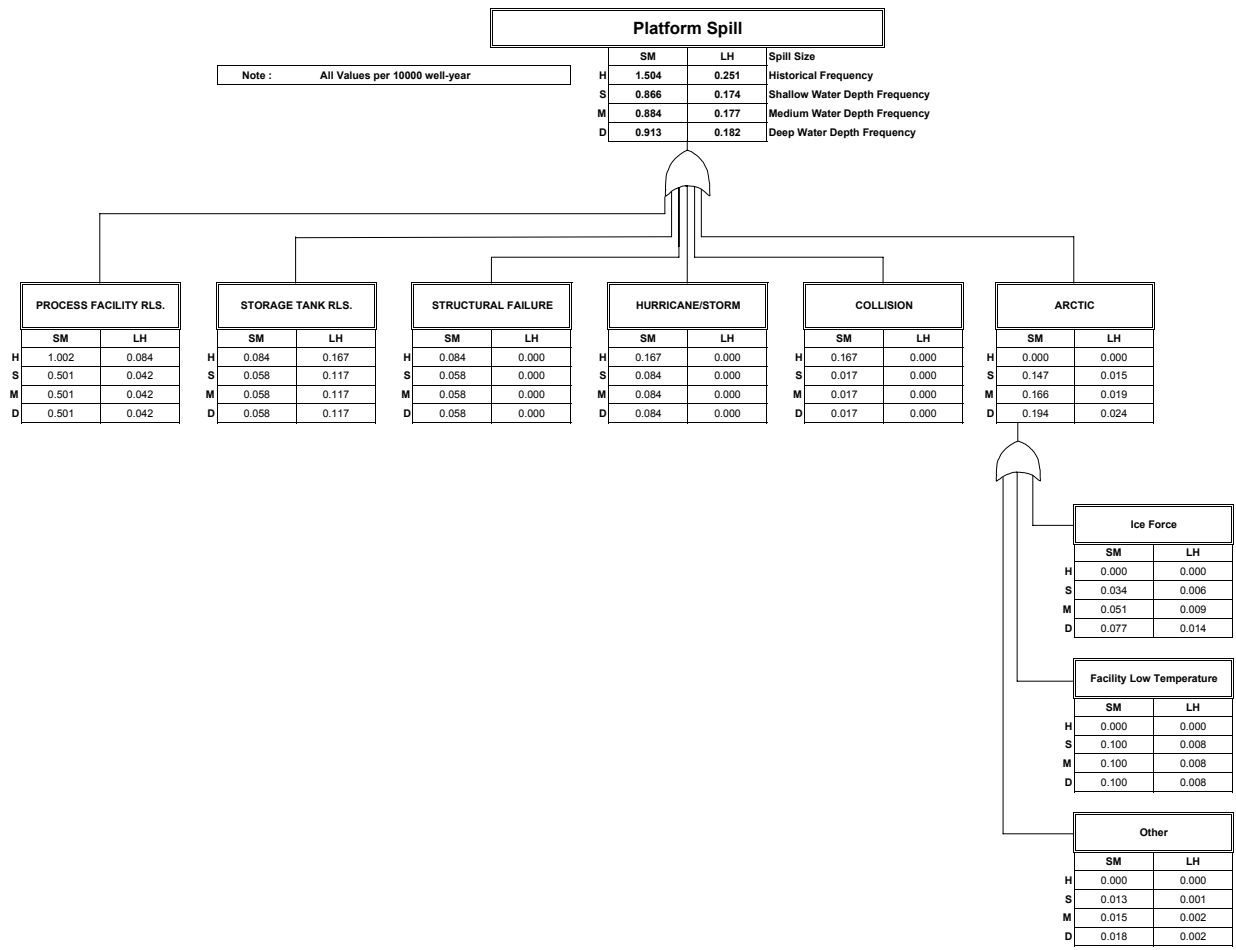


Figure 2.5 Fault Tree - Platform Spill

**Table 3.1
Beaufort Sea Sale 1 2004-2038**

Year	Water Depth	Exploration Wells	Delineation Wells	Expl./Del. Rigs	Production Platforms		Production Wells		Service Wells		Production Rigs	In-use Pipeline Length [miles]						Production MMbbl
					Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		Sum<10"		Sum >=10"		Sum All		
												Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2004	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2005	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2006	Shallow	1	2	2														
	Medium																	
	Deep																	
	Total	1	2	2														
2007	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2008	Shallow		2	1														
	Medium	1																
	Deep																	
	Total	1	2	1														
2009	Shallow				1	1	3	3	3	3	1							
	Medium	1		1														
	Deep																	
	Total	1		1	1	1	3	3	3	3	1							
2010	Shallow				1	10	13	4	7	1			10	10	10	10		10.9
	Medium		2	1														
	Deep																	
	Total		2	1	1	10	13	4	7	1			10	10	10	10		10.9
2011	Shallow				1	2	13	26	7	14	2			10		10		19.9
	Medium																	
	Deep																	
	Total				1	2	13	26	7	14	2			10		10		19.9
2012	Shallow				2	10	36	4	18	1			10	20	10	20		30.8
	Medium																	
	Deep																	
	Total				2	10	36	4	18	1			10	20	10	20		30.8
2013	Shallow				2	10	46	4	22	1			20		20			39.8
	Medium																	
	Deep																	
	Total				2	10	46	4	22	1			20		20			39.8
2014	Shallow				2		46		22				20		20			36.3
	Medium				1	1	3	3	3	3	1							
	Deep																	
	Total				1	3	3	49	3	25	1			20		20		36.3
2015	Shallow				2		46		22				10	30	10	30		33.4
	Medium				1	10	13	4	7	1			10	10	10	10		10.9
	Deep																	
	Total				3	10	59	4	29	1			20	40	20	40		44.3
2016	Shallow				2		46		22				30		30			27.6
	Medium				1	10	23	4	11	1			10		10			19.9
	Deep																	
	Total				3	10	69	4	33	1			40		40			47.5
2017	Shallow				2		46		22				30		30			22.7
	Medium				1		23		11				10		10			19.9
	Deep																	
	Total				3		69		33				40		40			42.6
2018	Shallow				2		46		22				30		30			18.8
	Medium				1		23		11				10		10			19.9
	Deep																	
	Total				3		69		33				40		40			38.7
2019	Shallow				2		46		22				30		30			15.5
	Medium				1		23		11				10		10			16.4
	Deep																	
	Total				3		69		33				40		40			31.9
2020	Shallow				2		46		22				30		30			12.8
	Medium				1		23		11				10		10			13.5
	Deep																	
	Total				3		69		33				40		40			26.3
2021	Shallow				2		46		22				30		30			10.5
	Medium				1		23		11				10		10			11.2
	Deep																	
	Total				3		69		33				40		40			21.7
2022	Shallow				2		46		22				30		30			8.7
	Medium				1		23		11				10		10			9.2
	Deep																	
	Total				3		69		33				40		40			17.9

**Table 3.1
Beaufort Sea Sale 1 2004-2038**

Year	Water Depth	Exploration Wells	Delineation Wells	Expl./Del. Rigs	Production Platforms		Production Wells		Service Wells		Production Rigs	In-use Pipeline Length [miles]						Production MMbbl
					Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		Sum <10"		Sum >=10"		Sum All		
												Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2023	Shallow					2	46	22						30	30	7.3		
	Medium					1	23	11						10	10	7.6		
	Deep																	
	Total					3	69	33						40	40	14.9		
2024	Shallow					2	46	22						30	30	6.1		
	Medium					1	23	11						10	10	6.3		
	Deep																	
	Total					3	69	33						40	40	12.4		
2025	Shallow					-1	1	-23	23	-11	11			-10	20	-10	3.0	
	Medium					1	23	11						10	10	5.2		
	Deep																	
	Total					-1	2	-23	46	-11	22			-10	30	-10	8.2	
2026	Shallow					1	23	11						20	20	2.6		
	Medium					1	23	11						10	10	4.3		
	Deep																	
	Total					2	46	22						30	30	6.9		
2027	Shallow					-1	1	-23	23	-11	11			-10	10	-10	10	
	Medium					1	23	11						10	10	3.5		
	Deep																	
	Total					-1	1	-23	23	-11	11			-10	20	-10	20	
2028	Shallow													10	10			
	Medium					1	23	11						10	10	3.0		
	Deep																	
	Total					1	23	11						20	20	3.0		
2029	Shallow													10	10			
	Medium					1	23	11						10	10	2.6		
	Deep																	
	Total					1	23	11						20	20	2.6		
2030	Shallow													-10	-10			
	Medium					-1	-23	-11						-10	-10			
	Deep																	
	Total					-1	-23	-11						-20	-20			
2031	Shallow																	
	Medium																	
	Deep																	
	Total																	
2032	Shallow																	
	Medium																	
	Deep																	
	Total																	
2033	Shallow																	
	Medium																	
	Deep																	
	Total																	
2034	Shallow																	
	Medium																	
	Deep																	
	Total																	
2035	Shallow																	
	Medium																	
	Deep																	
	Total																	
2036	Shallow																	
	Medium																	
	Deep																	
	Total																	
2037	Shallow																	
	Medium																	
	Deep																	
	Total																	
2038	Shallow																	
	Medium																	
	Deep																	
	Total																	

**Table 3.2
Beaufort Sea Sale 2 2004-2038**

Year	Water Depth	Exploration Wells	Delineation Wells	Expl./Del. Rigs	Production Platforms		Production Wells		Service Wells		Production Rigs	In-use Pipeline Length [miles]						Production MMbbl
					Incr. Cum.		Incr. Cum.		Incr. Cum.			Sum<10"		Sum >=10"		Sum All		
					Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2004	Shallow																	
	Medium																	
	Deep																	
	Total																	
2005	Shallow																	
	Medium																	
	Deep																	
	Total																	
2006	Shallow																	
	Medium																	
	Deep																	
	Total																	
2007	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2008	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2009	Shallow		2	1														
	Medium																	
	Deep																	
	Total		2	1														
2010	Shallow																	
	Medium	1		1														
	Deep																	
	Total	1		1														
2011	Shallow																	
	Medium																	
	Deep																	
	Total																	
2012	Shallow				1	1	3	3	3	3	1							
	Medium	1		1														
	Deep	1		1														
	Total	2		2	1	1	3	3	3	3	1							
2013	Shallow					1	10	13	4	7	1			15	15	15	15	10.9
	Medium		2	1														
	Deep	1		1														
	Total	1	2	2		1	10	13	4	7	1			15	15	15	15	10.9
2014	Shallow					1	10	23	4	11	1				15	15	15	19.9
	Medium		2	1														
	Deep																	
	Total		2	1		1	10	23	4	11	1			15	15	15	19.9	
2015	Shallow					1	23	23	11	11					15	15	15	19.9
	Medium																	
	Deep																	
	Total					1	23	23	11	11				15	15	15	19.9	
2016	Shallow					1	1	3	3	3	1							
	Medium																	
	Deep																	
	Total					1	2	3	26	3	14	1			15	15	15	19.9
2017	Shallow					1	2	23	11	11				10	25	10	25	16.4
	Medium					1	2	13	16	7	10	2	5	5	10	10	15	18.4
	Deep																	
	Total					1	3	13	39	7	21	2	5	5	20	35	25	40
2018	Shallow					1	2	23	11	11					25	25	25	13.5
	Medium					2	20	36	8	18	2		5	10	10	15	15	30.7
	Deep																	
	Total					3	20	59	8	29	2		5	10	35	40	40	44.2
2019	Shallow					1	2	23	11	11					25	25	25	11.2
	Medium					2	10	46	4	22	1		5	10	10	15	15	30.7
	Deep																	
	Total					3	10	69	4	33	1		5	10	35	40	40	41.9
2020	Shallow					1	2	23	11	11					25	25	25	9.2
	Medium					2	10	46	4	22	1		5	10	10	15	15	30.7
	Deep																	
	Total					3	10	69	4	33	1		5	10	35	40	40	39.9
2021	Shallow					1	2	23	11	11					25	25	25	7.6
	Medium					2	10	46	4	22	1		5	10	10	15	15	30.7
	Deep																	
	Total					3	10	69	4	33	1		5	10	35	40	40	38.3
2022	Shallow					1	2	23	11	11					25	25	25	6.3
	Medium					2	10	46	4	22	1		5	10	10	15	15	26.4
	Deep																	
	Total					3	10	69	4	33	1		5	10	35	40	40	32.7

**Table 3.2
Beaufort Sea Sale 2 2004-2038**

Year	Water Depth	Exploration Wells	Delineation Wells	Expl./Del. Rigs	Production Platforms		Production Wells		Service Wells		Production Rigs	In-use Pipeline Length [miles]						Production MMbbl
					Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		Sum <10"		Sum >=10"		Sum All		
												Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2023	Shallow					1	23		11						25	25	5.2	
	Medium					2	46		22			5		10	15	22.7		
	Deep																	
	Total					3	69		33			5		35	40	27.9		
2024	Shallow					1	23		11					25	25	4.3		
	Medium					2	46		22			5		10	15	19.5		
	Deep																	
	Total					3	69		33			5		35	40	23.8		
2025	Shallow					1	23		11					25	25	3.5		
	Medium					2	46		22			5		10	15	16.8		
	Deep																	
	Total					3	69		33			5		35	40	20.3		
2026	Shallow					1	23		11					25	25	2.9		
	Medium					2	46		22			5		10	15	14.4		
	Deep																	
	Total					3	69		33			5		35	40	17.3		
2027	Shallow					1	23		11					25	25	2.4		
	Medium					2	46		22			5		10	15	12.4		
	Deep																	
	Total					3	69		33			5		35	40	14.8		
2028	Shallow					-1	-23		-11				-15	10	-15	10		
	Medium					2	46		22			5		10	15	10.7		
	Deep																	
	Total					-1	2	-23	46	-11	22		5	-15	20	-15	25	10.7
2029	Shallow													10	10			
	Medium					2	46		22			5		10	15	9.2		
	Deep																	
	Total					2	46		22			5		20	25	9.2		
2030	Shallow													10	10			
	Medium					2	46		22			5		10	15	7.9		
	Deep																	
	Total					2	46		22			5		20	25	7.9		
2031	Shallow													10	10			
	Medium					2	46		22			5		10	15	6.8		
	Deep																	
	Total					2	46		22			5		20	25	6.8		
2032	Shallow													10	10			
	Medium					2	46		22			5		10	15	5.8		
	Deep																	
	Total					2	46		22			5		20	25	5.8		
2033	Shallow													10	10			
	Medium					2	46		22			5		10	15	5.0		
	Deep																	
	Total					2	46		22			5		20	25	5.0		
2034	Shallow													10	10			
	Medium					2	46		22			5		10	15	4.3		
	Deep																	
	Total					2	46		22			5		20	25	4.3		
2035	Shallow													10	10			
	Medium					2	46		22			5		10	15	3.7		
	Deep																	
	Total					2	46		22			5		20	25	3.7		
2036	Shallow												-10		-10			
	Medium					-2	-46		-22			-5		-10	-15			
	Deep																	
	Total					-2	-46		-22			-5		-20	-25			
2037	Shallow																	
	Medium																	
	Deep																	
	Total																	
2038	Shallow																	
	Medium																	
	Deep																	
	Total																	

**Table 3.3
Beaufort Sea Sale 3 2004-2038**

Year	Water Depth	Exploration Wells	Delineation Wells	Expl./Del. Rigs	Production Platforms		Production Wells		Service Wells		Production Rigs	In-use Pipeline Length [miles]						Production MMbbl
					Incr. Cum.		Incr. Cum.		Incr. Cum.			Sum<10"		Sum >=10"		Sum All		
					Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2004	Shallow																	
	Medium																	
	Deep																	
	Total																	
2005	Shallow																	
	Medium																	
	Deep																	
	Total																	
2006	Shallow																	
	Medium																	
	Deep																	
	Total																	
2007	Shallow																	
	Medium																	
	Deep																	
	Total																	
2008	Shallow																	
	Medium																	
	Deep																	
	Total																	
2009	Shallow																	
	Medium																	
	Deep																	
	Total																	
2010	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2011	Shallow																	
	Medium																	
	Deep																	
	Total																	
2012	Shallow																	
	Medium	1		1														
	Deep																	
	Total	1		1														
2013	Shallow																	
	Medium	1	1	1														
	Deep																	
	Total	1	1	1														
2014	Shallow																	
	Medium		2	1														
	Deep																	
	Total		2	1														
2015	Shallow																	
	Medium		2	1														
	Deep	1		1														
	Total	1	2	2														
2016	Shallow																	
	Medium																	
	Deep																	
	Total																	
2017	Shallow																	
	Medium																	
	Deep	1		1														
	Total	1		1														
2018	Shallow																	
	Medium				1	1	4	4	4	4	1							
	Deep	1		1														
	Total	1		1	1	1	4	4	4	4	1							
2019	Shallow													15	15	15	15	
	Medium				1	2	14	18	8	12	2	5	5	15	15	20	20	30.8
	Deep																	
	Total				1	2	14	18	8	12	2	5	5	30	30	35	35	30.8
2020	Shallow													15		15		
	Medium					2	20	38	8	20	2		5	15		20		38.6
	Deep																	
	Total					2	20	38	8	20	2		5	30		35		38.6
2021	Shallow													15		15		
	Medium					2	20	58	9	29	2		5	15		20		38.6
	Deep																	
	Total					2	20	58	9	29	2		5	30		35		38.6
2022	Shallow													15		15		
	Medium					2	10	68	5	34	1		5	15		20		38.6
	Deep																	
	Total					2	10	68	5	34	1		5	30		35		38.6

**Table 3.3
Beaufort Sea Sale 3 2004-2038**

2023	Shallow												15	15	
	Medium				2	68	34					5	15	20	38.6
	Deep														
	Total				2	68	34					5	30	35	38.6
2024	Shallow												15	15	
	Medium				2	68	34					5	15	20	38.6
	Deep														
	Total				2	68	34					5	30	35	38.6
2025	Shallow												15	15	
	Medium				2	68	34					5	15	20	34.0
	Deep														
	Total				2	68	34					5	30	35	34.0
2026	Shallow												15	15	
	Medium				2	68	34					5	15	20	29.9
	Deep														
	Total				2	68	34					5	30	35	29.9
2027	Shallow												15	15	
	Medium				2	68	34					5	15	20	26.3
	Deep														
	Total				2	68	34					5	30	35	26.3
2028	Shallow												15	15	
	Medium				2	68	34					5	15	20	23.2
	Deep														
	Total				2	68	34					5	30	35	23.2
2029	Shallow												15	15	
	Medium				2	68	34					5	15	20	20.4
	Deep														
	Total				2	68	34					5	30	35	20.4
2030	Shallow												15	15	
	Medium				2	68	34					5	15	20	17.9
	Deep														
	Total				2	68	34					5	30	35	17.9
2031	Shallow												15	15	
	Medium				2	68	34					5	15	20	15.8
	Deep														
	Total				2	68	34					5	30	35	15.8
2032	Shallow												15	15	
	Medium				2	68	34					5	15	20	13.9
	Deep														
	Total				2	68	34					5	30	35	13.9
2033	Shallow												15	15	
	Medium				2	68	34					5	15	20	12.2
	Deep														
	Total				2	68	34					5	30	35	12.2
2034	Shallow												15	15	
	Medium				2	68	34					5	15	20	10.8
	Deep														
	Total				2	68	34					5	30	35	10.8
2035	Shallow												15	15	
	Medium				2	68	34					5	15	20	9.5
	Deep														
	Total				2	68	34					5	30	35	9.5
2036	Shallow												15	15	
	Medium				2	68	34					5	15	20	8.3
	Deep														
	Total				2	68	34					5	30	35	8.3
2037	Shallow												15	15	
	Medium				2	68	34					5	15	20	7.3
	Deep														
	Total				2	68	34					5	30	35	7.3
2038	Shallow												15	15	
	Medium				2	68	34					5	15	20	6.5
	Deep														
	Total				2	68	34					5	30	35	6.5

**Table 3.4
Beaufort Sea All Sales 2004-2038**

Year	Water Depth	Exploration Wells	Delineation Wells	Expl./Del. Rigs	Production Platforms		Production Wells		Service Wells		Production Rigs	In-use Pipeline Length [miles]						Production MMbbl
					Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		Sum<10"		Sum >=10"		Sum All		
												Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2004	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2005	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2006	Shallow	1	2	2														
	Medium																	
	Deep																	
	Total	1	2	2														
2007	Shallow	2		2														
	Medium																	
	Deep																	
	Total	2		2														
2008	Shallow	1	2	2														
	Medium	1																
	Deep																	
	Total	2	2	2														
2009	Shallow		2	1	1	1	3	3	3	3	1							
	Medium	1		1														
	Deep																	
	Total	1	2	2	1	1	3	3	3	3	1							
2010	Shallow	1		1		1	10	13	4	7	1		10	10	10	10		10.9
	Medium	1	2	2														
	Deep																	
	Total	2	2	3		1	10	13	4	7	1		10	10	10	10		10.9
2011	Shallow				1	2	13	26	7	14	2			10	10		19.9	
	Medium																	
	Deep																	
	Total				1	2	13	26	7	14	2			10	10	10		19.9
2012	Shallow				1	3	13	39	7	21	2		10	20	10	20		30.8
	Medium	2		2														
	Deep	1		1														
	Total	3		3	1	3	13	39	7	21	2		10	20	10	20		30.8
2013	Shallow					3	20	59	8	29	2		15	35	15	35		50.7
	Medium	1	3	2														
	Deep	1		1														
	Total	2	3	3		3	20	59	8	29	2		15	35	15	35		50.7
2014	Shallow					3	10	69	4	33	1			35		35		56.2
	Medium		4	2	1	1	3	3	3	3	1							
	Deep																	
	Total		4	2	1	4	13	72	7	36	2			35		35		56.2
2015	Shallow					3		69		33			10	45	10	45		53.3
	Medium		2	1		1	10	13	4	7	1		10	10	10	10		10.9
	Deep	1		1														
	Total	1	2	2		4	10	82	4	40	1		20	55	20	55		64.2
2016	Shallow					3		69		33				45		45		47.5
	Medium				1	2	13	26	7	14	2			10		10		19.9
	Deep																	
	Total				1	5	13	95	7	47	2			55		55		67.4
2017	Shallow					3		69		33			10	55	10	55		39.1
	Medium				1	3	13	39	7	21	2	5	5	10	20	15	25	38.3
	Deep	1		1														
	Total	1		1	1	6	13	108	7	54	2	5	5	20	75	25	80	77.4
2018	Shallow					3		69		33				55		55		32.3
	Medium				1	4	24	63	12	33	3		5	20		25		50.6
	Deep	1		1														
	Total	1		1	1	7	24	132	12	66	3		5		75		80	82.9
2019	Shallow					3		69		33				15	70	15	70	26.7
	Medium				1	5	24	87	12	45	3	5	10	15	35	20	45	77.9
	Deep																	
	Total				1	8	24	156	12	78	3	5	10	30	105	35	115	104.6
2020	Shallow					3		69		33				70		70		22.0
	Medium					5	20	107	8	53	2		10	35		45		82.8
	Deep																	
	Total					8	20	176	8	86	2		10		105		115	104.8
2021	Shallow					3		69		33				70		70		18.1
	Medium					5	20	127	9	62	2		10	35		45		80.5
	Deep																	
	Total					8	20	196	9	95	2		10		105		115	98.6
2022	Shallow					3		69		33				70		70		15.0
	Medium					5	10	137	5	67	1		10	35		45		74.2
	Deep																	
	Total					8	10	206	5	100	1		10		105		115	89.2

**Table 3.4
Beaufort Sea All Sales 2004-2038**

Year	Water Depth	Exploration Wells	Delineation Wells	Expl./Del. Rigs	Production Platforms		Production Wells		Service Wells		Production Rigs	In-use Pipeline Length [miles]						Production MMbbl	
					Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		Sum <10"		Sum >=10"		Sum All			
												Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		
2023	Shallow					3		69		33					70		70	12.5	
	Medium					5		137		67		10		35		45	68.9		
	Deep																		
	Total					8		206		100		10		105		115	81.4		
2024	Shallow					3		69		33				70		70	10.4		
	Medium					5		137		67		10		35		45	64.4		
	Deep																		
	Total					8		206		100		10		105		115	74.8		
2025	Shallow					-1	2	-23	46	-11	22			-10	60	-10	60	6.5	
	Medium					5		137		67		10		35		45	56.0		
	Deep																		
	Total					-1	7	-23	183	-11	89		10	-10	95	-10	105	62.5	
2026	Shallow						2		46		22			60		60	5.5		
	Medium					5		137		67		10		35		45	48.6		
	Deep																		
	Total					7		183		89		10		95		105	54.1		
2027	Shallow					-1	1	-23	23	-11	11			-10	50	-10	50	2.4	
	Medium					5		137		67		10		35		45	42.2		
	Deep																		
	Total					-1	6	-23	160	-11	78		10	-10	85	-10	95	44.6	
2028	Shallow					-1		-23		-11				-15	35	-15	35		
	Medium					5		137		67		10		35		45	36.9		
	Deep																		
	Total					-1	5	-23	137	-11	67		10	-15	70	-15	80	36.9	
2029	Shallow													35		35			
	Medium					5		137		67		10		35		45	32.2		
	Deep																		
	Total					5		137		67		10		70		80	32.2		
2030	Shallow													-10	25	-10	25		
	Medium					-1	4	-23	114	-11	56		10	-10	25	-10	35	25.8	
	Deep																		
	Total					-1	4	-23	114	-11	56		10	-20	50	-20	60	25.8	
2031	Shallow													25		25			
	Medium					4		114		56		10		25		35	22.6		
	Deep																		
	Total					4		114		56		10		50		60	22.6		
2032	Shallow													25		25			
	Medium					4		114		56		10		25		35	19.7		
	Deep																		
	Total					4		114		56		10		50		60	19.7		
2033	Shallow													25		25			
	Medium					4		114		56		10		25		35	17.2		
	Deep																		
	Total					4		114		56		10		50		60	17.2		
2034	Shallow													25		25			
	Medium					4		114		56		10		25		35	15.1		
	Deep																		
	Total					4		114		56		10		50		60	15.1		
2035	Shallow													25		25			
	Medium					4		114		56		10		25		35	13.2		
	Deep																		
	Total					4		114		56		10		50		60	13.2		
2036	Shallow													-10	15	-10	15		
	Medium					-2	2	-46	68	-22	34		-5	5	-10	15	-15	20	8.3
	Deep																		
	Total					-2	2	-46	68	-22	34		-5	5	-20	30	-25	35	8.3
2037	Shallow													15		15			
	Medium					2		68		34		5		15		20	7.3		
	Deep																		
	Total					2		68		34		5		30		35	7.3		
2038	Shallow													15		15			
	Medium					2		68		34		5		15		20	6.5		
	Deep																		
	Total					2		68		34		5		30		35	6.5		

**Table T.3.5
Chukchi Sea Base Case 1998-2010**

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Prod./Serv. Wells		Pipeline Length [miles]						Production MMbbl	
				Incr.	Cum.	Incr.	Cum.	Sum<10"		Sum >=10"		Sum All			
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		
1998	Shallow														
	Medium														
	Deep	2	2												
	Total	2	2												0
1999	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep									135	135	135	135		
	Total									200	200	200	200		0
2000	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep			2	2	8	8			135	135	135	135		
	Total			2	2	8	8			200	200	200	200		0
2001	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep			2	4	40	48			135	135	135	135		
	Total			2	4	40	48			200	200	200	200		0
2002	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep			2	6	60	108			135	135	135	135		
	Total			2	6	60	108			200	200	200	200		101
2003	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	80	188			135	135	135	135		
	Total				6	80	188			200	200	200	200		135
2004	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	26	214			135	135	135	135		
	Total				6	26	214			200	200	200	200		135
2005	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	214				135	135	135	135		
	Total				6	214				200	200	200	200		135
2006	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	214				135	135	135	135		
	Total				6	214				200	200	200	200		135
2007	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	214				135	135	135	135		
	Total				6	214				200	200	200	200		135
2008	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	214				135	135	135	135		
	Total				6	214				200	200	200	200		119
2009	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	214				135	135	135	135		
	Total				6	214				200	200	200	200		103
2010	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	214				135	135	135	135		
	Total				6	214				200	200	200	200		92

**Table T.3.6
Chukchi Sea High Case 1998-2010**

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Prod./Serv. Wells		Pipeline Length [miles]						Production MMbbl	
				Incr.	Cum.	Incr.	Cum.	Sum<10"		Sum >=10"		Sum All			
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		
1998	Shallow														
	Medium														
	Deep	3	1												
	Total	3	1												0
1999	Shallow														
	Medium														
	Deep	2	1												
	Total	2	1												0
2000	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep	2		2	2					135	135	135	135		
	Total	2		2	2					200	200	200	200		0
2001	Shallow										5		5		
	Medium										60		60		
	Deep			6	8	50	50					135		135	
	Total			6	8	50	50					200		200	0
2002	Shallow										5		5		
	Medium										60		60		
	Deep			4	12	80	130					135		135	
	Total			4	12	80	130					200		200	0
2003	Shallow										5		5		
	Medium										60		60		
	Deep				12	140	270					135		135	
	Total				12	140	270					200		200	223
2004	Shallow										5		5		
	Medium										60		60		
	Deep				12	140	410					135		135	
	Total				12	140	410					200		200	297
2005	Shallow										5		5		
	Medium										60		60		
	Deep				12	72	482					135		135	
	Total				12	72	482					200		200	297
2006	Shallow										5		5		
	Medium										60		60		
	Deep				12		482					135		135	
	Total				12		482					200		200	297
2007	Shallow										5		5		
	Medium										60		60		
	Deep				12		482					135		135	
	Total				12		482					200		200	297
2008	Shallow										5		5		
	Medium										60		60		
	Deep				12		482					135		135	
	Total				12		482					200		200	297
2009	Shallow										5		5		
	Medium										60		60		
	Deep				12		482					135		135	
	Total				12		482					200		200	262
2010	Shallow										5		5		
	Medium										60		60		
	Deep				12		482					135		135	
	Total				12		482					200		200	227

**Table 4.1.1
Arctic Spill Occurrence Beaufort Sea Sale 1 P/L**

Year	Water Depth	P/L Dia <10"												P/L Dia >= 10"													
		P/L [miles]	Small Spills			Medium Spills			Large Spills			Huge Spills			P/L [miles]	Small Spills			Medium Spills			Large Spills			Huge Spills		
			Average Spill [bb] =	58		Average Spill [bb] =	266		Average Spill [bb] =	4436		Average Spill [bb] =	14423			Average Spill [bb] =	58		Average Spill [bb] =	387		Average Spill [bb] =	3932		Average Spill [bb] =		
			Cumm.	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years		Spill Index bbl	Cumm.	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year
2004	Shallow																										
	Medium																										
	Deep																										
	Total																										
2005	Shallow																										
	Medium																										
	Deep																										
	Total																										
2006	Shallow																										
	Medium																										
	Deep																										
	Total																										
2007	Shallow																										
	Medium																										
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	Total																										
2008	Shallow																										
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2009	Shallow																										
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2011	Shallow																										
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2015	Shallow																										
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2016	Shallow																										
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	Total																										
2017	Shallow																										
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2018	Shallow																										
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	Total																										
2019	Shallow																										
	Medium																										
	Deep																										
	Total																										
2020	Shallow																										
	Medium																										
	Deep																										
	Total																										
2021	Shallow																										
	Medium																										
	Deep																										
	Total																										

**Table 4.1.1
Arctic Spill Occurrence Beaufort Sea Sale 1 P/L**

Year	Water Depth	P/L Dia <10"												P/L Dia >= 10"													
		P/L [miles]	Small Spills			Medium Spills			Large Spills			Huge Spills			P/L [miles]	Small Spills			Medium Spills			Large Spills			Huge Spills		
			Average Spill [bbl] = 58		Spill Index bbl	Average Spill [bbl] = 266		Spill Index bbl	Average Spill [bbl] = 4436		Spill Index bbl	Average Spill [bbl] = 14423		Spill Index bbl		Average Spill [bbl] = 58		Spill Index bbl	Average Spill [bbl] = 387		Spill Index bbl	Average Spill [bbl] = 3932		Spill Index bbl	Average Spill [bbl] =		Spill Index bbl
		Cumm.	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years		Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years		Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years		Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years		Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Frequency spills per 10 ³ km-year		Frequency spills per 10 ³ years	Frequency spills per 10 ³ km-year		Frequency spills per 10 ³ years	Frequency spills per 10 ³ km-year		Frequency spills per 10 ³ years	Frequency spills per 10 ³ km-year	
2022	Shallow		1.393			2.441			1.087			0.282			30	0.928	0.448	0.03	2.256	1.089	0.42	1.789	0.863	3.39	0.578	0.279	
	Medium		1.411			2.471			0.962			0.245			10	0.924	0.149	0.01	2.278	0.367	0.14	1.703	0.274	1.08	0.559	0.090	
	Deep		1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541		
Total														40		0.596	0.03		1.456	0.56		1.137	4.47		0.369		
2023	Shallow		1.393			2.441			1.087			0.282			30	0.928	0.448	0.03	2.256	1.089	0.42	1.789	0.863	3.39	0.578	0.279	
	Medium		1.411			2.471			0.962			0.245			10	0.924	0.149	0.01	2.278	0.367	0.14	1.703	0.274	1.08	0.559	0.090	
	Deep		1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541		
Total														40		0.596	0.03		1.456	0.56		1.137	4.47		0.369		
2024	Shallow		1.393			2.441			1.087			0.282			30	0.928	0.448	0.03	2.256	1.089	0.42	1.789	0.863	3.39	0.578	0.279	
	Medium		1.411			2.471			0.962			0.245			10	0.924	0.149	0.01	2.278	0.367	0.14	1.703	0.274	1.08	0.559	0.090	
	Deep		1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541		
Total														40		0.596	0.03		1.456	0.56		1.137	4.47		0.369		
2025	Shallow		1.393			2.441			1.087			0.282			20	0.928	0.299	0.02	2.256	0.726	0.28	1.789	0.863	3.39	0.578	0.186	
	Medium		1.411			2.471			0.962			0.245			10	0.924	0.149	0.01	2.278	0.367	0.14	1.703	0.274	1.08	0.559	0.090	
	Deep		1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541		
Total														30		0.447	0.03		1.093	0.42		0.850	3.34		0.276		
2026	Shallow		1.393			2.441			1.087			0.282			20	0.928	0.299	0.02	2.256	0.726	0.28	1.789	0.863	3.39	0.578	0.186	
	Medium		1.411			2.471			0.962			0.245			10	0.924	0.149	0.01	2.278	0.367	0.14	1.703	0.274	1.08	0.559	0.090	
	Deep		1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541		
Total														30		0.447	0.03		1.093	0.42		0.850	3.34		0.276		
2027	Shallow		1.393			2.441			1.087			0.282			10	0.928	0.149	0.01	2.256	0.363	0.14	1.789	0.576	2.26	0.578	0.093	
	Medium		1.411			2.471			0.962			0.245			10	0.924	0.149	0.01	2.278	0.367	0.14	1.703	0.274	1.08	0.559	0.090	
	Deep		1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541		
Total														20		0.298	0.02		0.730	0.28		0.562	2.21		0.183		
2028	Shallow		1.393			2.441			1.087			0.282			10	0.928	0.149	0.01	2.256	0.363	0.14	1.789	0.576	2.26	0.578	0.093	
	Medium		1.411			2.471			0.962			0.245			10	0.924	0.149	0.01	2.278	0.367	0.14	1.703	0.274	1.08	0.559	0.090	
	Deep		1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541		
Total														20		0.298	0.02		0.730	0.28		0.562	2.21		0.183		
2029	Shallow		1.393			2.441			1.087			0.282			10	0.928	0.149	0.01	2.256	0.363	0.14	1.789	0.576	2.26	0.578	0.093	
	Medium		1.411			2.471			0.962			0.245			10	0.924	0.149	0.01	2.278	0.367	0.14	1.703	0.274	1.08	0.559	0.090	
	Deep		1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541		
Total														20		0.298	0.02		0.730	0.28		0.562	2.21		0.183		
2030	Shallow		1.393			2.441			1.087			0.282				0.928			2.256			1.789			0.578		
	Medium		1.411			2.471			0.962			0.245				0.924			2.278			1.703			0.559		
	Deep		1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541		
Total																											
2031	Shallow		1.393			2.441			1.087			0.282				0.928			2.256			1.789			0.578		
	Medium		1.411			2.471			0.962			0.245				0.924			2.278			1.703			0.559		
	Deep		1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541		
Total																											
2032	Shallow		1.393			2.441			1.087			0.282				0.928			2.256			1.789			0.578		
	Medium		1.411			2.471			0.962			0.245				0.924			2.278			1.703			0.559		
	Deep		1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541		
Total																											
2033	Shallow		1.393			2.441			1.087			0.282				0.928			2.256			1.789			0.578		
	Medium		1.411			2.471			0.962			0.245				0.924			2.278			1.703			0.559		
	Deep		1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541		
Total																											
2034	Shallow		1.393			2.441			1.087			0.282				0.928			2.256			1.789			0.578		
	Medium		1.411			2.471			0.962			0.245				0.924			2.278			1.703			0.559		
	Deep		1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541		
Total																											
2035	Shallow		1.393			2.441			1.087			0.282				0.928			2.256			1.789			0.578		
	Medium		1.411			2.471			0.962			0.245				0.924			2.278			1.703			0.559		
	Deep		1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541		
Total																											
2036	Shallow		1.39																								

Table 4.1.1
Arctic Spill Occurrence Beaufort Sea Sale 1 P/L

Spill Index bbl
17705
1.65
1.65
1.65
1.65
3.30
3.30
3.30
3.30
3.30
3.30
4.94
1.59
6.53
4.94
1.59
6.53
4.94
1.59
6.53
4.94
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4.94
1.59
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4.94
1.59
6.53

Table 4.1.1
Artic Spill Occurrence Beaufort Sea Sale 1 P/L

17705
Spill Index bbl
4.94
1.59
6.53
4.94
1.59
6.53
4.94
1.59
6.53
3.30
1.59
4.89
3.30
1.59
4.89
1.65
1.59
3.24
1.65
1.59
3.24
1.65
1.59
3.24

**Table 4.1.2
Arctic Spill Occurrence Beaufort Sea Sale 1 P/L Summary**

Year	Production [MMbbl]	Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]
2004																			
2005																			
2006																			
2007																			
2008																			
2009																			
2010	10.9	0.149	0.014	0.009	0.363	0.033	0.141	0.512	0.047	0.149	0.288	0.026	1.132	0.093	0.009	1.648	0.893	0.082	2.928
2011	19.9	0.149	0.008	0.009	0.363	0.018	0.141	0.512	0.026	0.149	0.288	0.014	1.132	0.093	0.005	1.648	0.893	0.045	2.928
2012	30.8	0.299	0.010	0.017	0.726	0.024	0.281	1.025	0.033	0.298	0.576	0.019	2.263	0.186	0.006	3.295	1.786	0.058	5.857
2013	39.8	0.299	0.008	0.017	0.726	0.018	0.281	1.025	0.026	0.298	0.576	0.014	2.263	0.186	0.005	3.295	1.786	0.045	5.857
2014	36.3	0.299	0.008	0.017	0.726	0.020	0.281	1.025	0.028	0.298	0.576	0.016	2.263	0.186	0.005	3.295	1.786	0.049	5.857
2015	44.3	0.596	0.013	0.035	1.456	0.033	0.563	2.052	0.046	0.598	1.137	0.026	4.472	0.369	0.008	6.535	3.559	0.080	11.605
2016	47.5	0.596	0.013	0.035	1.456	0.031	0.563	2.052	0.043	0.598	1.137	0.024	4.472	0.369	0.008	6.535	3.559	0.075	11.605
2017	42.6	0.596	0.014	0.035	1.456	0.034	0.563	2.052	0.048	0.598	1.137	0.027	4.472	0.369	0.009	6.535	3.559	0.084	11.605
2018	38.7	0.596	0.015	0.035	1.456	0.038	0.563	2.052	0.053	0.598	1.137	0.029	4.472	0.369	0.010	6.535	3.559	0.092	11.605
2019	31.9	0.596	0.019	0.035	1.456	0.046	0.563	2.052	0.064	0.598	1.137	0.036	4.472	0.369	0.012	6.535	3.559	0.112	11.605
2020	26.3	0.596	0.023	0.035	1.456	0.055	0.563	2.052	0.078	0.598	1.137	0.043	4.472	0.369	0.014	6.535	3.559	0.135	11.605
2021	21.7	0.596	0.027	0.035	1.456	0.067	0.563	2.052	0.095	0.598	1.137	0.052	4.472	0.369	0.017	6.535	3.559	0.164	11.605
2022	17.9	0.596	0.033	0.035	1.456	0.081	0.563	2.052	0.115	0.598	1.137	0.064	4.472	0.369	0.021	6.535	3.559	0.199	11.605
2023	14.9	0.596	0.040	0.035	1.456	0.098	0.563	2.052	0.138	0.598	1.137	0.076	4.472	0.369	0.025	6.535	3.559	0.239	11.605
2024	12.4	0.596	0.048	0.035	1.456	0.117	0.563	2.052	0.165	0.598	1.137	0.092	4.472	0.369	0.030	6.535	3.559	0.287	11.605
2025	8.2	0.447	0.055	0.026	1.093	0.133	0.423	1.540	0.188	0.449	0.850	0.104	3.341	0.276	0.034	4.887	2.666	0.325	8.677
2026	6.9	0.447	0.065	0.026	1.093	0.158	0.423	1.540	0.223	0.449	0.850	0.123	3.341	0.276	0.040	4.887	2.666	0.386	8.677
2027	3.5	0.298	0.085	0.017	0.730	0.208	0.282	1.028	0.294	0.300	0.562	0.161	2.209	0.183	0.052	3.240	1.772	0.506	5.748
2028	3.0	0.298	0.099	0.017	0.730	0.243	0.282	1.028	0.343	0.300	0.562	0.187	2.209	0.183	0.061	3.240	1.772	0.591	5.748
2029	2.6	0.298	0.115	0.017	0.730	0.281	0.282	1.028	0.395	0.300	0.562	0.216	2.209	0.183	0.070	3.240	1.772	0.682	5.748
2030																			
2031																			
2032																			
2033																			
2034																			
2035																			
2036																			
2037																			
2038																			

**Table 4.1.3
Arctic Spill Occurrence Beaufort Sea Sale 1 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2005	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2006	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2007	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2008	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2009	Shallow	1	3	0.866	0.260	0.04	0.174	0.052	0.32
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	1	3		0.260	0.04		0.052	0.32
2010	Shallow	1	13	0.866	1.126	0.18	0.174	0.226	1.39
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	1	13		1.126	0.18		0.226	1.39
2011	Shallow	2	26	0.866	2.251	0.36	0.174	0.453	2.77
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	2	26		2.251	0.36		0.453	2.77
2012	Shallow	2	36	0.866	3.117	0.49	0.174	0.627	3.84
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	2	36		3.117	0.49		0.627	3.84
2013	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	2	46		3.983	0.63		0.801	4.91
2014	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	3	0.884	0.265	0.04	0.177	0.053	0.33
	Deep			0.913			0.182		
	Total	3	49		4.248	0.67		0.854	5.24
2015	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	13	0.884	1.150	0.18	0.177	0.231	1.41
	Deep			0.913			0.182		
	Total	3	59		5.132	0.81		1.032	6.32
2016	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	3	69		6.017	0.95		1.209	7.41
2017	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	3	69		6.017	0.95		1.209	7.41

**Table 4.1.3
Arctic Spill Occurrence Beaufort Sea Sale 1 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	3	69		6.017	0.95		1.209	7.41
2019	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	3	69		6.017	0.95		1.209	7.41
2020	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	3	69		6.017	0.95		1.209	7.41
2021	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	3	69		6.017	0.95		1.209	7.41
2022	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	3	69		6.017	0.95		1.209	7.41
2023	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	3	69		6.017	0.95		1.209	7.41
2024	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	3	69		6.017	0.95		1.209	7.41
2025	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	2	46		4.026	0.64		0.809	4.96
2026	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	2	46		4.026	0.64		0.809	4.96
2027	Shallow			0.866			0.174		
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	1	23		2.034	0.32		0.408	2.50
2028	Shallow			0.866			0.174		
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	1	23		2.034	0.32		0.408	2.50
2029	Shallow			0.866			0.174		
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	1	23		2.034	0.32		0.408	2.50
2030	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2031	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								

**Table 4.1.3
Arctic Spill Occurrence Beaufort Sea Sale 1 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2033	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2034	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2035	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2036	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2037	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2038	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								

**Table 4.1.4
Arctic Spill Occurrence Beaufort Sea Sale 1 Platforms Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004										
2005										
2006										
2007										
2008										
2009		0.260		0.041	0.052		0.320	0.312		0.361
2010	10.9	1.126	0.103	0.178	0.226	0.021	1.387	1.352	0.124	1.565
2011	19.9	2.251	0.113	0.356	0.453	0.023	2.775	2.704	0.136	3.131
2012	30.8	3.117	0.101	0.492	0.627	0.020	3.842	3.744	0.122	4.335
2013	39.8	3.983	0.100	0.629	0.801	0.020	4.910	4.783	0.120	5.539
2014	36.3	4.248	0.117	0.671	0.854	0.024	5.236	5.102	0.141	5.907
2015	44.3	5.132	0.116	0.811	1.032	0.023	6.323	6.164	0.139	7.134
2016	47.5	6.017	0.127	0.951	1.209	0.025	7.411	7.226	0.152	8.362
2017	42.6	6.017	0.141	0.951	1.209	0.028	7.411	7.226	0.170	8.362
2018	38.7	6.017	0.155	0.951	1.209	0.031	7.411	7.226	0.187	8.362
2019	31.9	6.017	0.189	0.951	1.209	0.038	7.411	7.226	0.227	8.362
2020	26.3	6.017	0.229	0.951	1.209	0.046	7.411	7.226	0.275	8.362
2021	21.7	6.017	0.277	0.951	1.209	0.056	7.411	7.226	0.333	8.362
2022	17.9	6.017	0.336	0.951	1.209	0.068	7.411	7.226	0.404	8.362
2023	14.9	6.017	0.404	0.951	1.209	0.081	7.411	7.226	0.485	8.362
2024	12.4	6.017	0.485	0.951	1.209	0.097	7.411	7.226	0.583	8.362
2025	8.2	4.026	0.491	0.636	0.809	0.099	4.956	4.834	0.590	5.592
2026	6.9	4.026	0.583	0.636	0.809	0.117	4.956	4.834	0.701	5.592
2027	3.5	2.034	0.581	0.321	0.408	0.117	2.501	2.442	0.698	2.823
2028	3.0	2.034	0.678	0.321	0.408	0.136	2.501	2.442	0.814	2.823
2029	2.6	2.034	0.782	0.321	0.408	0.157	2.501	2.442	0.939	2.823
2030										
2031										
2032										
2033										
2034										
2035										
2036										
2037										
2038										

**Table 4.1.5
Arctic Spill Occurrence Beaufort Sea Sale 1 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2009	Shallow	3	0.500	0.015	0.01	3.500	0.105	0.47	1.500	0.045	0.90	1.000	0.030	6.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	3		0.015	0.01		0.105	0.47		0.045	0.90		0.030	6.00
2010	Shallow	13	0.500	0.065	0.03	3.500	0.455	2.05	1.500	0.195	3.90	1.000	0.130	26.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	13		0.065	0.03		0.455	2.05		0.195	3.90		0.130	26.00
2011	Shallow	26	0.500	0.130	0.07	3.500	0.910	4.10	1.500	0.390	7.80	1.000	0.260	52.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	26		0.130	0.07		0.910	4.10		0.390	7.80		0.260	52.00
2012	Shallow	36	0.500	0.180	0.09	3.500	1.260	5.67	1.500	0.540	10.80	1.000	0.360	72.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	36		0.180	0.09		1.260	5.67		0.540	10.80		0.360	72.00
2013	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2014	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	3	0.500	0.015	0.01	3.500	0.105	0.47	1.500	0.045	0.90	1.000	0.030	6.00
	Deep		0.500			3.500			1.500			1.000		
	Total	49		0.245	0.12		1.715	7.72		0.735	14.70		0.490	98.00
2015	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	13	0.500	0.065	0.03	3.500	0.455	2.05	1.500	0.195	3.90	1.000	0.130	26.00
	Deep		0.500			3.500			1.500			1.000		
	Total	59		0.295	0.15		2.065	9.29		0.885	17.70		0.590	118.00
2016	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2017	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00

**Table 4.1.5
Arctic Spill Occurrence Beaufort Sea Sale 1 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2019	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2020	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2021	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2022	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2023	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2024	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2025	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2026	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2027	Shallow		0.500			3.500			1.500			1.000		
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	23		0.115	0.06		0.805	3.62		0.345	6.90		0.230	46.00
2028	Shallow		0.500			3.500			1.500			1.000		
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	23		0.115	0.06		0.805	3.62		0.345	6.90		0.230	46.00
2029	Shallow		0.500			3.500			1.500			1.000		
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	23		0.115	0.06		0.805	3.62		0.345	6.90		0.230	46.00
2030	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2031	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													

**Table 4.1.5
Arctic Spill Occurrence Beaufort Sea Sale 1 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2033	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2034	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2035	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2036	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2037	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2038	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													

Table 4.1.6

Arctic Spill Occurrence Beaufort Sea Sale 1 Production Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009		0.015		0.008	0.045		0.473	0.075		6.900	0.135		7.380
2010	10.9	0.065	0.006	0.033	0.195	0.018	2.048	0.325	0.030	29.900	0.585	0.054	31.980
2011	19.9	0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
2012	30.8	0.180	0.006	0.090	0.540	0.018	5.670	0.900	0.029	82.800	1.620	0.053	88.560
2013	39.8	0.230	0.006	0.115	0.690	0.017	7.245	1.150	0.029	105.800	2.070	0.052	113.160
2014	36.3	0.245	0.007	0.123	0.735	0.020	7.718	1.225	0.034	112.700	2.205	0.061	120.540
2015	44.3	0.295	0.007	0.148	0.885	0.020	9.293	1.475	0.033	135.700	2.655	0.060	145.140
2016	47.5	0.345	0.007	0.173	1.035	0.022	10.868	1.725	0.036	158.700	3.105	0.065	169.740
2017	42.6	0.345	0.008	0.173	1.035	0.024	10.868	1.725	0.040	158.700	3.105	0.073	169.740
2018	38.7	0.345	0.009	0.173	1.035	0.027	10.868	1.725	0.045	158.700	3.105	0.080	169.740
2019	31.9	0.345	0.011	0.173	1.035	0.032	10.868	1.725	0.054	158.700	3.105	0.097	169.740
2020	26.3	0.345	0.013	0.173	1.035	0.039	10.868	1.725	0.066	158.700	3.105	0.118	169.740
2021	21.7	0.345	0.016	0.173	1.035	0.048	10.868	1.725	0.079	158.700	3.105	0.143	169.740
2022	17.9	0.345	0.019	0.173	1.035	0.058	10.868	1.725	0.096	158.700	3.105	0.173	169.740
2023	14.9	0.345	0.023	0.173	1.035	0.069	10.868	1.725	0.116	158.700	3.105	0.208	169.740
2024	12.4	0.345	0.028	0.173	1.035	0.083	10.868	1.725	0.139	158.700	3.105	0.250	169.740
2025	8.2	0.230	0.028	0.115	0.690	0.084	7.245	1.150	0.140	105.800	2.070	0.252	113.160
2026	6.9	0.230	0.033	0.115	0.690	0.100	7.245	1.150	0.167	105.800	2.070	0.300	113.160
2027	3.5	0.115	0.033	0.058	0.345	0.099	3.623	0.575	0.164	52.900	1.035	0.296	56.580
2028	3.0	0.115	0.038	0.058	0.345	0.115	3.623	0.575	0.192	52.900	1.035	0.345	56.580
2029	2.6	0.115	0.044	0.058	0.345	0.133	3.623	0.575	0.221	52.900	1.035	0.398	56.580
2030													
2031													
2032													
2033													
2034													
2035													
2036													
2037													
2038													

**Table 4.1.7
Artic Spill Occurrence Beaufort Sea Sale 1 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2005	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2006	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2007	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2008	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2010	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2011	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2012	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2013	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2014	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2015	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2016	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2017	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

**Table 4.1.7
Arctic Spill Occurrence Beaufort Sea Sale 1 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2019	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2020	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2021	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2022	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2023	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2024	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2025	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2026	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2027	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2028	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2029	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2030	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2031	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

**Table 4.1.7
Arctic Spill Occurrence Beaufort Sea Sale 1 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2033	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2034	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2035	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2036	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2037	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2038	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.1.8

Arctic Spill Occurrence Beaufort Sea Sale 1 Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2005		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2006		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2007		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2008		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2009		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2010	10.9												
2011	19.9												
2012	30.8												
2013	39.8												
2014	36.3												
2015	44.3												
2016	47.5												
2017	42.6												
2018	38.7												
2019	31.9												
2020	26.3												
2021	21.7												
2022	17.9												
2023	14.9												
2024	12.4												
2025	8.2												
2026	6.9												
2027	3.5												
2028	3.0												
2029	2.6												
2030													
2031													
2032													
2033													
2034													
2035													
2036													
2037													
2038													

**Table 4.1.9
Arctic Spill Occurrence Beaufort Sea Sale 1 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2009	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2011	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2012	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2013	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2014	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2015	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2016	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2017	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.1.9
Arctic Spill Occurrence Beaufort Sea Sale 1 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] = 500		Spill Index bbl	Average Spill [bbl] = 4500		Spill Index bbl	Average Spill [bbl] = 20000		Spill Index bbl	Average Spill [bbl] = 200000		Spill Index bbl
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2019	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2020	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2021	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2022	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2023	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2024	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2025	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2026	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2027	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2028	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2029	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2030	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2031	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.1.9
Arctic Spill Occurrence Beaufort Sea Sale 1 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2033	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2034	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2035	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2036	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2037	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2038	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.1.10

Arctic Spill Occurrence Beaufort Sea Sale 1 Development Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004													
2005													
2006		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2007													
2008		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2009													
2010	10.9	0.026	0.002	0.013	0.078	0.007	0.817	0.156	0.014	17.160	0.260	0.024	17.990
2011	19.9												
2012	30.8												
2013	39.8												
2014	36.3												
2015	44.3												
2016	47.5												
2017	42.6												
2018	38.7												
2019	31.9												
2020	26.3												
2021	21.7												
2022	17.9												
2023	14.9												
2024	12.4												
2025	8.2												
2026	6.9												
2027	3.5												
2028	3.0												
2029	2.6												
2030													
2031													
2032													
2033													
2034													
2035													
2036													
2037													
2038													

**Table 4.1.11
Arctic Spill Occurrence Beaufort Sea Sale 1 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
	Total		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2005	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
	Total		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2006	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
	Total		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901
2007	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
	Total		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2008	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
	Total		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901
2009	Pipeline													
	Platforms													
	Production Wells		0.260		0.041	0.052		0.320				0.312		0.361
	Exploration Wells		0.015		0.008	0.045		0.473	0.075		6.900	0.135		7.380
	Development Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Total		0.306		0.064	0.192		1.788	0.225		19.800	0.724		21.652
2010	Pipeline	10.9	0.512	0.047	0.149	0.288	0.026	1.132	0.093	0.009	1.648	0.893	0.082	2.928
	Platforms		1.126	0.103	0.178	0.226	0.021	1.387				1.352	0.124	1.565
	Production Wells		0.065	0.006	0.033	0.195	0.018	2.048	0.325	0.030	29.900	0.585	0.054	31.980
	Exploration Wells													
	Development Wells		0.026	0.002	0.013	0.078	0.007	0.817	0.156	0.014	17.160	0.260	0.024	17.990
	Total		1.729	0.159	0.372	0.787	0.072	5.384	0.574	0.053	48.708	3.090	0.283	54.464
2011	Pipeline	19.9	0.512	0.026	0.149	0.288	0.014	1.132	0.093	0.005	1.648	0.893	0.045	2.928
	Platforms		2.251	0.113	0.356	0.453	0.023	2.775				2.704	0.136	3.131
	Production Wells		0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
	Exploration Wells													
	Development Wells													
	Total		2.893	0.145	0.570	1.130	0.057	8.002	0.743	0.037	61.448	4.767	0.240	70.019
2012	Pipeline	30.8	1.025	0.033	0.298	0.576	0.019	2.263	0.186	0.006	3.295	1.786	0.058	5.857
	Platforms		3.117	0.101	0.492	0.627	0.020	3.842				3.744	0.122	4.335
	Production Wells		0.180	0.006	0.090	0.540	0.018	5.670	0.900	0.029	82.800	1.620	0.053	88.560
	Exploration Wells													
	Development Wells													
	Total		4.321	0.140	0.881	1.742	0.057	11.775	1.086	0.035	86.095	7.150	0.232	98.751
2013	Pipeline	39.8	1.025	0.026	0.298	0.576	0.014	2.263	0.186	0.005	3.295	1.786	0.045	5.857
	Platforms		3.983	0.100	0.629	0.801	0.020	4.910				4.783	0.120	5.539
	Production Wells		0.230	0.006	0.115	0.690	0.017	7.245	1.150	0.029	105.800	2.070	0.052	113.160
	Exploration Wells													
	Development Wells													
	Total		5.237	0.132	1.043	2.066	0.052	14.418	1.336	0.034	109.095	8.640	0.217	124.555

**Table 4.1.11
Arctic Spill Occurrence Beaufort Sea Sale 1 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2014	Pipeline	36.3	1.025	0.028	0.298	0.576	0.016	2.263	0.186	0.005	3.295	1.786	0.049	5.857
	Platforms		4.248	0.117	0.671	0.854	0.024	5.236				5.102	0.141	5.907
	Production Wells		0.245	0.007	0.123	0.735	0.020	7.718	1.225	0.034	112.700	2.205	0.061	120.540
	Exploration Wells													
	Development Wells													
	Total		5.518	0.152	1.092	2.165	0.060	15.217	1.411	0.039	115.995	9.093	0.251	132.304
2015	Pipeline	44.3	2.052	0.046	0.598	1.137	0.026	4.472	0.369	0.008	6.535	3.559	0.080	11.605
	Platforms		5.132	0.116	0.811	1.032	0.023	6.323				6.164	0.139	7.134
	Production Wells		0.295	0.007	0.148	0.885	0.020	9.293	1.475	0.033	135.700	2.655	0.060	145.140
	Exploration Wells													
	Development Wells													
	Total		7.480	0.169	1.556	3.054	0.069	20.088	1.844	0.042	142.235	12.378	0.279	163.879
2016	Pipeline	47.5	2.052	0.043	0.598	1.137	0.024	4.472	0.369	0.008	6.535	3.559	0.075	11.605
	Platforms		6.017	0.127	0.951	1.209	0.025	7.411				7.226	0.152	8.362
	Production Wells		0.345	0.007	0.173	1.035	0.022	10.868	1.725	0.036	158.700	3.105	0.065	169.740
	Exploration Wells													
	Development Wells													
	Total		8.414	0.177	1.721	3.381	0.071	22.751	2.094	0.044	165.235	13.890	0.292	189.706
2017	Pipeline	42.6	2.052	0.048	0.598	1.137	0.027	4.472	0.369	0.009	6.535	3.559	0.084	11.605
	Platforms		6.017	0.141	0.951	1.209	0.028	7.411				7.226	0.170	8.362
	Production Wells		0.345	0.008	0.173	1.035	0.024	10.868	1.725	0.040	158.700	3.105	0.073	169.740
	Exploration Wells													
	Development Wells													
	Total		8.414	0.198	1.721	3.381	0.079	22.751	2.094	0.049	165.235	13.890	0.326	189.706
2018	Pipeline	38.7	2.052	0.053	0.598	1.137	0.029	4.472	0.369	0.010	6.535	3.559	0.092	11.605
	Platforms		6.017	0.155	0.951	1.209	0.031	7.411				7.226	0.187	8.362
	Production Wells		0.345	0.009	0.173	1.035	0.027	10.868	1.725	0.045	158.700	3.105	0.080	169.740
	Exploration Wells													
	Development Wells													
	Total		8.414	0.217	1.721	3.381	0.087	22.751	2.094	0.054	165.235	13.890	0.359	189.706
2019	Pipeline	31.9	2.052	0.064	0.598	1.137	0.036	4.472	0.369	0.012	6.535	3.559	0.112	11.605
	Platforms		6.017	0.189	0.951	1.209	0.038	7.411				7.226	0.227	8.362
	Production Wells		0.345	0.011	0.173	1.035	0.032	10.868	1.725	0.054	158.700	3.105	0.097	169.740
	Exploration Wells													
	Development Wells													
	Total		8.414	0.264	1.721	3.381	0.106	22.751	2.094	0.066	165.235	13.890	0.435	189.706
2020	Pipeline	26.3	2.052	0.078	0.598	1.137	0.043	4.472	0.369	0.014	6.535	3.559	0.135	11.605
	Platforms		6.017	0.229	0.951	1.209	0.046	7.411				7.226	0.275	8.362
	Production Wells		0.345	0.013	0.173	1.035	0.039	10.868	1.725	0.066	158.700	3.105	0.118	169.740
	Exploration Wells													
	Development Wells													
	Total		8.414	0.320	1.721	3.381	0.129	22.751	2.094	0.080	165.235	13.890	0.528	189.706
2021	Pipeline	21.7	2.052	0.095	0.598	1.137	0.052	4.472	0.369	0.017	6.535	3.559	0.164	11.605
	Platforms		6.017	0.277	0.951	1.209	0.056	7.411				7.226	0.333	8.362
	Production Wells		0.345	0.016	0.173	1.035	0.048	10.868	1.725	0.079	158.700	3.105	0.143	169.740
	Exploration Wells													
	Development Wells													
	Total		8.414	0.388	1.721	3.381	0.156	22.751	2.094	0.097	165.235	13.890	0.640	189.706
2022	Pipeline	17.9	2.052	0.115	0.598	1.137	0.064	4.472	0.369	0.021	6.535	3.559	0.199	11.605
	Platforms		6.017	0.336	0.951	1.209	0.068	7.411				7.226	0.404	8.362
	Production Wells		0.345	0.019	0.173	1.035	0.058	10.868	1.725	0.096	158.700	3.105	0.173	169.740
	Exploration Wells													
	Development Wells													
	Total		8.414	0.470	1.721	3.381	0.189	22.751	2.094	0.117	165.235	13.890	0.776	189.706
2023	Pipeline	14.9	2.052	0.138	0.598	1.137	0.076	4.472	0.369	0.025	6.535	3.559	0.239	11.605
	Platforms		6.017	0.404	0.951	1.209	0.081	7.411				7.226	0.485	8.362
	Production Wells		0.345	0.023	0.173	1.035	0.069	10.868	1.725	0.116	158.700	3.105	0.208	169.740
	Exploration Wells													
	Development Wells													
	Total		8.414	0.565	1.721	3.381	0.227	22.751	2.094	0.141	165.235	13.890	0.932	189.706

**Table 4.1.11
Arctic Spill Occurrence Beaufort Sea Sale 1 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
2024	Pipeline	12.4	2.052	0.165	0.598	1.137	0.092	4.472	0.369	0.030	6.535	3.559	0.287	11.605
	Platforms		6.017	0.485	0.951	1.209	0.097	7.411				7.226	0.583	8.362
	Production Wells		0.345	0.028	0.173	1.035	0.083	10.868	1.725	0.139	158.700	3.105	0.250	169.740
	Exploration Wells													
	Development Wells													
Total			8.414	0.679	1.721	3.381	0.273	22.751	2.094	0.169	165.235	13.890	1.120	189.706
2025	Pipeline	8.2	1.540	0.188	0.449	0.850	0.104	3.341	0.276	0.034	4.887	2.666	0.325	8.677
	Platforms		4.026	0.491	0.636	0.809	0.099	4.956				4.834	0.590	5.592
	Production Wells		0.230	0.028	0.115	0.690	0.084	7.245	1.150	0.140	105.800	2.070	0.252	113.160
	Exploration Wells													
	Development Wells													
Total			5.795	0.707	1.200	2.348	0.286	15.542	1.426	0.174	110.687	9.570	1.167	127.429
2026	Pipeline	6.9	1.540	0.223	0.449	0.850	0.123	3.341	0.276	0.040	4.887	2.666	0.386	8.677
	Platforms		4.026	0.583	0.636	0.809	0.117	4.956				4.834	0.701	5.592
	Production Wells		0.230	0.033	0.115	0.690	0.100	7.245	1.150	0.167	105.800	2.070	0.300	113.160
	Exploration Wells													
	Development Wells													
Total			5.795	0.840	1.200	2.348	0.340	15.542	1.426	0.207	110.687	9.570	1.387	127.429
2027	Pipeline	3.5	1.028	0.294	0.300	0.562	0.161	2.209	0.183	0.052	3.240	1.772	0.506	5.748
	Platforms		2.034	0.581	0.321	0.408	0.117	2.501				2.442	0.698	2.823
	Production Wells		0.115	0.033	0.058	0.345	0.099	3.623	0.575	0.164	52.900	1.035	0.296	56.580
	Exploration Wells													
	Development Wells													
Total			3.177	0.908	0.679	1.315	0.376	8.333	0.758	0.217	56.140	5.250	1.500	65.151
2028	Pipeline	3.0	1.028	0.343	0.300	0.562	0.187	2.209	0.183	0.061	3.240	1.772	0.591	5.748
	Platforms		2.034	0.678	0.321	0.408	0.136	2.501				2.442	0.814	2.823
	Production Wells		0.115	0.038	0.058	0.345	0.115	3.623	0.575	0.192	52.900	1.035	0.345	56.580
	Exploration Wells													
	Development Wells													
Total			3.177	1.059	0.679	1.315	0.438	8.333	0.758	0.253	56.140	5.250	1.750	65.151
2029	Pipeline	2.6	1.028	0.395	0.300	0.562	0.216	2.209	0.183	0.070	3.240	1.772	0.682	5.748
	Platforms		2.034	0.782	0.321	0.408	0.157	2.501				2.442	0.939	2.823
	Production Wells		0.115	0.044	0.058	0.345	0.133	3.623	0.575	0.221	52.900	1.035	0.398	56.580
	Exploration Wells													
	Development Wells													
Total			3.177	1.222	0.679	1.315	0.506	8.333	0.758	0.292	56.140	5.250	2.019	65.151
2030	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2031	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2032	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2033	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														

**Table 4.1.11
Arctic Spill Occurrence Beaufort Sea Sale 1 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
2034	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2035	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2036	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2037	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2038	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													

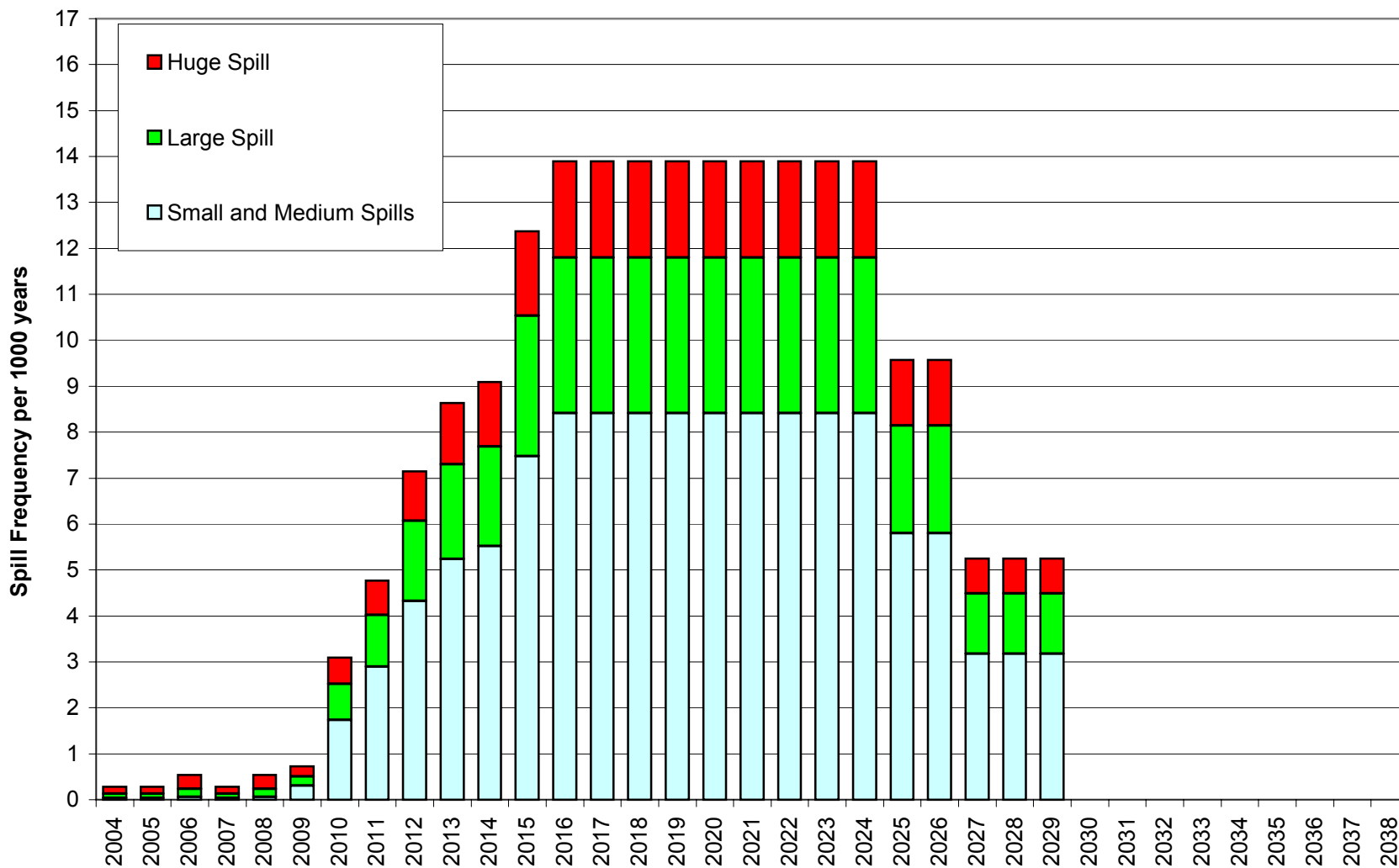
**Table 4.1.12
Arctic Spill Occurrence Beaufort Sea Sale 1 Annual Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2005		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2006		0.06		0.029	0.17		1.812	0.306		30.06	0.537		31.901
2007		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2008		0.06		0.029	0.17		1.812	0.306		30.06	0.537		31.901
2009		0.31		0.064	0.19		1.788	0.225		19.80	0.724		21.652
2010	10.9	1.73	0.159	0.372	0.79	0.072	5.384	0.574	0.053	48.71	3.090	0.283	54.464
2011	19.9	2.89	0.145	0.570	1.13	0.057	8.002	0.743	0.037	61.45	4.767	0.240	70.019
2012	30.8	4.32	0.140	0.881	1.74	0.057	11.775	1.086	0.035	86.10	7.150	0.232	98.751
2013	39.8	5.24	0.132	1.043	2.07	0.052	14.418	1.336	0.034	109.10	8.640	0.217	124.555
2014	36.3	5.52	0.152	1.092	2.16	0.060	15.217	1.411	0.039	116.00	9.093	0.251	132.304
2015	44.3	7.48	0.169	1.556	3.05	0.069	20.088	1.844	0.042	142.23	12.378	0.279	163.879
2016	47.5	8.41	0.177	1.721	3.38	0.071	22.751	2.094	0.044	165.23	13.890	0.292	189.706
2017	42.6	8.41	0.198	1.721	3.38	0.079	22.751	2.094	0.049	165.23	13.890	0.326	189.706
2018	38.7	8.41	0.217	1.721	3.38	0.087	22.751	2.094	0.054	165.23	13.890	0.359	189.706
2019	31.9	8.41	0.264	1.721	3.38	0.106	22.751	2.094	0.066	165.23	13.890	0.435	189.706
2020	26.3	8.41	0.320	1.721	3.38	0.129	22.751	2.094	0.080	165.23	13.890	0.528	189.706
2021	21.7	8.41	0.388	1.721	3.38	0.156	22.751	2.094	0.097	165.23	13.890	0.640	189.706
2022	17.9	8.41	0.470	1.721	3.38	0.189	22.751	2.094	0.117	165.23	13.890	0.776	189.706
2023	14.9	8.41	0.565	1.721	3.38	0.227	22.751	2.094	0.141	165.23	13.890	0.932	189.706
2024	12.4	8.41	0.679	1.721	3.38	0.273	22.751	2.094	0.169	165.23	13.890	1.120	189.706
2025	8.2	5.80	0.707	1.200	2.35	0.286	15.542	1.426	0.174	110.69	9.570	1.167	127.429
2026	6.9	5.80	0.840	1.200	2.35	0.340	15.542	1.426	0.207	110.69	9.570	1.387	127.429
2027	3.5	3.18	0.908	0.679	1.31	0.376	8.333	0.758	0.217	56.14	5.250	1.500	65.151
2028	3.0	3.18	1.059	0.679	1.31	0.438	8.333	0.758	0.253	56.14	5.250	1.750	65.151
2029	2.6	3.18	1.222	0.679	1.31	0.506	8.333	0.758	0.292	56.14	5.250	2.019	65.151
2030													
2031													
2032													
2033													
2034													
2035													
2036													
2037													
2038													

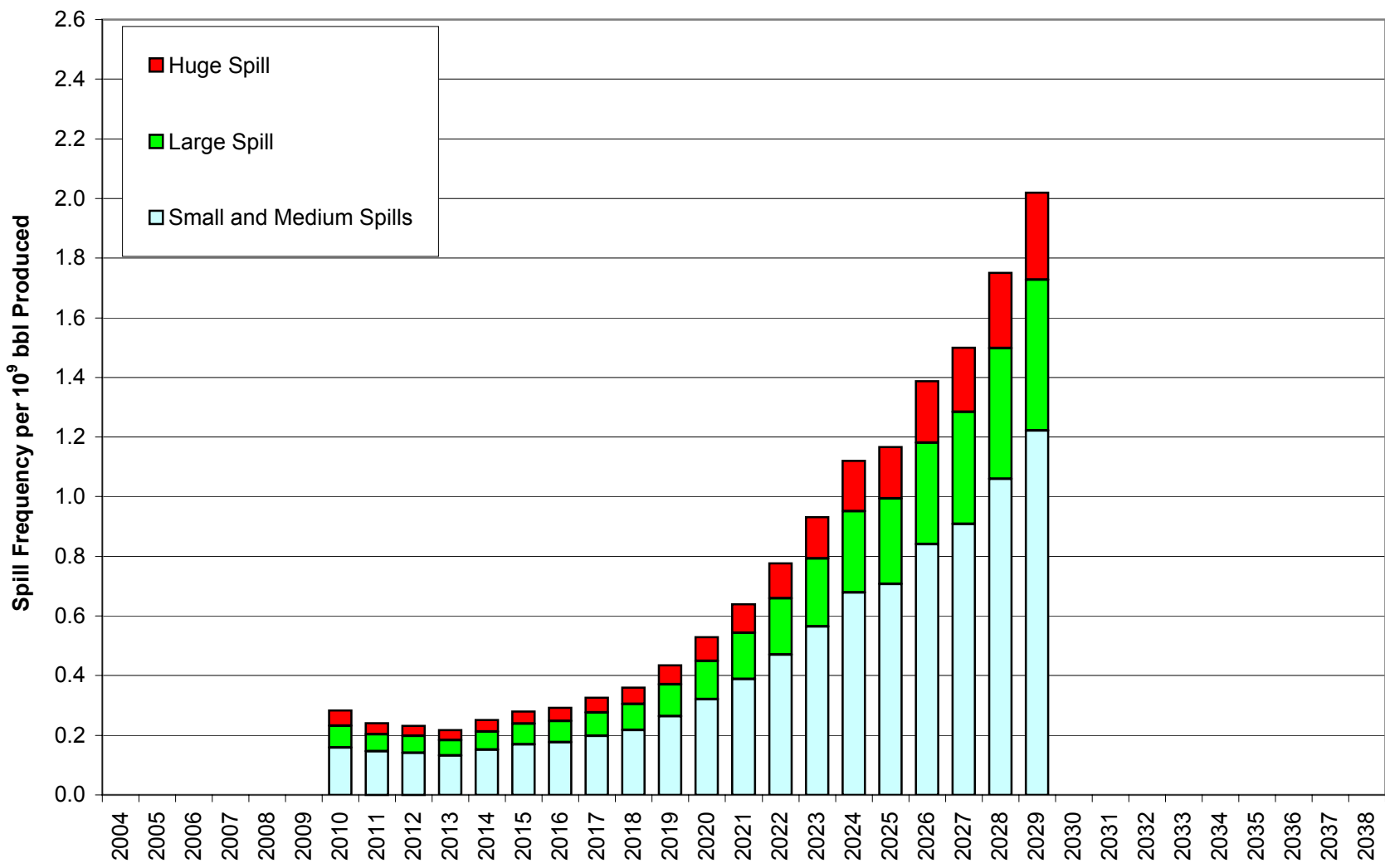
**Table 4.1.13
Arctic Spill Occurrence Beaufort Sea Sale 1 Wells Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2005		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2006		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901
2007		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2008		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901
2009		0.047		0.023	0.140		1.467	0.225		19.800	0.412		21.291
2010	10.9	0.091	0.008	0.046	0.273	0.025	2.865	0.481	0.044	47.060	0.845	0.078	49.970
2011	19.9	0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
2012	30.8	0.180	0.006	0.090	0.540	0.018	5.670	0.900	0.029	82.800	1.620	0.053	88.560
2013	39.8	0.230	0.006	0.115	0.690	0.017	7.245	1.150	0.029	105.800	2.070	0.052	113.160
2014	36.3	0.245	0.007	0.123	0.735	0.020	7.718	1.225	0.034	112.700	2.205	0.061	120.540
2015	44.3	0.295	0.007	0.148	0.885	0.020	9.293	1.475	0.033	135.700	2.655	0.060	145.140
2016	47.5	0.345	0.007	0.173	1.035	0.022	10.868	1.725	0.036	158.700	3.105	0.065	169.740
2017	42.6	0.345	0.008	0.173	1.035	0.024	10.868	1.725	0.040	158.700	3.105	0.073	169.740
2018	38.7	0.345	0.009	0.173	1.035	0.027	10.868	1.725	0.045	158.700	3.105	0.080	169.740
2019	31.9	0.345	0.011	0.173	1.035	0.032	10.868	1.725	0.054	158.700	3.105	0.097	169.740
2020	26.3	0.345	0.013	0.173	1.035	0.039	10.868	1.725	0.066	158.700	3.105	0.118	169.740
2021	21.7	0.345	0.016	0.173	1.035	0.048	10.868	1.725	0.079	158.700	3.105	0.143	169.740
2022	17.9	0.345	0.019	0.173	1.035	0.058	10.868	1.725	0.096	158.700	3.105	0.173	169.740
2023	14.9	0.345	0.023	0.173	1.035	0.069	10.868	1.725	0.116	158.700	3.105	0.208	169.740
2024	12.4	0.345	0.028	0.173	1.035	0.083	10.868	1.725	0.139	158.700	3.105	0.250	169.740
2025	8.2	0.230	0.028	0.115	0.690	0.084	7.245	1.150	0.140	105.800	2.070	0.252	113.160
2026	6.9	0.230	0.033	0.115	0.690	0.100	7.245	1.150	0.167	105.800	2.070	0.300	113.160
2027	3.5	0.115	0.033	0.058	0.345	0.099	3.623	0.575	0.164	52.900	1.035	0.296	56.580
2028	3.0	0.115	0.038	0.058	0.345	0.115	3.623	0.575	0.192	52.900	1.035	0.345	56.580
2029	2.6	0.115	0.044	0.058	0.345	0.133	3.623	0.575	0.221	52.900	1.035	0.398	56.580
2030													
2031													
2032													
2033													
2034													
2035													
2036													
2037													
2038													

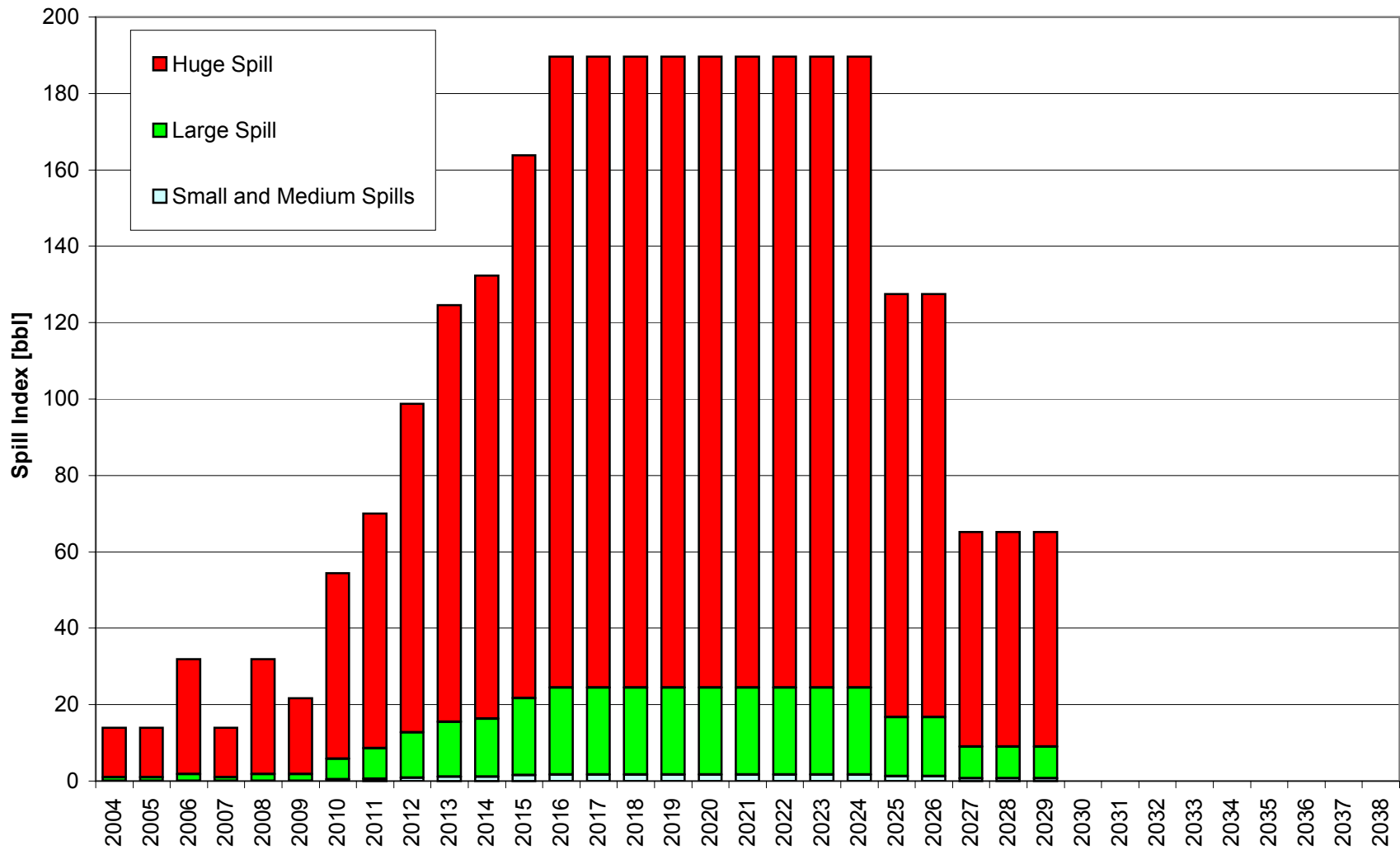
Beaufort Sea Sale 1 Spill Frequency



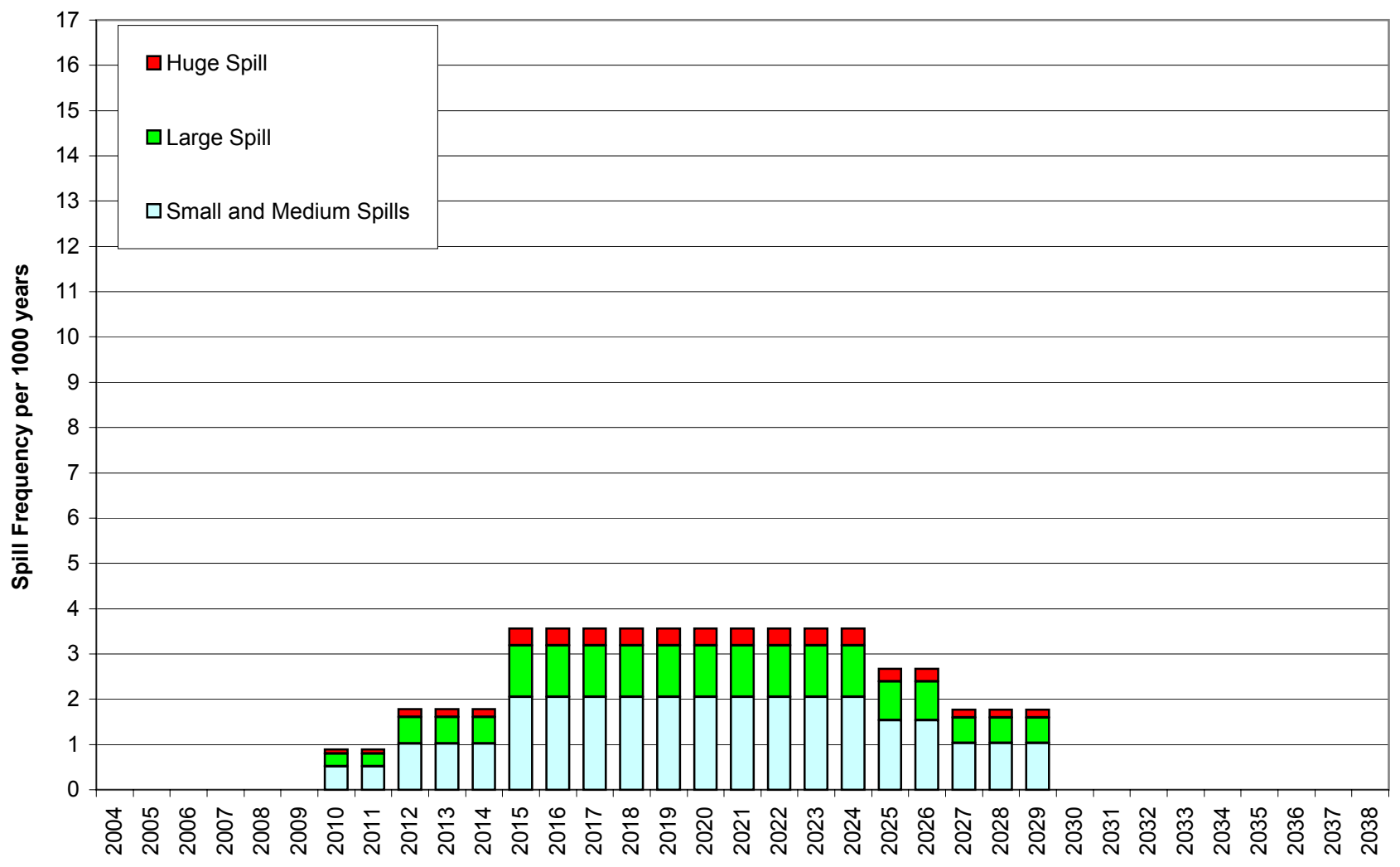
Beaufort Sea Sale 1 Spill Frequency per 10⁹ bbl Produced



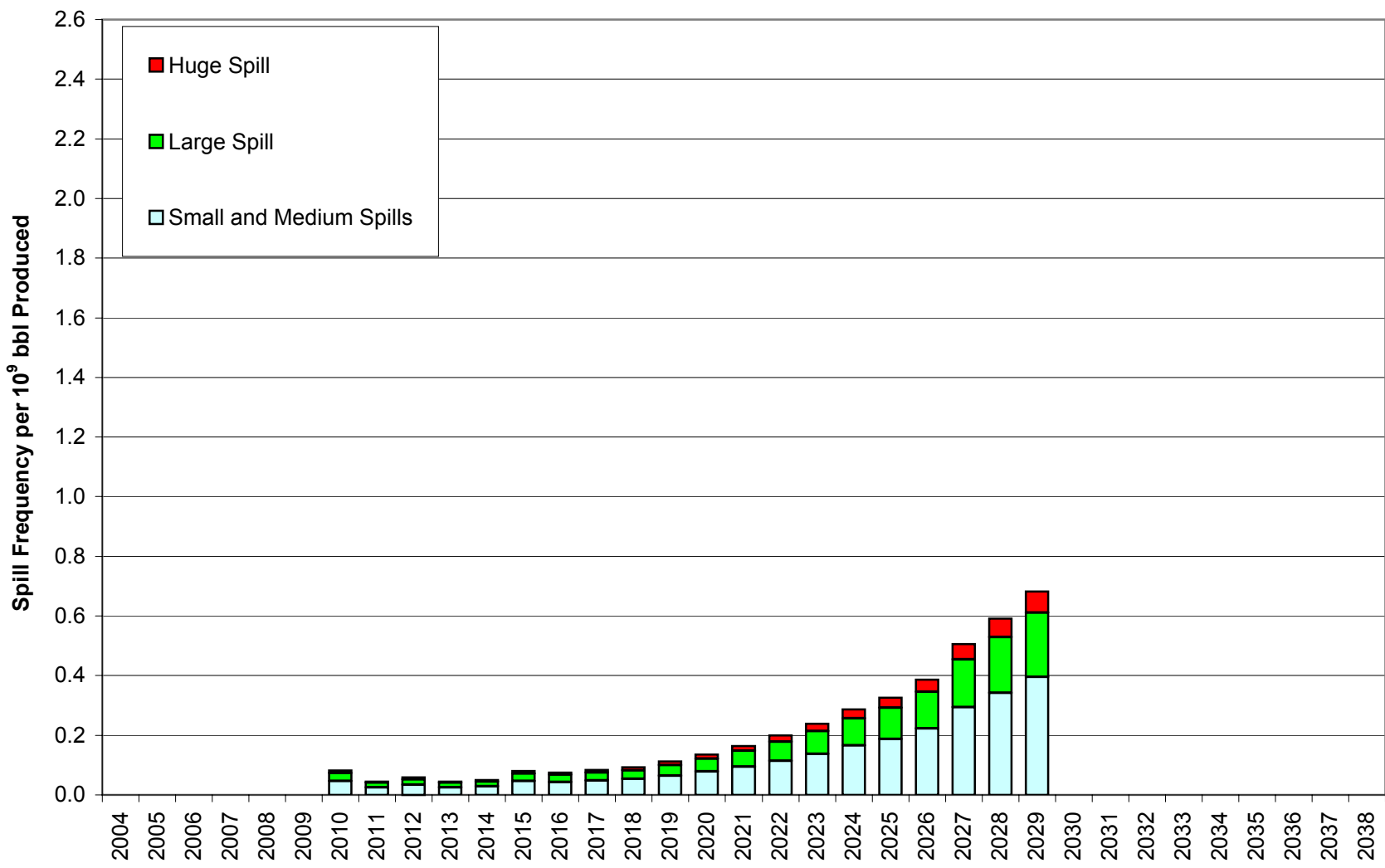
Beaufort Sea Sale 1 Spill Index



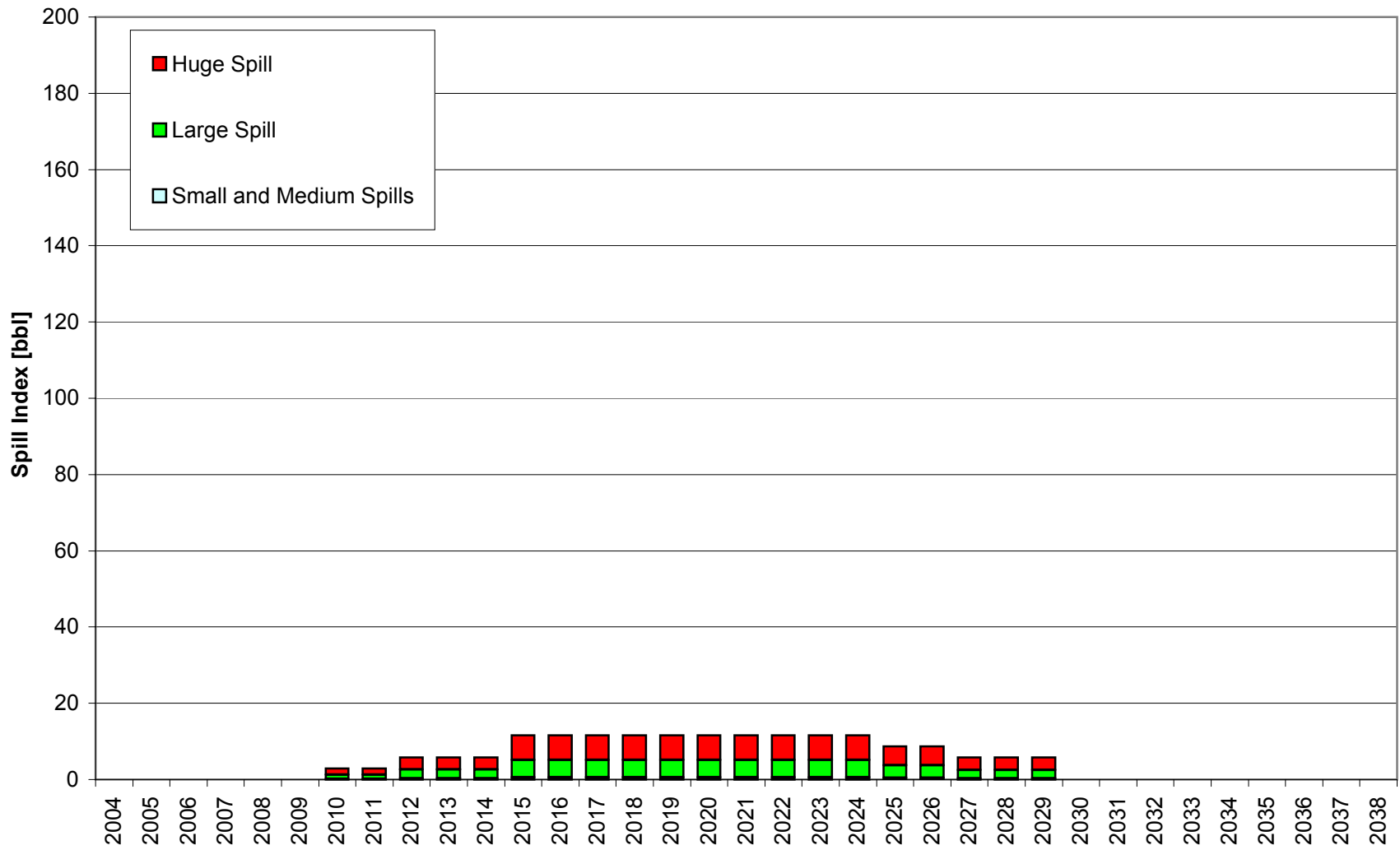
Beaufort Sea Sale 1 Spill Frequency - P/L



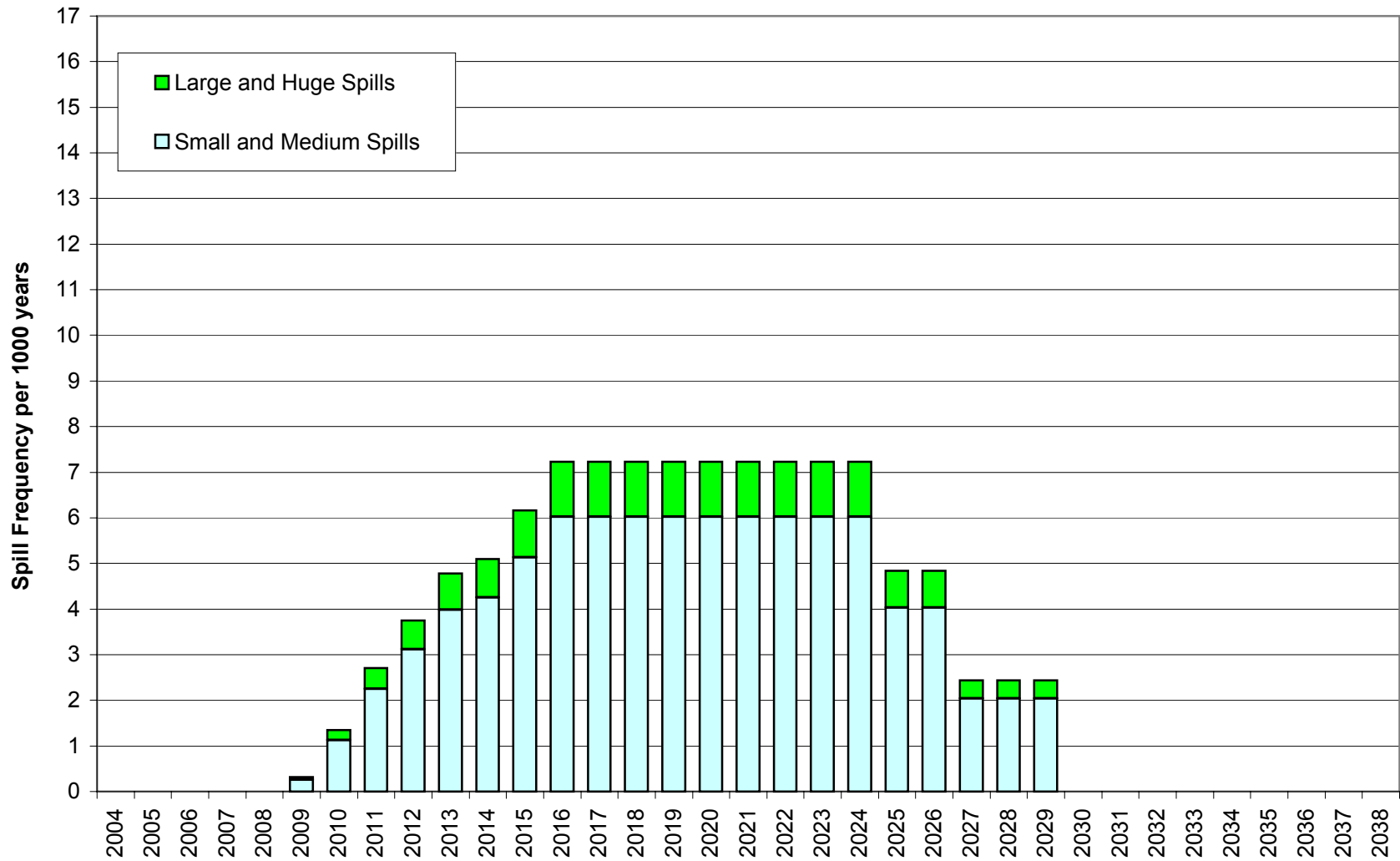
Beaufort Sea Sale 1 Spill Frequency per 10⁹ bbl Produced - P/L



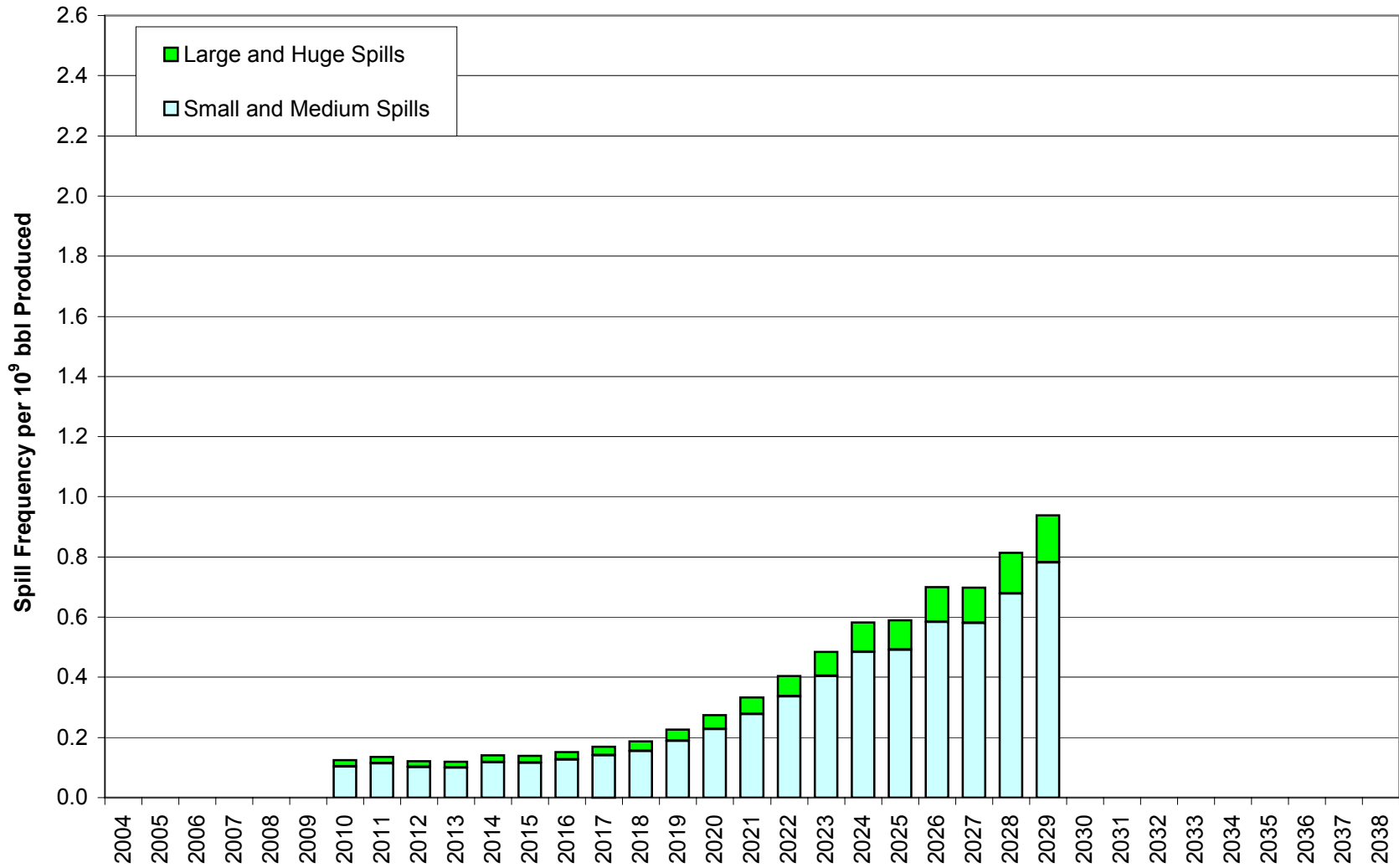
Beaufort Sea Sale 1 Spill Index - P/L



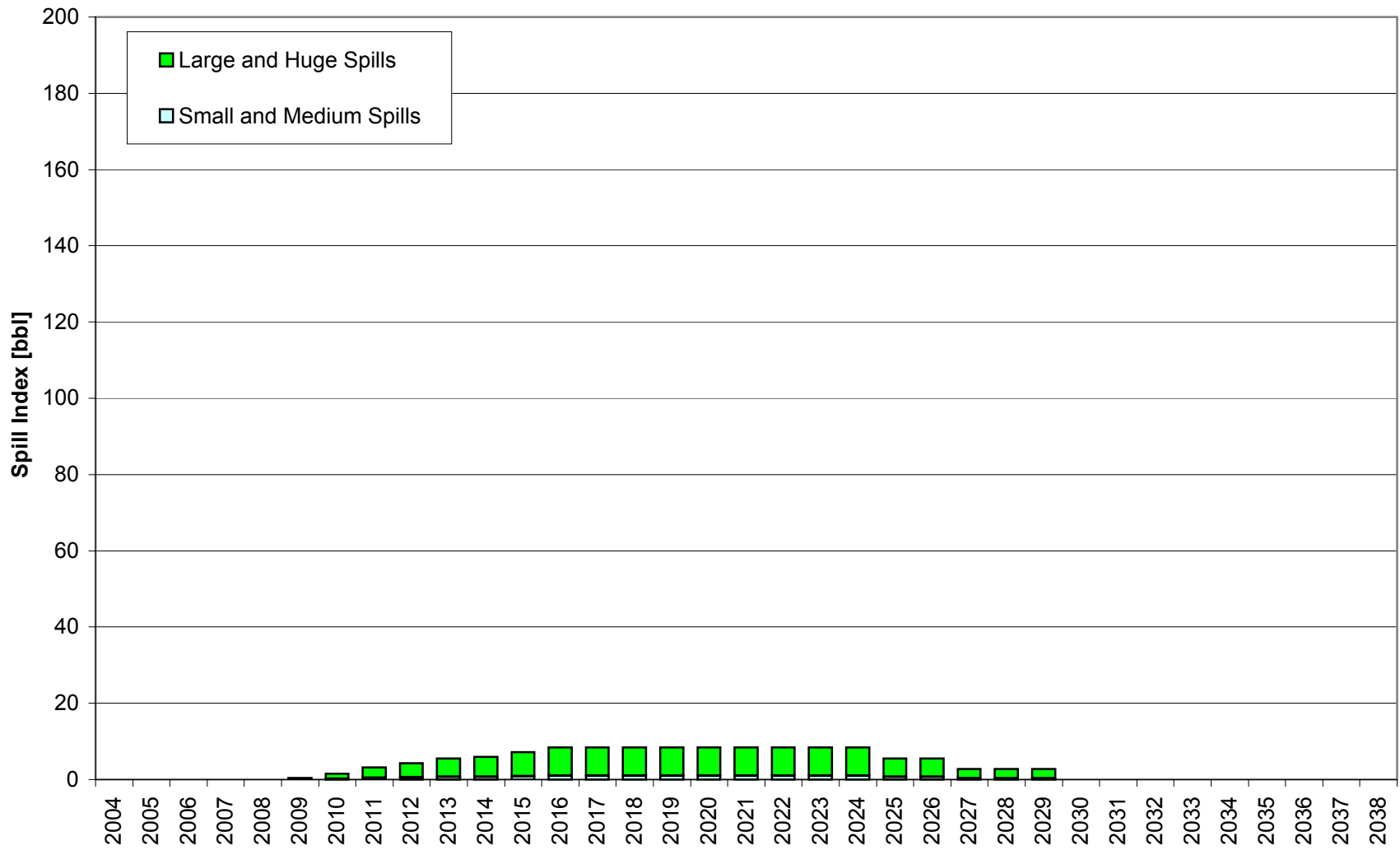
Beaufort Sea Sale 1 Spill Frequency - Platforms



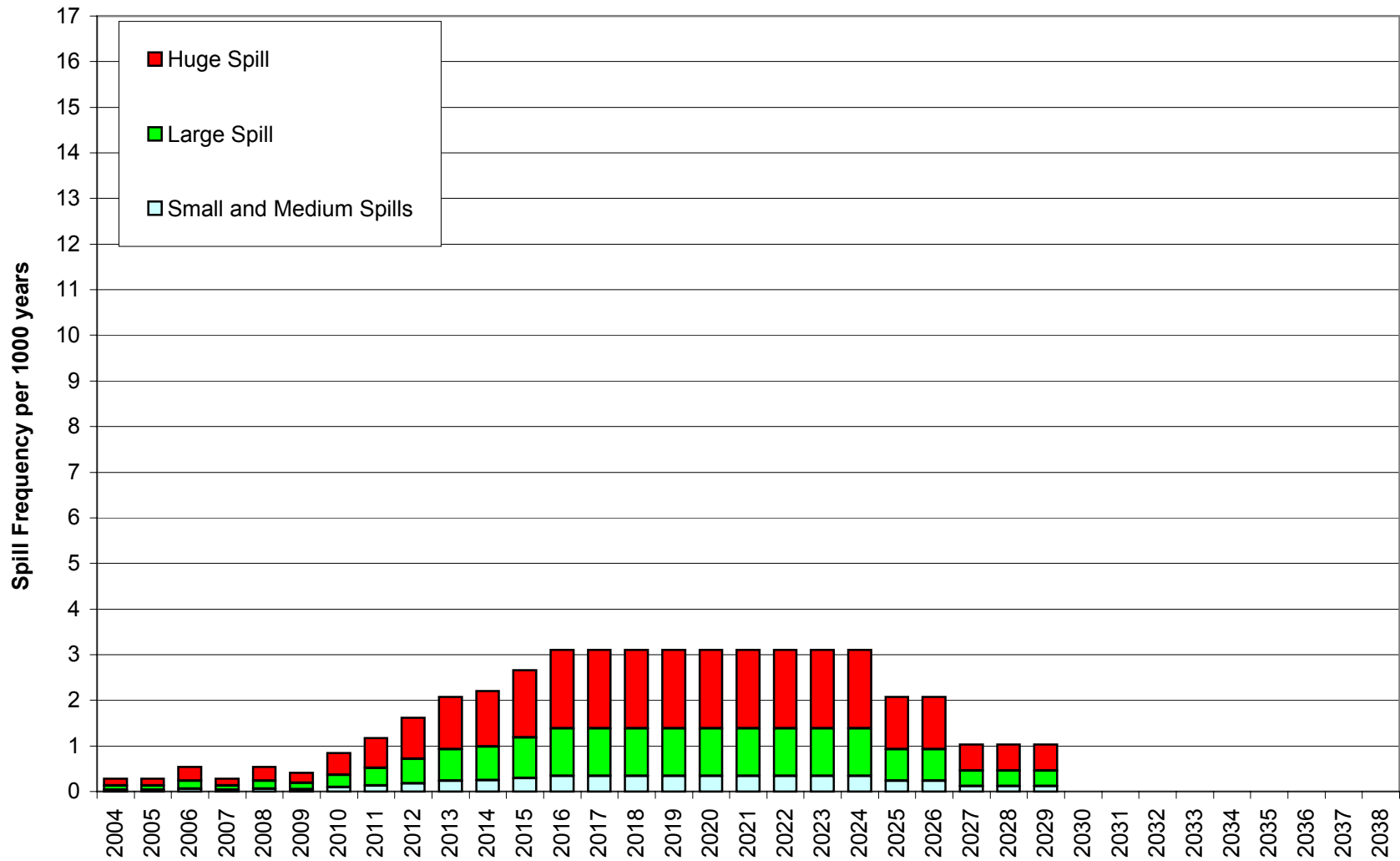
Beaufort Sea Sale 1 Spill Frequency per 10⁹ bbl Produced - Platforms



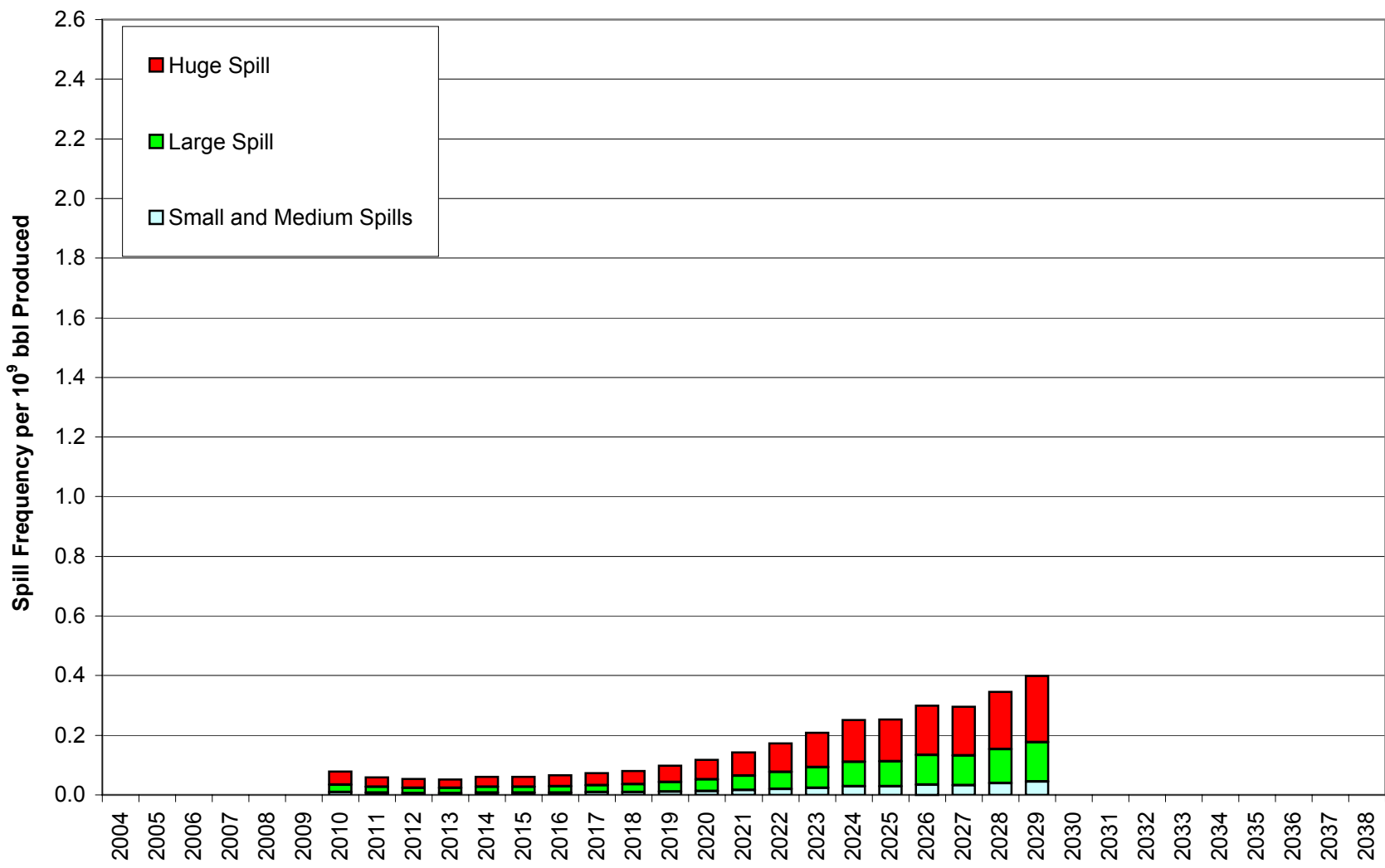
Beaufort Sea Sale 1 Spill Index - Platforms



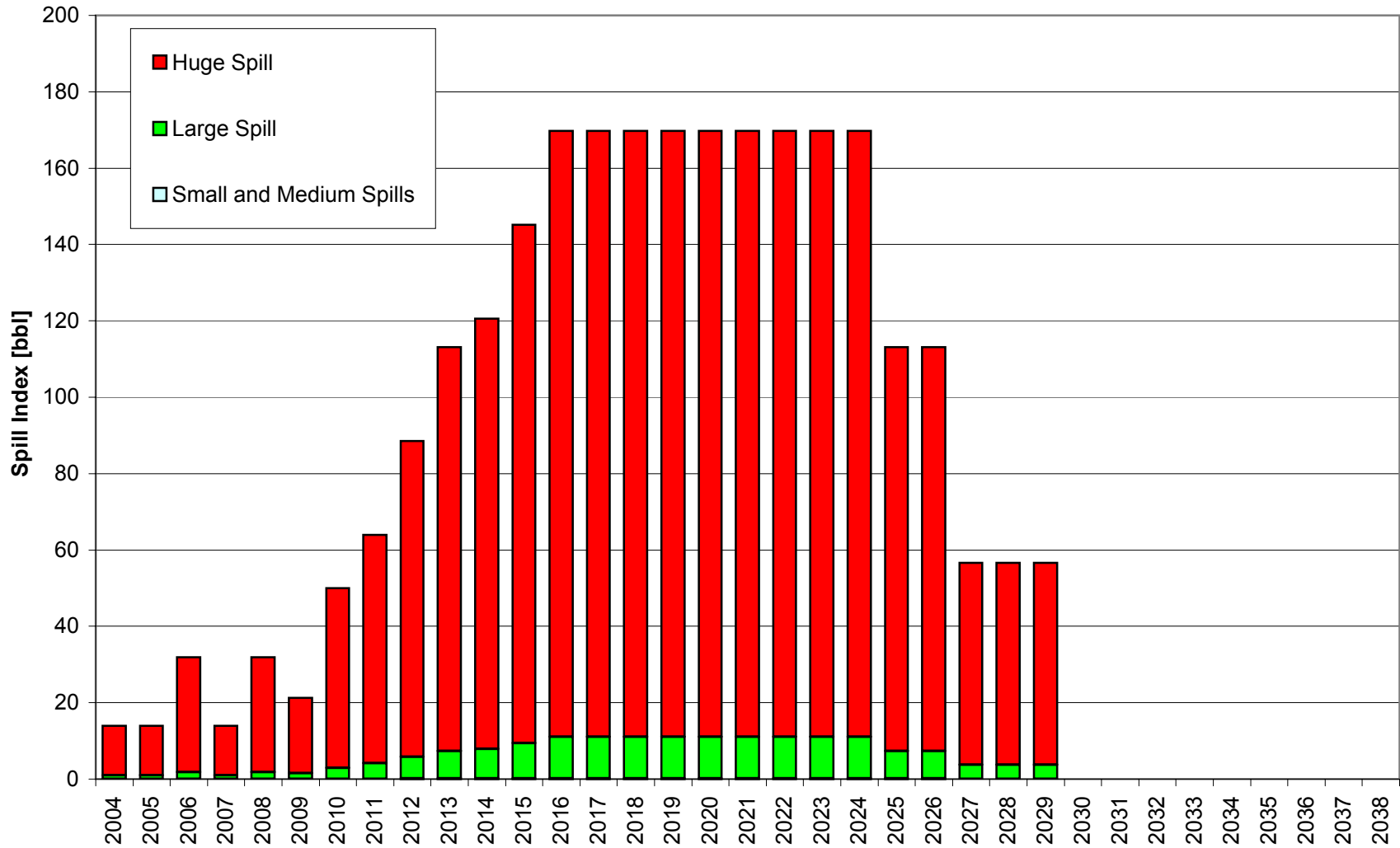
Beaufort Sea Sale 1 Spill Frequency - Wells



Beaufort Sea Sale 1 Spill Frequency per 10⁹ bbl Produced - Wells



Beaufort Sea Sale 1 Spill Index - Wells



**Table 4.2.2
Arctic Spill Occurrence Beaufort Sea Sale 2 P/L Summary**

Year	Production [MMbbbl]	Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004																			
2005																			
2006																			
2007																			
2008																			
2009																			
2010																			
2011																			
2012																			
2013	10.9	0.224	0.021	0.013	0.545	0.050	0.211	0.768	0.071	0.224	0.432	0.040	1.697	0.140	0.013	2.471	1.340	0.123	4.392
2014	19.9	0.224	0.011	0.013	0.545	0.027	0.211	0.768	0.039	0.224	0.432	0.022	1.697	0.140	0.007	2.471	1.340	0.067	4.392
2015	19.9	0.224	0.011	0.013	0.545	0.027	0.211	0.768	0.039	0.224	0.432	0.022	1.697	0.140	0.007	2.471	1.340	0.067	4.392
2016	19.9	0.224	0.011	0.013	0.545	0.027	0.211	0.768	0.039	0.224	0.432	0.022	1.697	0.140	0.007	2.471	1.340	0.067	4.392
2017	34.8	0.635	0.018	0.037	1.473	0.042	0.546	2.108	0.061	0.583	1.071	0.031	4.250	0.342	0.010	5.995	3.522	0.101	10.828
2018	44.2	0.635	0.014	0.037	1.473	0.033	0.546	2.108	0.048	0.583	1.071	0.024	4.250	0.342	0.008	5.995	3.522	0.080	10.828
2019	41.9	0.635	0.015	0.037	1.473	0.035	0.546	2.108	0.050	0.583	1.071	0.026	4.250	0.342	0.008	5.995	3.522	0.084	10.828
2020	39.9	0.635	0.016	0.037	1.473	0.037	0.546	2.108	0.053	0.583	1.071	0.027	4.250	0.342	0.009	5.995	3.522	0.088	10.828
2021	38.3	0.635	0.017	0.037	1.473	0.038	0.546	2.108	0.055	0.583	1.071	0.028	4.250	0.342	0.009	5.995	3.522	0.092	10.828
2022	32.7	0.635	0.019	0.037	1.473	0.045	0.546	2.108	0.064	0.583	1.071	0.033	4.250	0.342	0.010	5.995	3.522	0.108	10.828
2023	27.9	0.635	0.023	0.037	1.473	0.053	0.546	2.108	0.076	0.583	1.071	0.038	4.250	0.342	0.012	5.995	3.522	0.126	10.828
2024	23.8	0.635	0.027	0.037	1.473	0.062	0.546	2.108	0.089	0.583	1.071	0.045	4.250	0.342	0.014	5.995	3.522	0.148	10.828
2025	20.3	0.635	0.031	0.037	1.473	0.073	0.546	2.108	0.104	0.583	1.071	0.053	4.250	0.342	0.017	5.995	3.522	0.173	10.828
2026	17.3	0.635	0.037	0.037	1.473	0.085	0.546	2.108	0.122	0.583	1.071	0.062	4.250	0.342	0.020	5.995	3.522	0.204	10.828
2027	14.8	0.635	0.043	0.037	1.473	0.100	0.546	2.108	0.142	0.583	1.071	0.072	4.250	0.342	0.023	5.995	3.522	0.238	10.828
2028	10.7	0.411	0.038	0.024	0.928	0.087	0.335	1.340	0.125	0.359	0.639	0.060	2.552	0.203	0.019	3.524	2.182	0.204	6.436
2029	9.2	0.411	0.045	0.024	0.928	0.101	0.335	1.340	0.146	0.359	0.639	0.069	2.552	0.203	0.022	3.524	2.182	0.237	6.436
2030	7.9	0.411	0.052	0.024	0.928	0.118	0.335	1.340	0.170	0.359	0.639	0.081	2.552	0.203	0.026	3.524	2.182	0.276	6.436
2031	6.8	0.411	0.061	0.017	0.928	0.137	0.282	1.340	0.197	0.300	0.639	0.094	2.209	0.203	0.030	3.240	2.182	0.321	5.748
2032	5.8	0.411	0.071	0.024	0.928	0.160	0.335	1.340	0.231	0.359	0.639	0.110	2.552	0.203	0.035	3.524	2.182	0.376	6.436
2033	5.0	0.411	0.082	0.024	0.928	0.186	0.335	1.340	0.268	0.359	0.639	0.128	2.552	0.203	0.041	3.524	2.182	0.436	6.436
2034	4.3	0.411	0.096	0.024	0.928	0.216	0.335	1.340	0.312	0.359	0.639	0.149	2.552	0.203	0.047	3.524	2.182	0.507	6.436
2035	3.7	0.411	0.111	0.024	0.928	0.251	0.335	1.340	0.362	0.359	0.639	0.173	2.552	0.203	0.055	3.524	2.182	0.590	6.436
2036																			
2037																			
2038																			

**Table 4.2.3
Arctic Spill Occurrence Beaufort Sea Sale 2 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2005	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2006	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2007	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2008	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2009	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2010	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2011	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2012	Shallow	1	3	0.866	0.260	0.04	0.174	0.052	0.32
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	1	3		0.260	0.04		0.052	0.32
2013	Shallow	1	13	0.866	1.126	0.18	0.174	0.226	1.39
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	1	13		1.126	0.18		0.226	1.39
2014	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	1	23		1.991	0.31		0.400	2.45
2015	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	1	23		1.991	0.31		0.400	2.45
2016	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	1	3	0.884	0.265	0.04	0.177	0.053	0.33
	Deep			0.913			0.182		
	Total	2	26		2.257	0.36		0.454	2.78
2017	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	16	0.884	1.415	0.22	0.177	0.284	1.74
	Deep			0.913			0.182		
	Total	3	39		3.406	0.54		0.684	4.19

**Table 4.2.3
Arctic Spill Occurrence Beaufort Sea Sale 2 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	36	0.884	3.184	0.50	0.177	0.639	3.92
	Deep			0.913			0.182		
	Total	3	59		5.175	0.82		1.039	6.37
2019	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	3	69		6.060	0.96		1.217	7.46
2020	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	3	69		6.060	0.96		1.217	7.46
2021	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	3	69		6.060	0.96		1.217	7.46
2022	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	3	69		6.060	0.96		1.217	7.46
2023	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	3	69		6.060	0.96		1.217	7.46
2024	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	3	69		6.060	0.96		1.217	7.46
2025	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	3	69		6.060	0.96		1.217	7.46
2026	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	3	69		6.060	0.96		1.217	7.46
2027	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	3	69		6.060	0.96		1.217	7.46
2028	Shallow			0.866			0.174		
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	2	46		4.069	0.64		0.816	5.00
2029	Shallow			0.866			0.174		
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	2	46		4.069	0.64		0.816	5.00
2030	Shallow			0.866			0.174		
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	2	46		4.069	0.64		0.816	5.00
2031	Shallow			0.866			0.174		
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	2	46		4.069	0.64		0.816	5.00

**Table 4.2.3
Arctic Spill Occurrence Beaufort Sea Sale 2 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow			0.866			0.174		
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	2	46		4.069	0.64		0.816	5.00
2033	Shallow			0.866			0.174		
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	2	46		4.069	0.64		0.816	5.00
2034	Shallow			0.866			0.174		
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	2	46		4.069	0.64		0.816	5.00
2035	Shallow			0.866			0.174		
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	2	46		4.069	0.64		0.816	5.00
2036	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2037	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2038	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								

**Table 4.2.4
Arctic Spill Occurrence Beaufort Sea Sale 2 Platforms Summary**

Year	Production [MMbbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004										
2005										
2006										
2007										
2008										
2009										
2010										
2011										
2012		0.260		0.041	0.052		0.320	0.312		0.361
2013	10.9	1.126	0.103	0.178	0.226	0.021	1.387	1.352	0.124	1.565
2014	19.9	1.991	0.100	0.315	0.400	0.020	2.455	2.392	0.120	2.769
2015	19.9	1.991	0.100	0.315	0.400	0.020	2.455	2.392	0.120	2.769
2016	19.9	2.257	0.113	0.357	0.454	0.023	2.781	2.710	0.136	3.138
2017	34.8	3.406	0.098	0.538	0.684	0.020	4.195	4.091	0.118	4.733
2018	44.2	5.175	0.117	0.818	1.039	0.024	6.370	6.215	0.141	7.188
2019	41.9	6.060	0.145	0.957	1.217	0.029	7.457	7.276	0.174	8.415
2020	39.9	6.060	0.152	0.957	1.217	0.030	7.457	7.276	0.182	8.415
2021	38.3	6.060	0.158	0.957	1.217	0.032	7.457	7.276	0.190	8.415
2022	32.7	6.060	0.185	0.957	1.217	0.037	7.457	7.276	0.223	8.415
2023	27.9	6.060	0.217	0.957	1.217	0.044	7.457	7.276	0.261	8.415
2024	23.8	6.060	0.255	0.957	1.217	0.051	7.457	7.276	0.306	8.415
2025	20.3	6.060	0.299	0.957	1.217	0.060	7.457	7.276	0.358	8.415
2026	17.3	6.060	0.350	0.957	1.217	0.070	7.457	7.276	0.421	8.415
2027	14.8	6.060	0.409	0.957	1.217	0.082	7.457	7.276	0.492	8.415
2028	10.7	4.069	0.380	0.643	0.816	0.076	5.003	4.885	0.457	5.645
2029	9.2	4.069	0.442	0.643	0.816	0.089	5.003	4.885	0.531	5.645
2030	7.9	4.069	0.515	0.643	0.816	0.103	5.003	4.885	0.618	5.645
2031	6.8	4.069	0.598	0.643	0.816	0.120	5.003	4.885	0.718	5.645
2032	5.8	4.069	0.701	0.643	0.816	0.141	5.003	4.885	0.842	5.645
2033	5.0	4.069	0.814	0.643	0.816	0.163	5.003	4.885	0.977	5.645
2034	4.3	4.069	0.946	0.643	0.816	0.190	5.003	4.885	1.136	5.645
2035	3.7	4.069	1.100	0.643	0.816	0.221	5.003	4.885	1.320	5.645
2036										
2037										
2038										

**Table 4.2.5
Arctic Spill Occurrence Beaufort Sea Sale 2 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2009	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2010	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2011	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2012	Shallow	3	0.500	0.015	0.01	3.500	0.105	0.47	1.500	0.045	0.90	1.000	0.030	6.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	3		0.015	0.01		0.105	0.47		0.045	0.90		0.030	6.00
2013	Shallow	13	0.500	0.065	0.03	3.500	0.455	2.05	1.500	0.195	3.90	1.000	0.130	26.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	13		0.065	0.03		0.455	2.05		0.195	3.90		0.130	26.00
2014	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	23		0.115	0.06		0.805	3.62		0.345	6.90		0.230	46.00
2015	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	23		0.115	0.06		0.805	3.62		0.345	6.90		0.230	46.00
2016	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	3	0.500	0.015	0.01	3.500	0.105	0.47	1.500	0.045	0.90	1.000	0.030	6.00
	Deep		0.500			3.500			1.500			1.000		
	Total	26		0.130	0.07		0.910	4.10		0.390	7.80		0.260	52.00
2017	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	16	0.500	0.080	0.04	3.500	0.560	2.52	1.500	0.240	4.80	1.000	0.160	32.00
	Deep		0.500			3.500			1.500			1.000		
	Total	39		0.195	0.10		1.365	6.14		0.585	11.70		0.390	78.00

**Table 4.2.5
Arctic Spill Occurrence Beaufort Sea Sale 2 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	36	0.500	0.180	0.09	3.500	1.260	5.67	1.500	0.540	10.80	1.000	0.360	72.00
	Deep		0.500			3.500			1.500			1.000		
	Total	59		0.295	0.15		2.065	9.29		0.885	17.70		0.590	118.00
2019	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2020	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2021	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2022	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2023	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2024	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2025	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2026	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2027	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2028	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2029	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2030	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2031	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00

**Table 4.2.5
Arctic Spill Occurrence Beaufort Sea Sale 2 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2033	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2034	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2035	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2036	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2037	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2038	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													

**Table 4.2.6
Arctic Spill Occurrence Beaufort Sea Sale 2 Production Wells Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009													
2010													
2011													
2012		0.015		0.008	0.045		0.473	0.075		6.900	0.135		7.380
2013	10.9	0.065	0.006	0.033	0.195	0.018	2.048	0.325	0.030	29.900	0.585	0.054	31.980
2014	19.9	0.115	0.006	0.058	0.345	0.017	3.623	0.575	0.029	52.900	1.035	0.052	56.580
2015	19.9	0.115	0.006	0.058	0.345	0.017	3.623	0.575	0.029	52.900	1.035	0.052	56.580
2016	19.9	0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
2017	34.8	0.195	0.006	0.098	0.585	0.017	6.143	0.975	0.028	89.700	1.755	0.050	95.940
2018	44.2	0.295	0.007	0.148	0.885	0.020	9.293	1.475	0.033	135.700	2.655	0.060	145.140
2019	41.9	0.345	0.008	0.173	1.035	0.025	10.868	1.725	0.041	158.700	3.105	0.074	169.740
2020	39.9	0.345	0.009	0.173	1.035	0.026	10.868	1.725	0.043	158.700	3.105	0.078	169.740
2021	38.3	0.345	0.009	0.173	1.035	0.027	10.868	1.725	0.045	158.700	3.105	0.081	169.740
2022	32.7	0.345	0.011	0.173	1.035	0.032	10.868	1.725	0.053	158.700	3.105	0.095	169.740
2023	27.9	0.345	0.012	0.173	1.035	0.037	10.868	1.725	0.062	158.700	3.105	0.111	169.740
2024	23.8	0.345	0.014	0.173	1.035	0.043	10.868	1.725	0.072	158.700	3.105	0.130	169.740
2025	20.3	0.345	0.017	0.173	1.035	0.051	10.868	1.725	0.085	158.700	3.105	0.153	169.740
2026	17.3	0.345	0.020	0.173	1.035	0.060	10.868	1.725	0.100	158.700	3.105	0.179	169.740
2027	14.8	0.345	0.023	0.173	1.035	0.070	10.868	1.725	0.117	158.700	3.105	0.210	169.740
2028	10.7	0.230	0.021	0.115	0.690	0.064	7.245	1.150	0.107	105.800	2.070	0.193	113.160
2029	9.2	0.230	0.025	0.115	0.690	0.075	7.245	1.150	0.125	105.800	2.070	0.225	113.160
2030	7.9	0.230	0.029	0.115	0.690	0.087	7.245	1.150	0.146	105.800	2.070	0.262	113.160
2031	6.8	0.230	0.034	0.115	0.690	0.101	7.245	1.150	0.169	105.800	2.070	0.304	113.160
2032	5.8	0.230	0.040	0.115	0.690	0.119	7.245	1.150	0.198	105.800	2.070	0.357	113.160
2033	5.0	0.230	0.046	0.115	0.690	0.138	7.245	1.150	0.230	105.800	2.070	0.414	113.160
2034	4.3	0.230	0.053	0.115	0.690	0.160	7.245	1.150	0.267	105.800	2.070	0.481	113.160
2035	3.7	0.230	0.062	0.115	0.690	0.186	7.245	1.150	0.311	105.800	2.070	0.559	113.160
2036													
2037													
2038													

Table 4.2.7
Artic Spill Occurrence Beaufort Sea Sale 2 Exploration Wells

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2005	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2006	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2007	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2008	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2010	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2011	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2012	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2013	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2014	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2015	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2016	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2017	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

**Table 4.2.7
Arctic Spill Occurrence Beaufort Sea Sale 2 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2019	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2020	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2021	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2022	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2023	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2024	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2025	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2026	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2027	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2028	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2029	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2030	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2031	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

**Table 4.2.7
Arctic Spill Occurrence Beaufort Sea Sale 2 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2033	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2034	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2035	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2036	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2037	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2038	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.2.8

Arctic Spill Occurrence Beaufort Sea Sale 2 Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2008		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2009													
2010		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2011													
2012		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2013	10.9	0.032	0.003	0.016	0.095	0.009	0.995	0.150	0.014	12.900	0.277	0.025	13.911
2014	19.9												
2015	19.9												
2016	19.9												
2017	34.8												
2018	44.2												
2019	41.9												
2020	39.9												
2021	38.3												
2022	32.7												
2023	27.9												
2024	23.8												
2025	20.3												
2026	17.3												
2027	14.8												
2028	10.7												
2029	9.2												
2030	7.9												
2031	6.8												
2032	5.8												
2033	5.0												
2034	4.3												
2035	3.7												
2036													
2037													
2038													

**Table 4.2.9
Arctic Spill Occurrence Beaufort Sea Sale 2 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2009	Shallow	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2011	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2012	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2013	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2014	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2015	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2016	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2017	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.2.9
Arctic Spill Occurrence Beaufort Sea Sale 2 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] = 500		Spill Index bbl	Average Spill [bbl] = 4500		Spill Index bbl	Average Spill [bbl] = 20000		Spill Index bbl	Average Spill [bbl] = 200000		Spill Index bbl
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2019	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2020	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2021	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2022	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2023	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2024	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2025	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2026	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2027	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2028	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2029	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2030	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2031	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.2.9
Arctic Spill Occurrence Beaufort Sea Sale 2 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2033	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2034	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2035	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2036	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2037	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2038	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.2.10

Arctic Spill Occurrence Beaufort Sea Sale 2 Development Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2010													
2011													
2012													
2013	10.9	0.026	0.002	0.013	0.078	0.007	0.817	0.156	0.014	17.160	0.260	0.024	17.990
2014	19.9	0.026	0.001	0.013	0.078	0.004	0.817	0.156	0.008	17.160	0.260	0.013	17.990
2015	19.9												
2016	19.9												
2017	34.8												
2018	44.2												
2019	41.9												
2020	39.9												
2021	38.3												
2022	32.7												
2023	27.9												
2024	23.8												
2025	20.3												
2026	17.3												
2027	14.8												
2028	10.7												
2029	9.2												
2030	7.9												
2031	6.8												
2032	5.8												
2033	5.0												
2034	4.3												
2035	3.7												
2036													
2037													
2038													

**Table 4.2.11
Arctic Spill Occurrence Beaufort Sea Sale 2 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
2004	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2005	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2006	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2007	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
Total		0.032	0.016	0.095		0.995	0.150		12.900	0.277		13.911		
2008	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
Total		0.032	0.016	0.095		0.995	0.150		12.900	0.277		13.911		
2009	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
Total		0.026	0.013	0.078		0.817	0.156		17.160	0.260		17.990		
2010	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
Total		0.032	0.016	0.095		0.995	0.150		12.900	0.277		13.911		
2011	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2012	Pipeline													
	Platforms		0.260		0.041	0.052		0.320				0.312		0.361
	Production Wells		0.015		0.008	0.045		0.473	0.075		6.900	0.135		7.380
	Exploration Wells		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
	Development Wells													
Total		0.338	0.080	0.287		2.783	0.375		32.700	1.000		35.563		
2013	Pipeline	10.9	0.768	0.071	0.224	0.432	0.040	1.697	0.140	0.013	2.471	1.340	0.123	4.392
	Platforms		1.126	0.103	0.178	0.226	0.021	1.387				1.352	0.124	1.565
	Production Wells		0.065	0.006	0.033	0.195	0.018	2.048	0.325	0.030	29.900	0.585	0.054	31.980
	Exploration Wells		0.032	0.003	0.016	0.095	0.009	0.995	0.150	0.014	12.900	0.277	0.025	13.911
	Development Wells		0.026	0.002	0.013	0.078	0.007	0.817	0.156	0.014	17.160	0.260	0.024	17.990
	Total			2.017	0.185	0.463	1.026	0.094	6.945	0.771	0.071	62.431	3.813	0.350

**Table 4.2.11
Arctic Spill Occurrence Beaufort Sea Sale 2 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
2014	Pipeline	19.9	0.768	0.039	0.224	0.432	0.022	1.697	0.140	0.007	2.471	1.340	0.067	4.392
	Platforms		1.991	0.100	0.315	0.400	0.020	2.455				2.392	0.120	2.769
	Production Wells		0.115	0.006	0.058	0.345	0.017	3.623	0.575	0.029	52.900	1.035	0.052	56.580
	Exploration Wells													
	Development Wells		0.026	0.001	0.013	0.078	0.004	0.817	0.156	0.008	17.160	0.260	0.013	17.990
	Total		2.901	0.146	0.609	1.255	0.063	8.592	0.871	0.044	72.531	5.027	0.253	81.732
2015	Pipeline	19.9	0.768	0.039	0.224	0.432	0.022	1.697	0.140	0.007	2.471	1.340	0.067	4.392
	Platforms		1.991	0.100	0.315	0.400	0.020	2.455				2.392	0.120	2.769
	Production Wells		0.115	0.006	0.058	0.345	0.017	3.623	0.575	0.029	52.900	1.035	0.052	56.580
	Exploration Wells													
	Development Wells		0.026	0.001	0.013	0.078	0.004	0.817	0.156	0.008	17.160	0.260	0.013	17.990
	Total		2.875	0.144	0.596	1.177	0.059	7.775	0.715	0.036	55.371	4.767	0.240	63.742
2016	Pipeline	19.9	0.768	0.039	0.224	0.432	0.022	1.697	0.140	0.007	2.471	1.340	0.067	4.392
	Platforms		2.257	0.113	0.357	0.454	0.023	2.781				2.710	0.136	3.138
	Production Wells		0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
	Exploration Wells													
	Development Wells													
	Total		3.155	0.159	0.645	1.275	0.064	8.573	0.790	0.040	62.271	5.220	0.262	71.490
2017	Pipeline	34.8	2.108	0.061	0.583	1.071	0.031	4.250	0.342	0.010	5.995	3.522	0.101	10.828
	Platforms		3.406	0.098	0.538	0.684	0.020	4.195				4.091	0.118	4.733
	Production Wells		0.195	0.006	0.098	0.585	0.017	6.143	0.975	0.028	89.700	1.755	0.050	95.940
	Exploration Wells													
	Development Wells													
	Total		5.710	0.164	1.219	2.340	0.067	14.587	1.317	0.038	95.695	9.367	0.269	111.501
2018	Pipeline	44.2	2.108	0.048	0.583	1.071	0.024	4.250	0.342	0.008	5.995	3.522	0.080	10.828
	Platforms		5.175	0.117	0.818	1.039	0.024	6.370				6.215	0.141	7.188
	Production Wells		0.295	0.007	0.148	0.885	0.020	9.293	1.475	0.033	135.700	2.655	0.060	145.140
	Exploration Wells													
	Development Wells													
	Total		7.579	0.171	1.548	2.995	0.068	19.912	1.817	0.041	141.695	12.391	0.280	163.156
2019	Pipeline	41.9	2.108	0.050	0.583	1.071	0.026	4.250	0.342	0.008	5.995	3.522	0.084	10.828
	Platforms		6.060	0.145	0.957	1.217	0.029	7.457				7.276	0.174	8.415
	Production Wells		0.345	0.008	0.173	1.035	0.025	10.868	1.725	0.041	158.700	3.105	0.074	169.740
	Exploration Wells													
	Development Wells													
	Total		8.513	0.203	1.713	3.322	0.079	22.575	2.067	0.049	164.695	13.903	0.332	188.983
2020	Pipeline	39.9	2.108	0.053	0.583	1.071	0.027	4.250	0.342	0.009	5.995	3.522	0.088	10.828
	Platforms		6.060	0.152	0.957	1.217	0.030	7.457				7.276	0.182	8.415
	Production Wells		0.345	0.009	0.173	1.035	0.026	10.868	1.725	0.043	158.700	3.105	0.078	169.740
	Exploration Wells													
	Development Wells													
	Total		8.513	0.213	1.713	3.322	0.083	22.575	2.067	0.052	164.695	13.903	0.348	188.983
2021	Pipeline	38.3	2.108	0.055	0.583	1.071	0.028	4.250	0.342	0.009	5.995	3.522	0.092	10.828
	Platforms		6.060	0.158	0.957	1.217	0.032	7.457				7.276	0.190	8.415
	Production Wells		0.345	0.009	0.173	1.035	0.027	10.868	1.725	0.045	158.700	3.105	0.081	169.740
	Exploration Wells													
	Development Wells													
	Total		8.513	0.222	1.713	3.322	0.087	22.575	2.067	0.054	164.695	13.903	0.363	188.983
2022	Pipeline	32.7	2.108	0.064	0.583	1.071	0.033	4.250	0.342	0.010	5.995	3.522	0.108	10.828
	Platforms		6.060	0.185	0.957	1.217	0.037	7.457				7.276	0.223	8.415
	Production Wells		0.345	0.011	0.173	1.035	0.032	10.868	1.725	0.053	158.700	3.105	0.095	169.740
	Exploration Wells													
	Development Wells													
	Total		8.513	0.260	1.713	3.322	0.102	22.575	2.067	0.063	164.695	13.903	0.425	188.983
2023	Pipeline	27.9	2.108	0.076	0.583	1.071	0.038	4.250	0.342	0.012	5.995	3.522	0.126	10.828
	Platforms		6.060	0.217	0.957	1.217	0.044	7.457				7.276	0.261	8.415
	Production Wells		0.345	0.012	0.173	1.035	0.037	10.868	1.725	0.062	158.700	3.105	0.111	169.740
	Exploration Wells													
	Development Wells													
	Total		8.513	0.305	1.713	3.322	0.119	22.575	2.067	0.074	164.695	13.903	0.498	188.983

**Table 4.2.11
Arctic Spill Occurrence Beaufort Sea Sale 2 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2024	Pipeline	23.8	2.108	0.089	0.583	1.071	0.045	4.250	0.342	0.014	5.995	3.522	0.148	10.828
	Platforms		6.060	0.255	0.957	1.217	0.051	7.457				7.276	0.306	8.415
	Production Wells		0.345	0.014	0.173	1.035	0.043	10.868	1.725	0.072	158.700	3.105	0.130	169.740
	Exploration Wells													
	Development Wells													
	Total		8.513	0.358	1.713	3.322	0.140	22.575	2.067	0.087	164.695	13.903	0.584	188.983
2025	Pipeline	20.3	2.108	0.104	0.583	1.071	0.053	4.250	0.342	0.017	5.995	3.522	0.173	10.828
	Platforms		6.060	0.299	0.957	1.217	0.060	7.457				7.276	0.358	8.415
	Production Wells		0.345	0.017	0.173	1.035	0.051	10.868	1.725	0.085	158.700	3.105	0.153	169.740
	Exploration Wells													
	Development Wells													
	Total		8.513	0.419	1.713	3.322	0.164	22.575	2.067	0.102	164.695	13.903	0.685	188.983
2026	Pipeline	17.3	2.108	0.122	0.583	1.071	0.062	4.250	0.342	0.020	5.995	3.522	0.204	10.828
	Platforms		6.060	0.350	0.957	1.217	0.070	7.457				7.276	0.421	8.415
	Production Wells		0.345	0.020	0.173	1.035	0.060	10.868	1.725	0.100	158.700	3.105	0.179	169.740
	Exploration Wells													
	Development Wells													
	Total		8.513	0.492	1.713	3.322	0.192	22.575	2.067	0.119	164.695	13.903	0.804	188.983
2027	Pipeline	14.8	2.108	0.142	0.583	1.071	0.072	4.250	0.342	0.023	5.995	3.522	0.238	10.828
	Platforms		6.060	0.409	0.957	1.217	0.082	7.457				7.276	0.492	8.415
	Production Wells		0.345	0.023	0.173	1.035	0.070	10.868	1.725	0.117	158.700	3.105	0.210	169.740
	Exploration Wells													
	Development Wells													
	Total		8.513	0.575	1.713	3.322	0.224	22.575	2.067	0.140	164.695	13.903	0.939	188.983
2028	Pipeline	10.7	1.340	0.125	0.359	0.639	0.060	2.552	0.203	0.019	3.524	2.182	0.204	6.436
	Platforms		4.069	0.380	0.643	0.816	0.076	5.003				4.885	0.457	5.645
	Production Wells		0.230	0.021	0.115	0.690	0.064	7.245	1.150	0.107	105.800	2.070	0.193	113.160
	Exploration Wells													
	Development Wells													
	Total		5.639	0.527	1.117	2.145	0.200	14.800	1.353	0.126	109.324	9.136	0.854	125.241
2029	Pipeline	9.2	1.340	0.146	0.359	0.639	0.069	2.552	0.203	0.022	3.524	2.182	0.237	6.436
	Platforms		4.069	0.442	0.643	0.816	0.089	5.003				4.885	0.531	5.645
	Production Wells		0.230	0.025	0.115	0.690	0.075	7.245	1.150	0.125	105.800	2.070	0.225	113.160
	Exploration Wells													
	Development Wells													
	Total		5.639	0.613	1.117	2.145	0.233	14.800	1.353	0.147	109.324	9.136	0.993	125.241
2030	Pipeline	7.9	1.340	0.170	0.359	0.639	0.081	2.552	0.203	0.026	3.524	2.182	0.276	6.436
	Platforms		4.069	0.515	0.643	0.816	0.103	5.003				4.885	0.618	5.645
	Production Wells		0.230	0.029	0.115	0.690	0.087	7.245	1.150	0.146	105.800	2.070	0.262	113.160
	Exploration Wells													
	Development Wells													
	Total		5.639	0.714	1.117	2.145	0.272	14.800	1.353	0.171	109.324	9.136	1.157	125.241
2031	Pipeline	5.8	1.340	0.197	0.300	0.639	0.094	2.209	0.203	0.030	3.240	2.182	0.321	5.748
	Platforms		4.069	0.598	0.643	0.816	0.120	5.003				4.885	0.718	5.645
	Production Wells		0.230	0.034	0.115	0.690	0.101	7.245	1.150	0.169	105.800	2.070	0.304	113.160
	Exploration Wells													
	Development Wells													
	Total		5.639	0.829	1.057	2.145	0.315	14.457	1.353	0.199	109.040	9.136	1.344	124.554
2032	Pipeline	5.0	1.340	0.231	0.359	0.639	0.110	2.552	0.203	0.035	3.524	2.182	0.376	6.436
	Platforms		4.069	0.701	0.643	0.816	0.141	5.003				4.885	0.842	5.645
	Production Wells		0.230	0.040	0.115	0.690	0.119	7.245	1.150	0.198	105.800	2.070	0.357	113.160
	Exploration Wells													
	Development Wells													
	Total		5.639	0.972	1.117	2.145	0.370	14.800	1.353	0.233	109.324	9.136	1.575	125.241
2033	Pipeline	3.7	1.340	0.268	0.359	0.639	0.128	2.552	0.203	0.041	3.524	2.182	0.436	6.436
	Platforms		4.069	0.814	0.643	0.816	0.163	5.003				4.885	0.977	5.645
	Production Wells		0.230	0.046	0.115	0.690	0.138	7.245	1.150	0.230	105.800	2.070	0.414	113.160
	Exploration Wells													
	Development Wells													
	Total		5.639	1.128	1.117	2.145	0.429	14.800	1.353	0.271	109.324	9.136	1.827	125.241

**Table 4.2.11
Arctic Spill Occurrence Beaufort Sea Sale 2 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
2034	Pipeline		1.340	0.312	0.359	0.639	0.149	2.552	0.203	0.047	3.524	2.182	0.507	6.436
	Platforms		4.069	0.946	0.643	0.816	0.190	5.003				4.885	1.136	5.645
	Production Wells		0.230	0.053	0.115	0.690	0.160	7.245	1.150	0.267	105.800	2.070	0.481	113.160
	Exploration Wells													
	Development Wells													
	Total			5.639	1.311	1.117	2.145	0.499	14.800	1.353	0.315	109.324	9.136	2.125
2035	Pipeline		1.340	0.362	0.359	0.639	0.173	2.552	0.203	0.055	3.524	2.182	0.590	6.436
	Platforms		4.069	1.100	0.643	0.816	0.221	5.003				4.885	1.320	5.645
	Production Wells		0.230	0.062	0.115	0.690	0.186	7.245	1.150	0.311	105.800	2.070	0.559	113.160
	Exploration Wells													
	Development Wells													
	Total			5.639	1.524	1.117	2.145	0.580	14.800	1.353	0.366	109.324	9.136	2.469
2036	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2037	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2038	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													

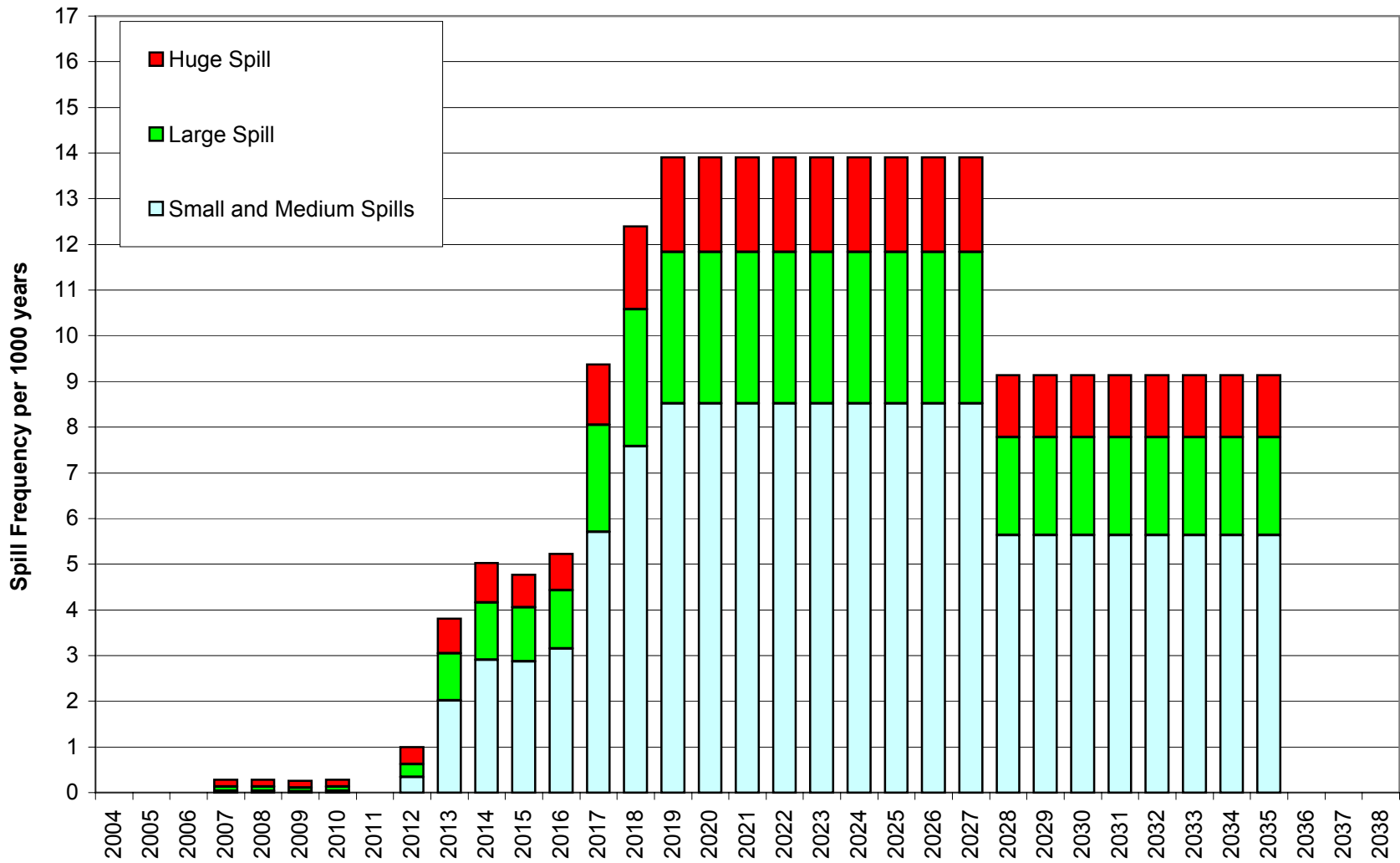
**Table 4.2.12
Arctic Spill Occurrence Beaufort Sea Sale 2 Annual Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2008		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2009		0.03		0.013	0.08		0.817	0.156		17.16	0.260		17.990
2010		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2011													
2012		0.34		0.080	0.29		2.783	0.375		32.70	1.000		35.563
2013	10.9	2.02	0.185	0.463	1.03	0.094	6.945	0.771	0.071	62.43	3.813	0.350	69.839
2014	19.9	2.90	0.146	0.609	1.26	0.063	8.592	0.871	0.044	72.53	5.027	0.253	81.732
2015	19.9	2.87	0.144	0.596	1.18	0.059	7.775	0.715	0.036	55.37	4.767	0.240	63.742
2016	19.9	3.16	0.159	0.645	1.28	0.064	8.573	0.790	0.040	62.27	5.220	0.262	71.490
2017	34.8	5.71	0.164	1.219	2.34	0.067	14.587	1.317	0.038	95.70	9.367	0.269	111.501
2018	44.2	7.58	0.171	1.548	3.00	0.068	19.912	1.817	0.041	141.70	12.391	0.280	163.156
2019	41.9	8.51	0.203	1.713	3.32	0.079	22.575	2.067	0.049	164.70	13.903	0.332	188.983
2020	39.9	8.51	0.213	1.713	3.32	0.083	22.575	2.067	0.052	164.70	13.903	0.348	188.983
2021	38.3	8.51	0.222	1.713	3.32	0.087	22.575	2.067	0.054	164.70	13.903	0.363	188.983
2022	32.7	8.51	0.260	1.713	3.32	0.102	22.575	2.067	0.063	164.70	13.903	0.425	188.983
2023	27.9	8.51	0.305	1.713	3.32	0.119	22.575	2.067	0.074	164.70	13.903	0.498	188.983
2024	23.8	8.51	0.358	1.713	3.32	0.140	22.575	2.067	0.087	164.70	13.903	0.584	188.983
2025	20.3	8.51	0.419	1.713	3.32	0.164	22.575	2.067	0.102	164.70	13.903	0.685	188.983
2026	17.3	8.51	0.492	1.713	3.32	0.192	22.575	2.067	0.119	164.70	13.903	0.804	188.983
2027	14.8	8.51	0.575	1.713	3.32	0.224	22.575	2.067	0.140	164.70	13.903	0.939	188.983
2028	10.7	5.64	0.527	1.117	2.15	0.200	14.800	1.353	0.126	109.32	9.136	0.854	125.241
2029	9.2	5.64	0.613	1.117	2.15	0.233	14.800	1.353	0.147	109.32	9.136	0.993	125.241
2030	7.9	5.64	0.714	1.117	2.15	0.272	14.800	1.353	0.171	109.32	9.136	1.157	125.241
2031	6.8	5.64	0.829	1.057	2.15	0.315	14.457	1.353	0.199	109.04	9.136	1.344	124.554
2032	5.8	5.64	0.972	1.117	2.15	0.370	14.800	1.353	0.233	109.32	9.136	1.575	125.241
2033	5.0	5.64	1.128	1.117	2.15	0.429	14.800	1.353	0.271	109.32	9.136	1.827	125.241
2034	4.3	5.64	1.311	1.117	2.15	0.499	14.800	1.353	0.315	109.32	9.136	2.125	125.241
2035	3.7	5.64	1.524	1.117	2.15	0.580	14.800	1.353	0.366	109.32	9.136	2.469	125.241
2036													
2037													
2038													

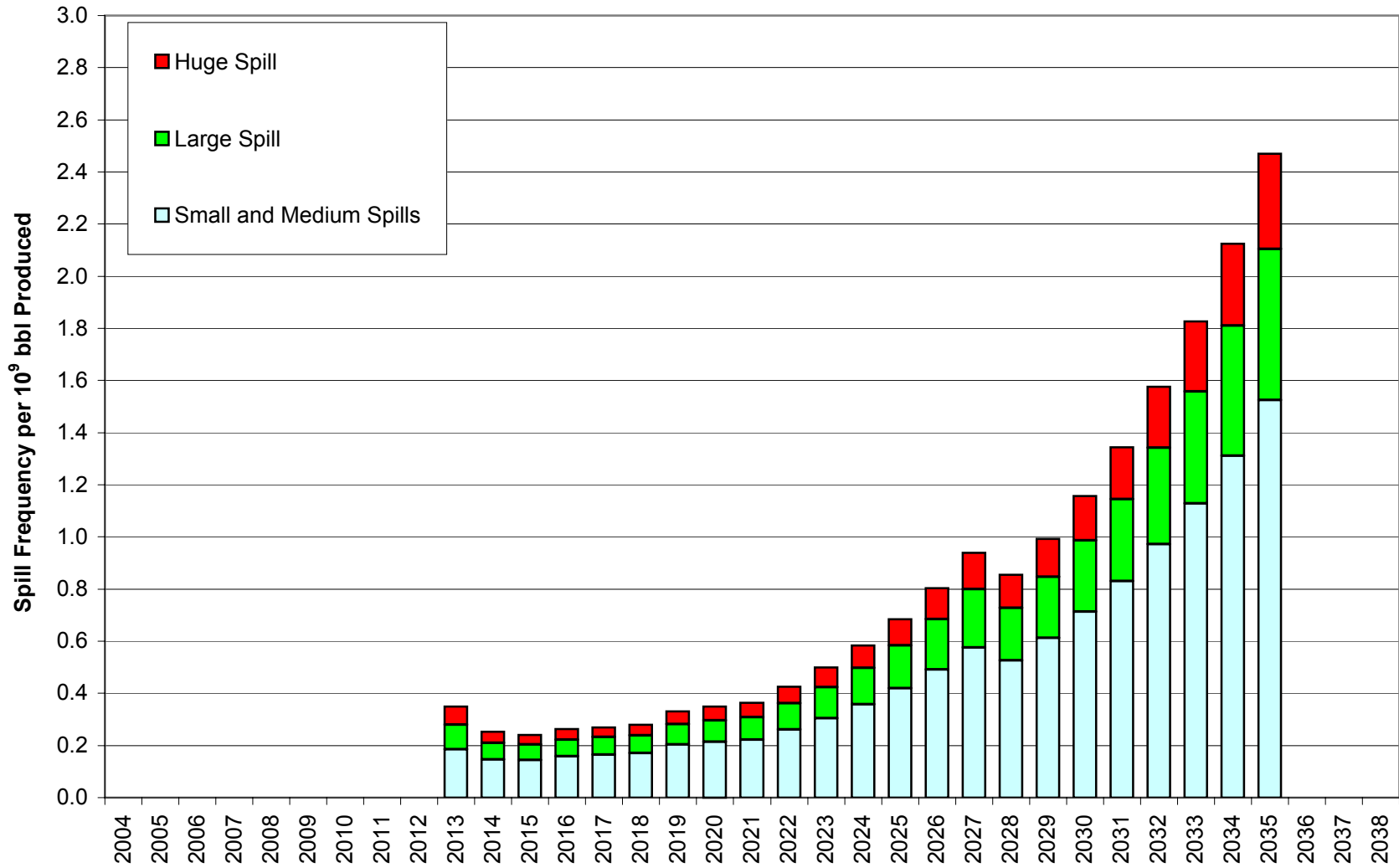
**Table 4.2.13
Arctic Spill Occurrence Beaufort Sea Sale 2 Wells Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2008		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2009		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2010		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2011													
2012		0.078		0.039	0.235		2.462	0.375		32.700	0.688		35.202
2013	10.9	0.123	0.011	0.061	0.368	0.034	3.860	0.631	0.058	59.960	1.122	0.103	63.881
2014	19.9	0.141	0.007	0.071	0.423	0.021	4.440	0.731	0.037	70.060	1.295	0.065	74.570
2015	19.9	0.115	0.006	0.058	0.345	0.017	3.623	0.575	0.029	52.900	1.035	0.052	56.580
2016	19.9	0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
2017	34.8	0.195	0.006	0.098	0.585	0.017	6.143	0.975	0.028	89.700	1.755	0.050	95.940
2018	44.2	0.295	0.007	0.148	0.885	0.020	9.293	1.475	0.033	135.700	2.655	0.060	145.140
2019	41.9	0.345	0.008	0.173	1.035	0.025	10.868	1.725	0.041	158.700	3.105	0.074	169.740
2020	39.9	0.345	0.009	0.173	1.035	0.026	10.868	1.725	0.043	158.700	3.105	0.078	169.740
2021	38.3	0.345	0.009	0.173	1.035	0.027	10.868	1.725	0.045	158.700	3.105	0.081	169.740
2022	32.7	0.345	0.011	0.173	1.035	0.032	10.868	1.725	0.053	158.700	3.105	0.095	169.740
2023	27.9	0.345	0.012	0.173	1.035	0.037	10.868	1.725	0.062	158.700	3.105	0.111	169.740
2024	23.8	0.345	0.014	0.173	1.035	0.043	10.868	1.725	0.072	158.700	3.105	0.130	169.740
2025	20.3	0.345	0.017	0.173	1.035	0.051	10.868	1.725	0.085	158.700	3.105	0.153	169.740
2026	17.3	0.345	0.020	0.173	1.035	0.060	10.868	1.725	0.100	158.700	3.105	0.179	169.740
2027	14.8	0.345	0.023	0.173	1.035	0.070	10.868	1.725	0.117	158.700	3.105	0.210	169.740
2028	10.7	0.230	0.021	0.115	0.690	0.064	7.245	1.150	0.107	105.800	2.070	0.193	113.160
2029	9.2	0.230	0.025	0.115	0.690	0.075	7.245	1.150	0.125	105.800	2.070	0.225	113.160
2030	7.9	0.230	0.029	0.115	0.690	0.087	7.245	1.150	0.146	105.800	2.070	0.262	113.160
2031	6.8	0.230	0.034	0.115	0.690	0.101	7.245	1.150	0.169	105.800	2.070	0.304	113.160
2032	5.8	0.230	0.040	0.115	0.690	0.119	7.245	1.150	0.198	105.800	2.070	0.357	113.160
2033	5.0	0.230	0.046	0.115	0.690	0.138	7.245	1.150	0.230	105.800	2.070	0.414	113.160
2034	4.3	0.230	0.053	0.115	0.690	0.160	7.245	1.150	0.267	105.800	2.070	0.481	113.160
2035	3.7	0.230	0.062	0.115	0.690	0.186	7.245	1.150	0.311	105.800	2.070	0.559	113.160
2036													
2037													
2038													

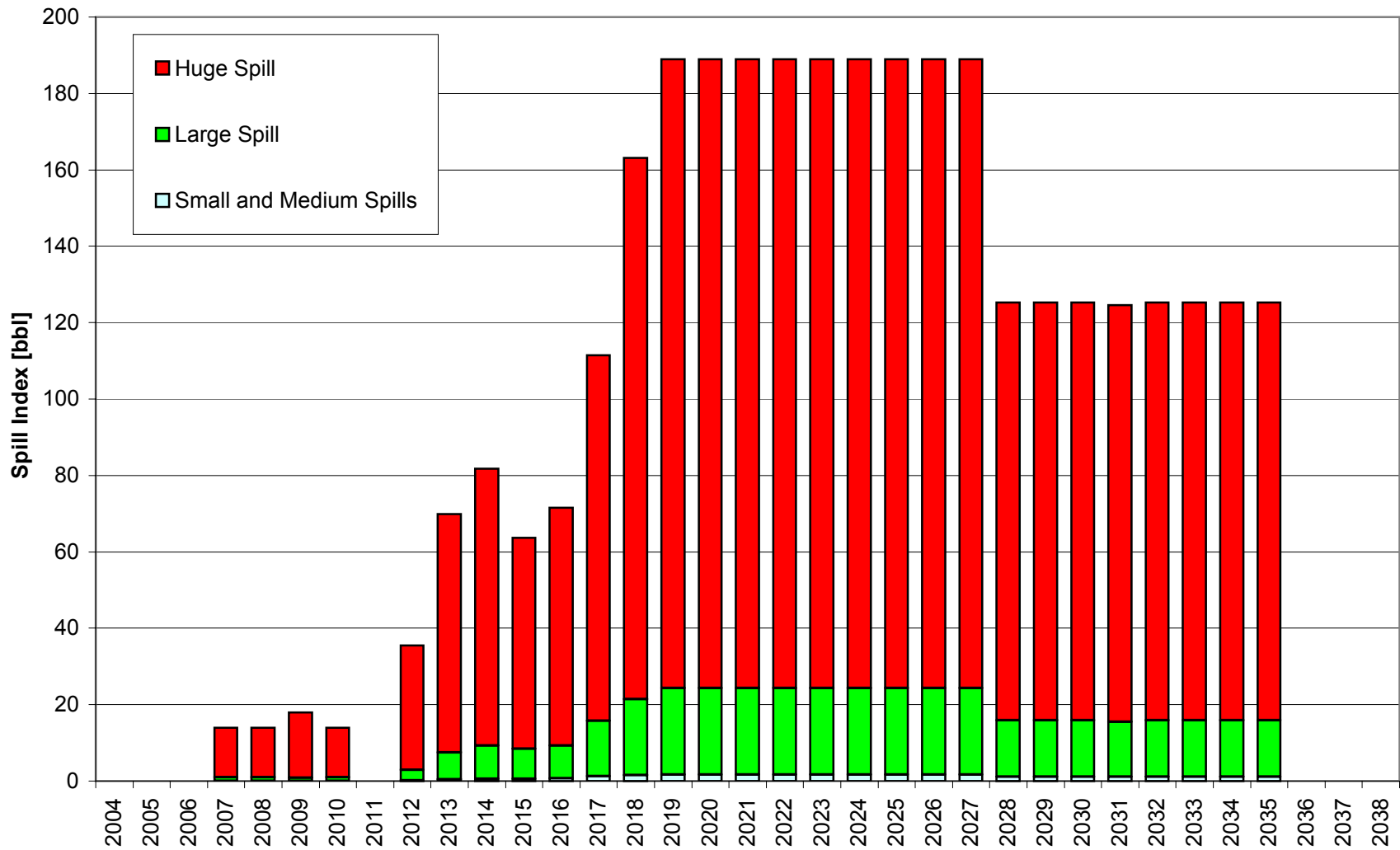
Beaufort Sea Sale 2 Spill Frequency



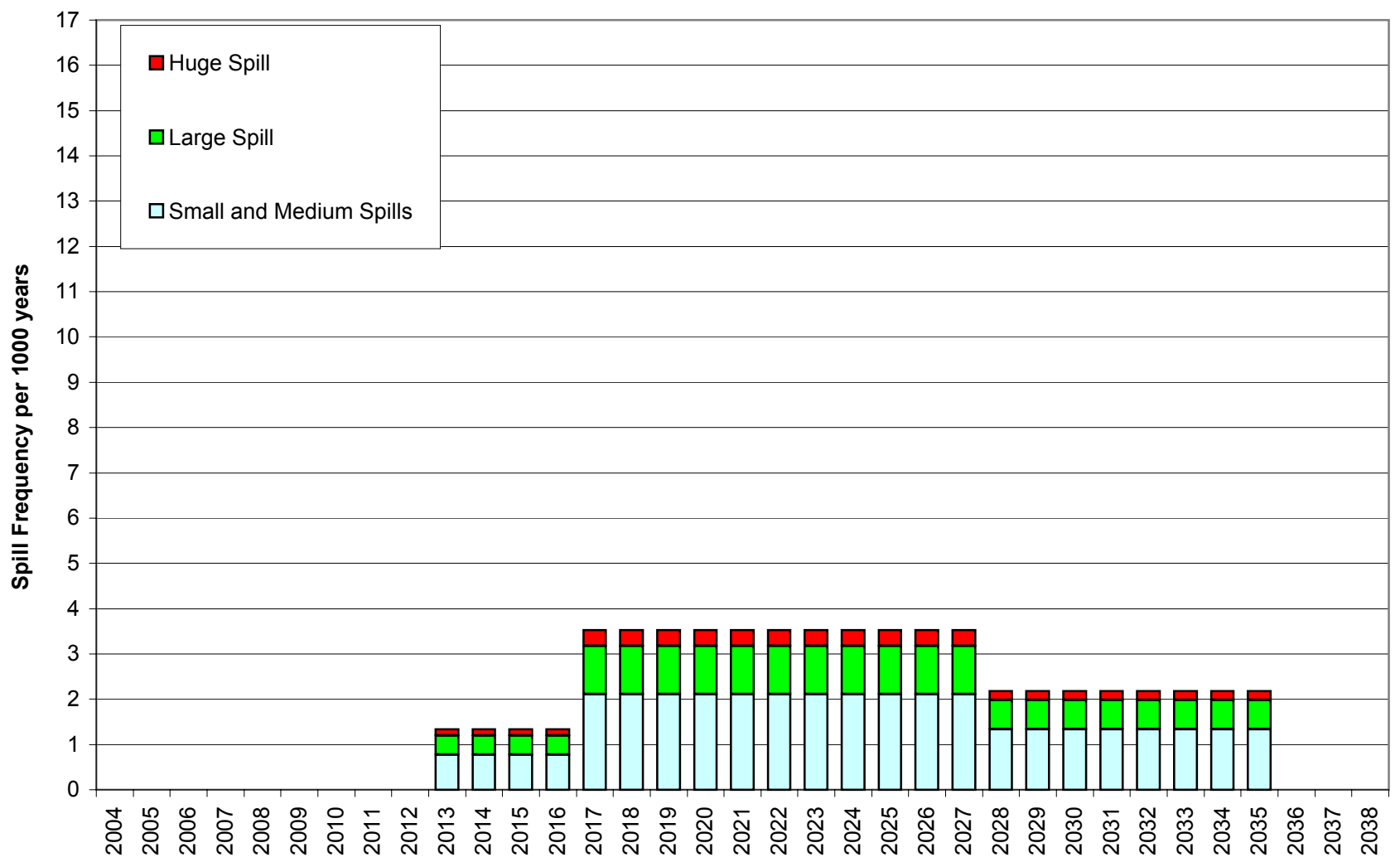
Beaufort Sea Sale 2 Spill Frequency per 10⁹ bbl Produced



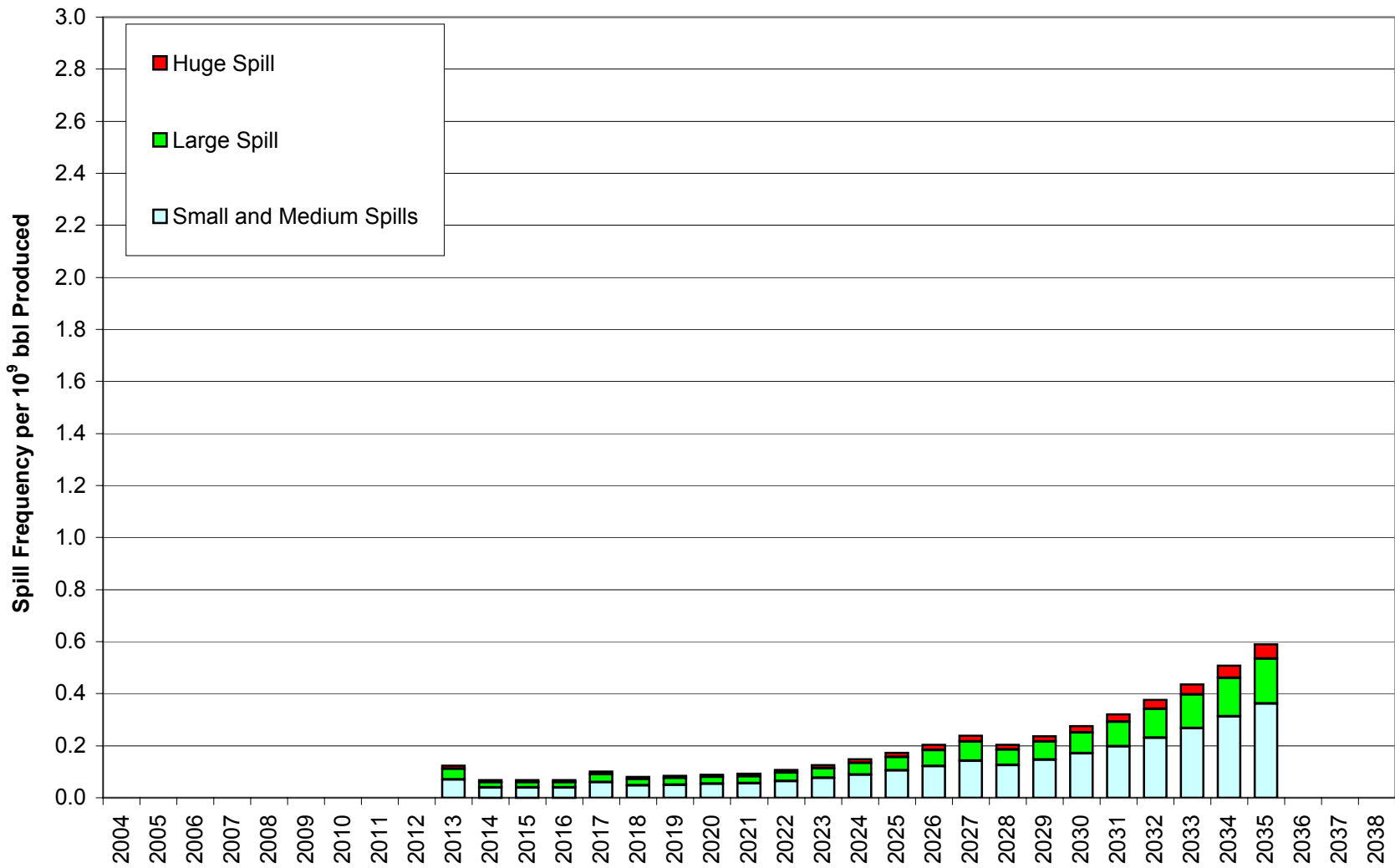
Beaufort Sea Sale 2 Spill Index



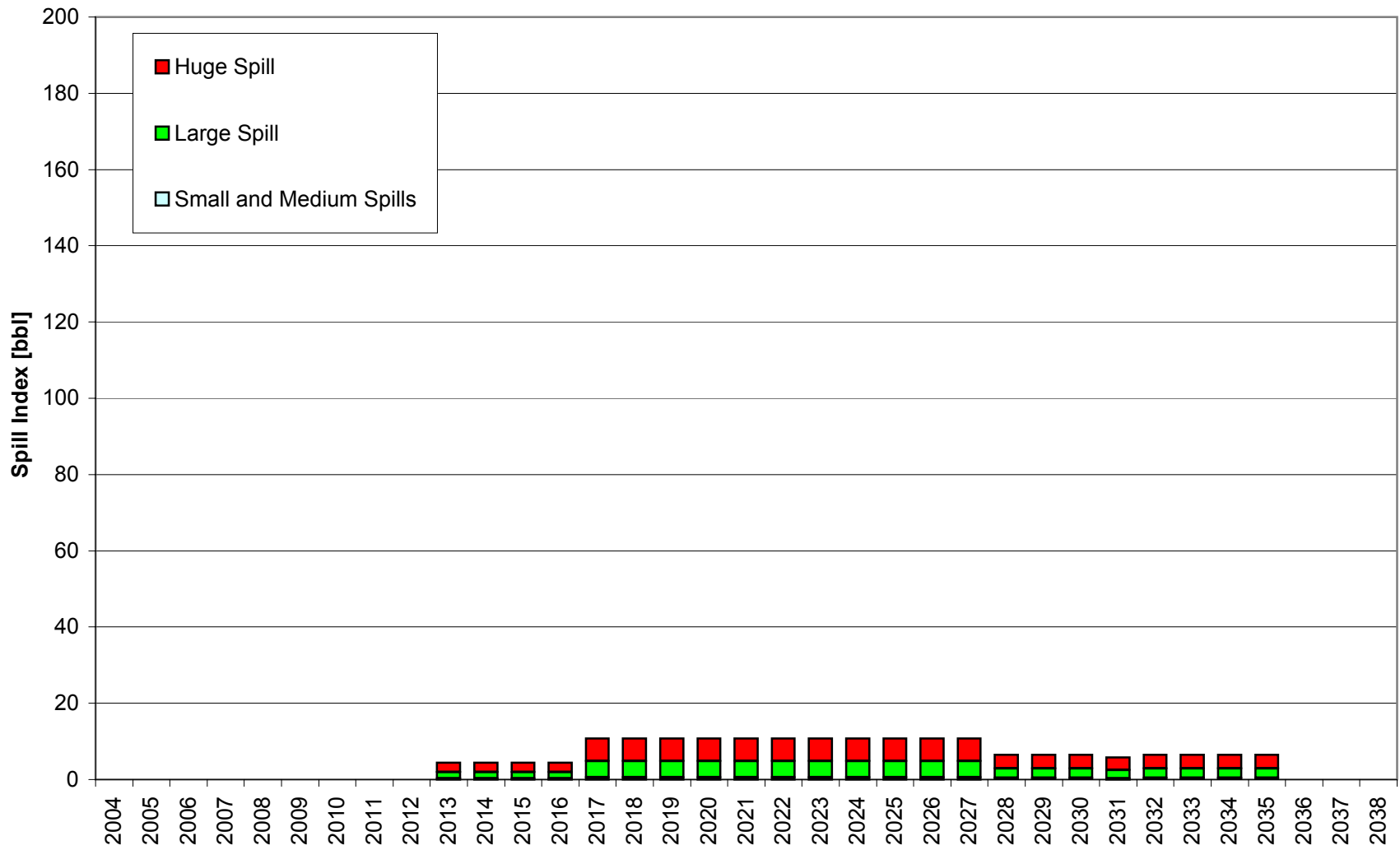
Beaufort Sea Sale 2 Spill Frequency - P/L



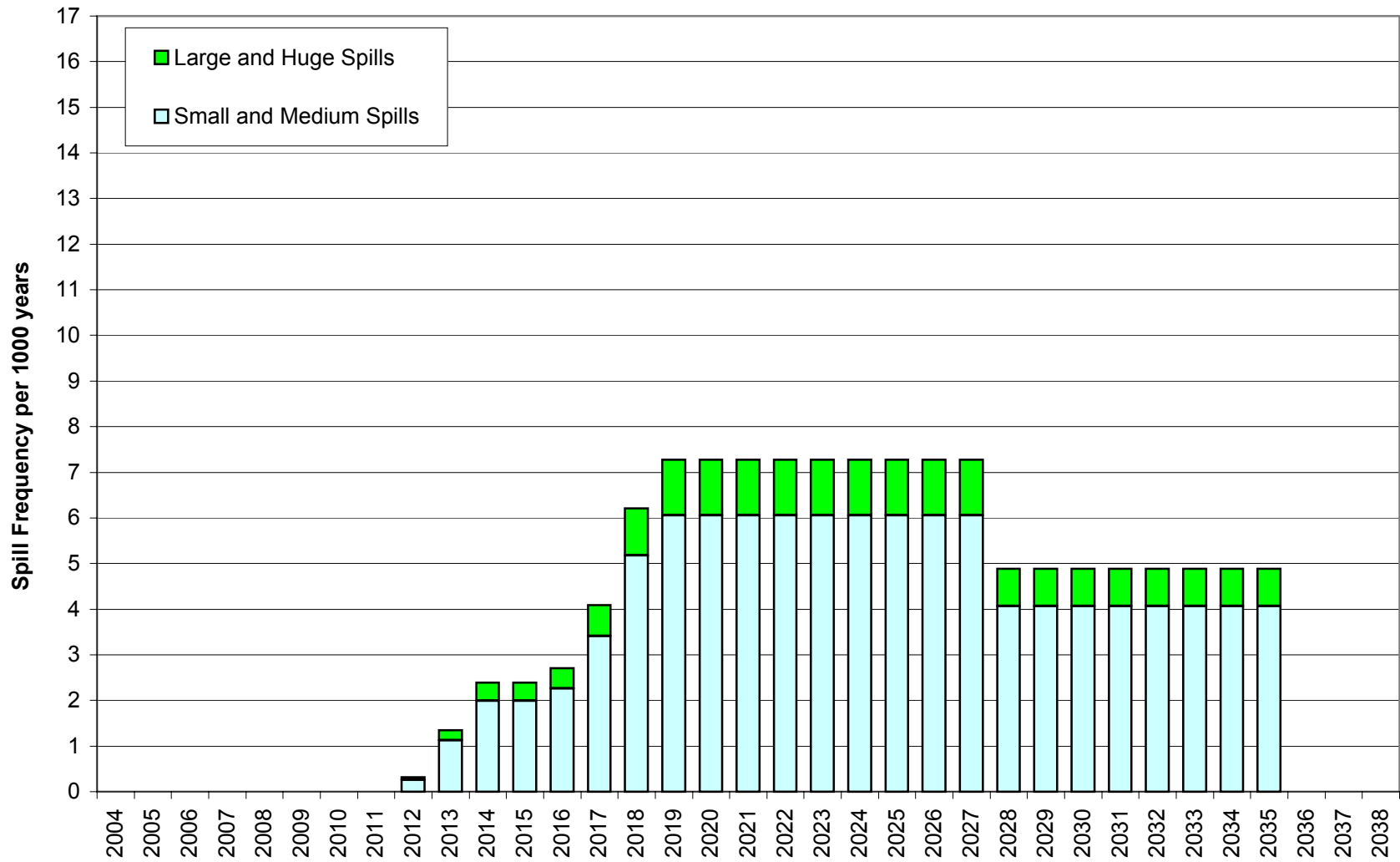
Beaufort Sea Sale 2 Spill Frequency per 10⁹ bbl Produced - P/L



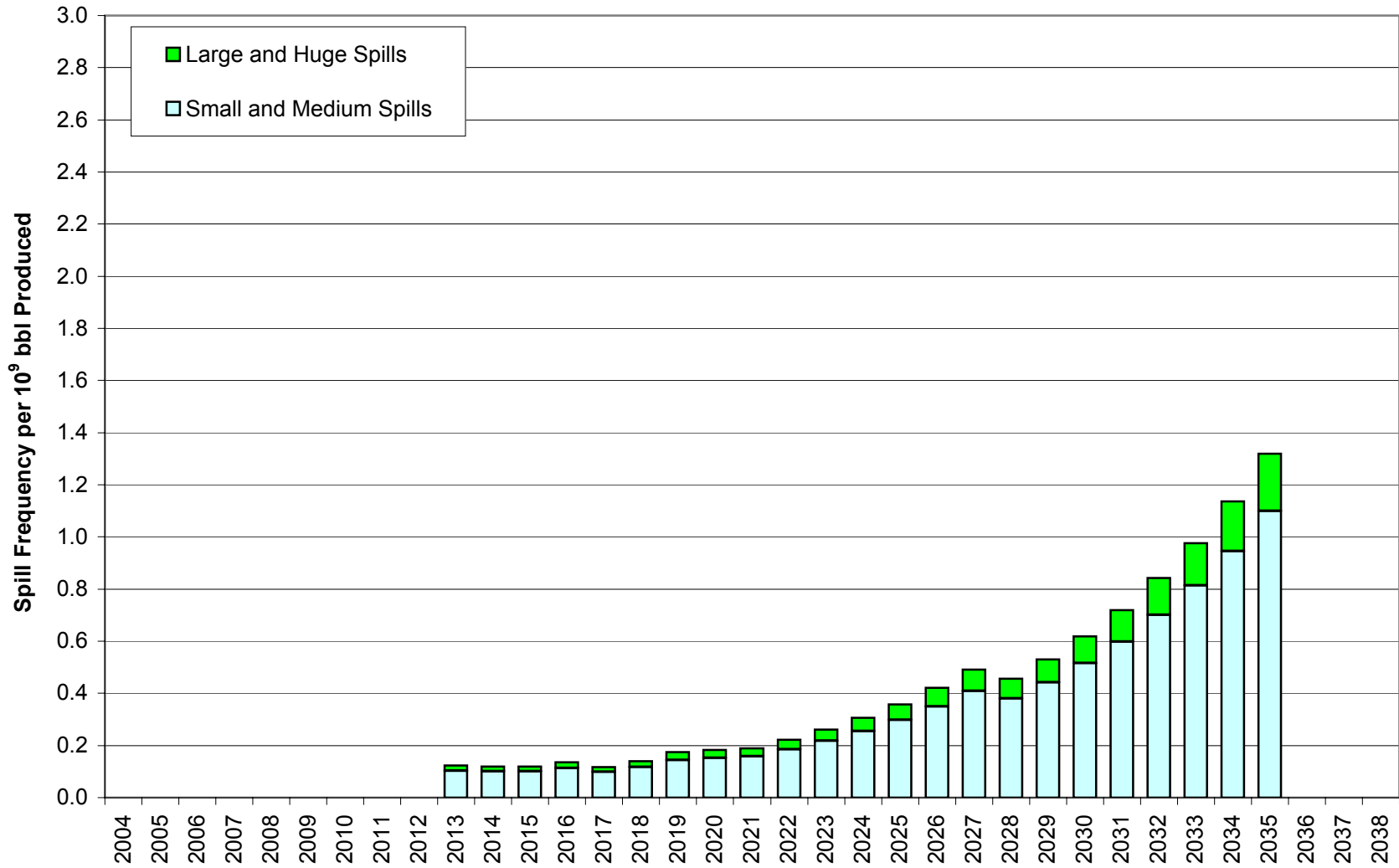
Beaufort Sea Sale 2 Spill Index - P/L



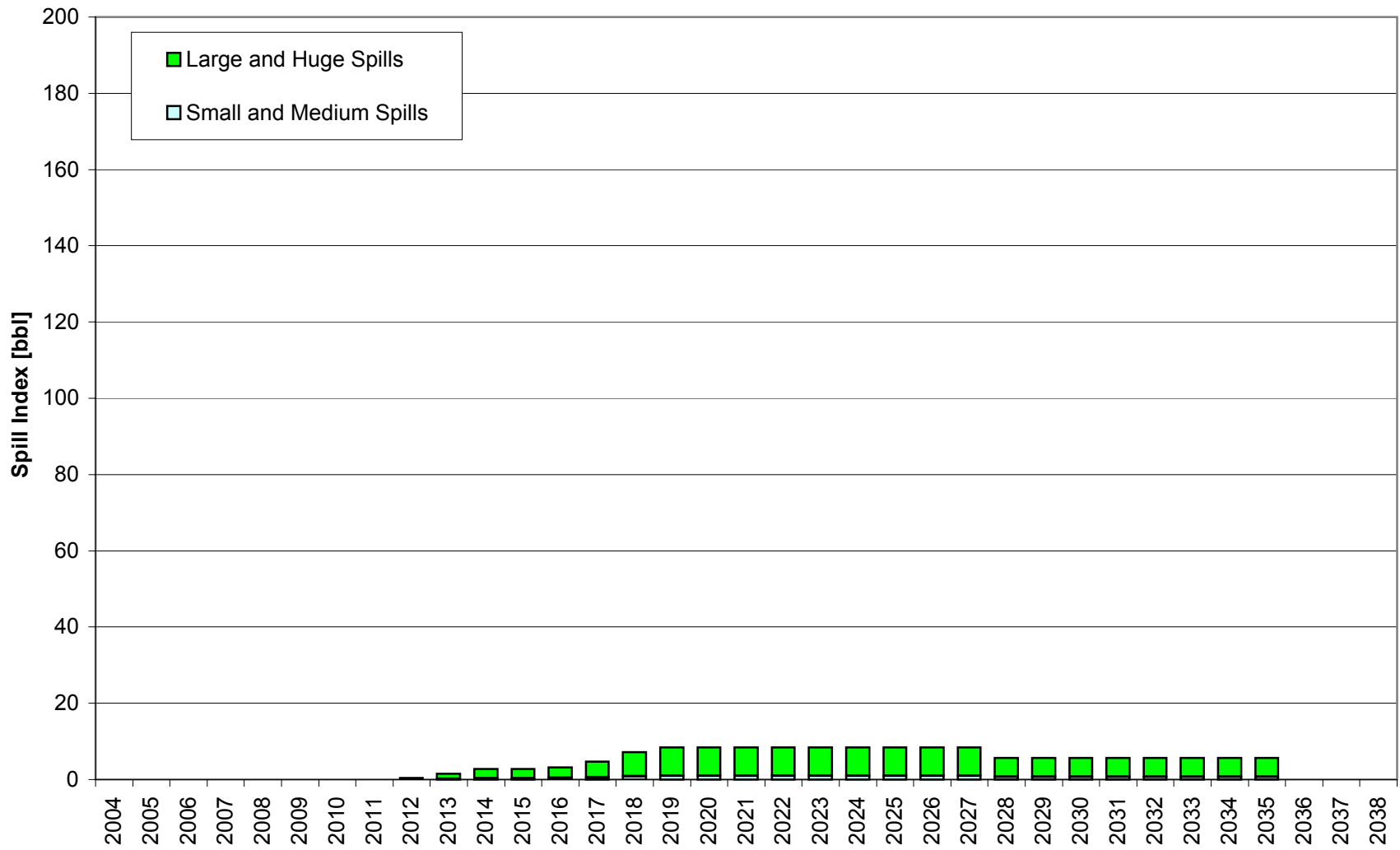
Beaufort Sea Sale 2 Spill Frequency - Platforms



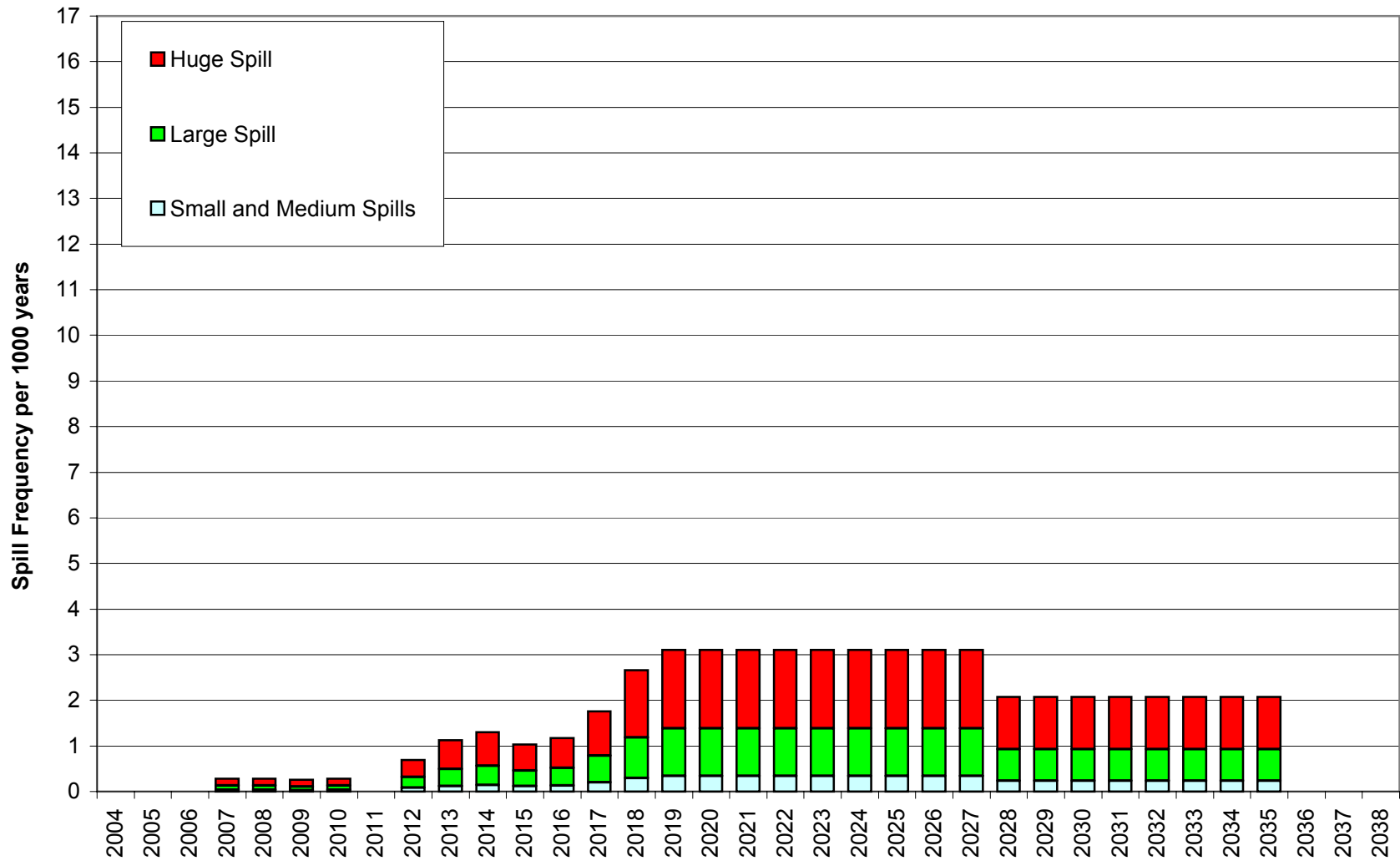
Beaufort Sea Sale 2 Spill Frequency per 10⁹ bbl Produced - Platforms



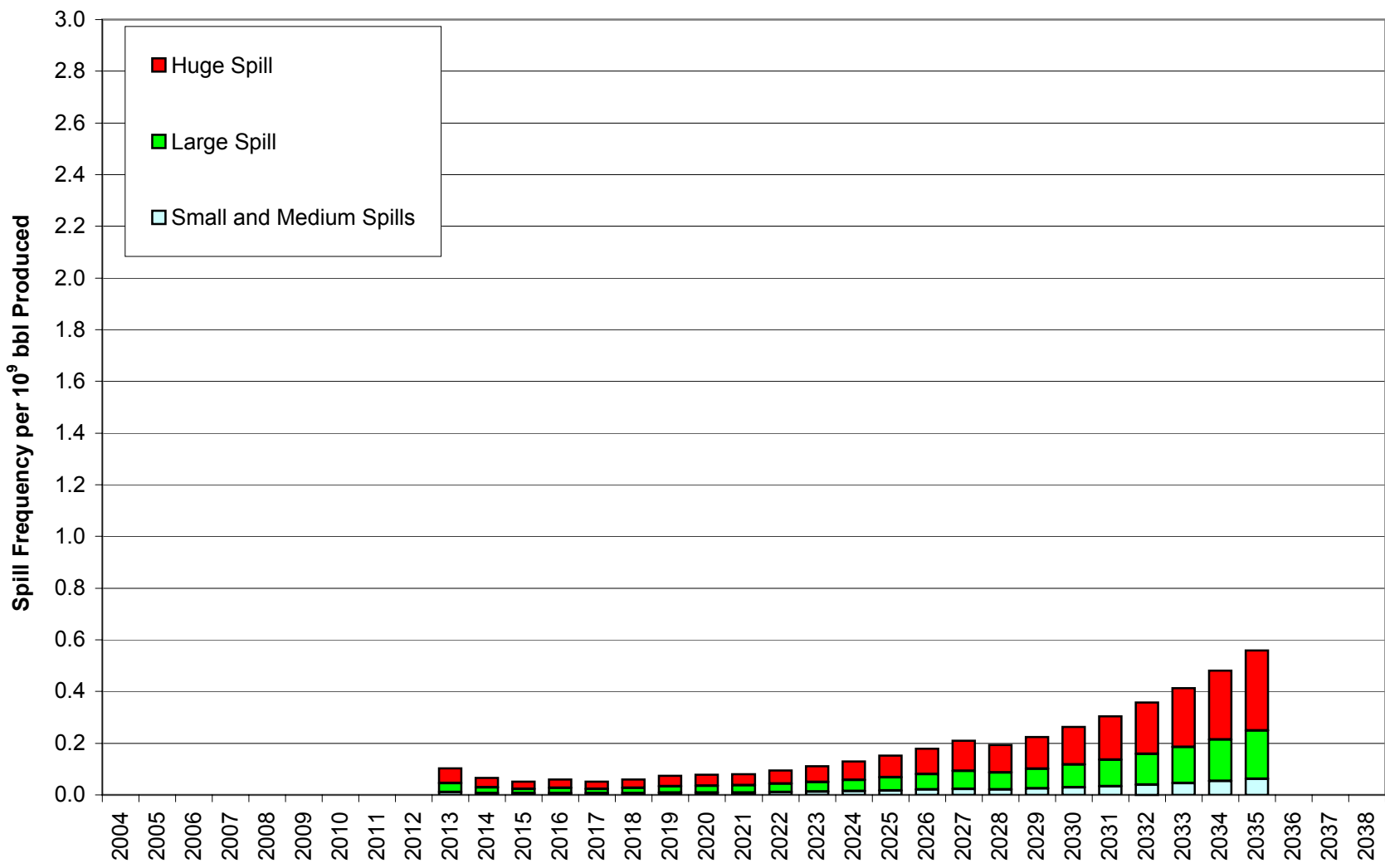
Beaufort Sea Sale 2 Spill Index - Platforms



Beaufort Sea Sale 2 Spill Frequency - Wells



Beaufort Sea Sale 2 Spill Frequency per 10⁹ bbl Produced - Wells



Beaufort Sea Sale 2 Spill Index - Wells

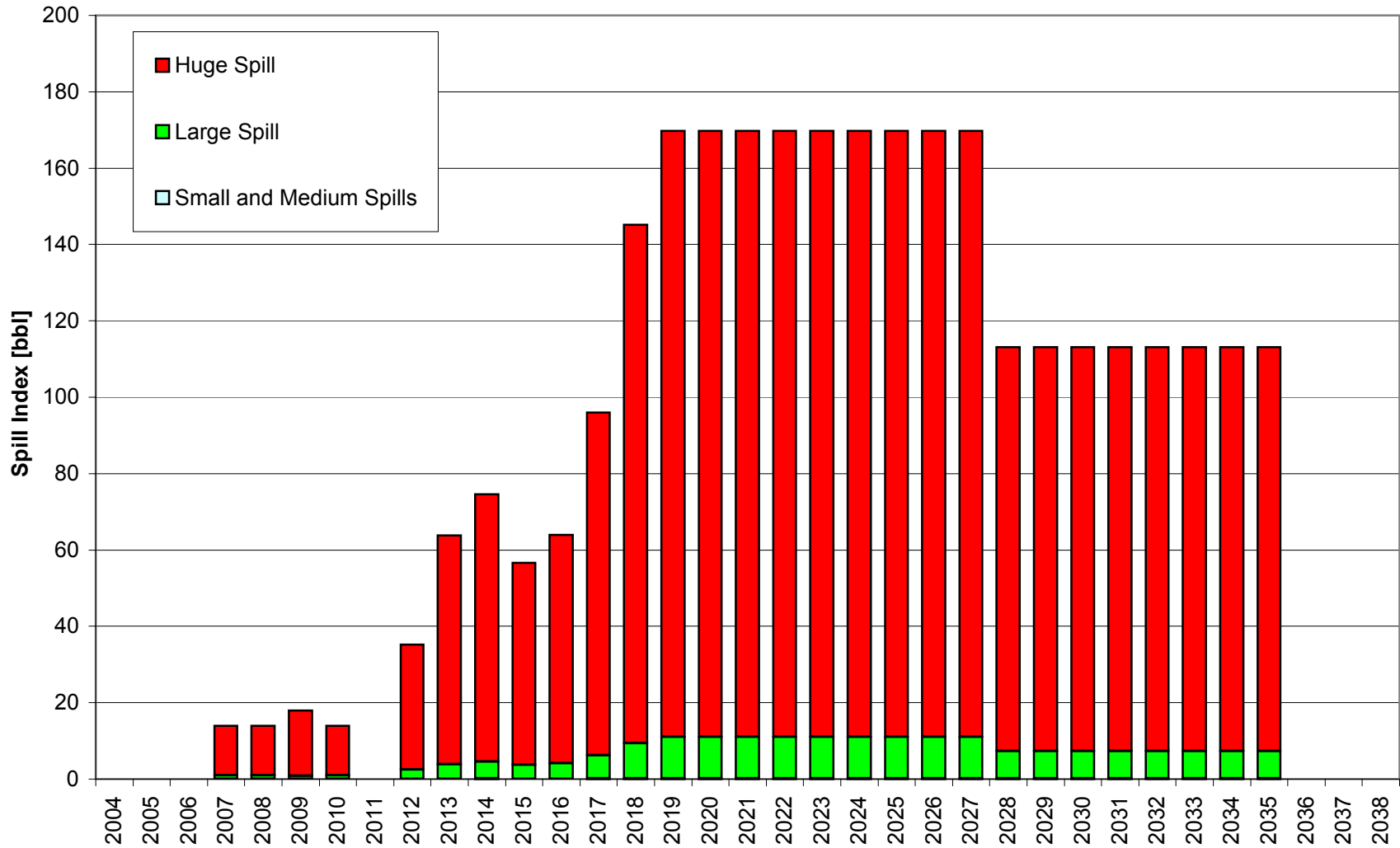


Table 4.3.1
Arctic Spill Occurrence Beaufort Sea Sale 3 P/L

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**Table 4.3.2
Arctic Spill Occurrence Beaufort Sea Sale 3 P/L Summary**

Year	Production [MMbbl]	Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004																			
2005																			
2006																			
2007																			
2008																			
2009																			
2010																			
2011																			
2012																			
2013																			
2014																			
2015																			
2016																			
2017																			
2018																			
2019	30.8	0.560	0.018	0.033	1.293	0.042	0.476	1.854	0.060	0.509	0.920	0.030	3.657	0.294	0.010	5.144	3.068	0.100	9.310
2020	38.6	0.560	0.015	0.033	1.293	0.034	0.476	1.854	0.048	0.509	0.920	0.024	3.657	0.294	0.008	5.144	3.068	0.079	9.310
2021	38.6	0.560	0.015	0.033	1.293	0.034	0.476	1.854	0.048	0.509	0.920	0.024	3.657	0.294	0.008	5.144	3.068	0.079	9.310
2022	38.6	0.560	0.015	0.033	1.293	0.034	0.476	1.854	0.048	0.509	0.920	0.024	3.657	0.294	0.008	5.144	3.068	0.079	9.310
2023	38.6	0.560	0.015	0.033	1.293	0.034	0.476	1.854	0.048	0.509	0.920	0.024	3.657	0.294	0.008	5.144	3.068	0.079	9.310
2024	38.6	0.560	0.015	0.033	1.293	0.034	0.476	1.854	0.048	0.509	0.920	0.024	3.657	0.294	0.008	5.144	3.068	0.079	9.310
2025	34.0	0.560	0.016	0.033	1.293	0.038	0.476	1.854	0.055	0.509	0.920	0.027	3.657	0.294	0.009	5.144	3.068	0.090	9.310
2026	29.9	0.560	0.019	0.033	1.293	0.043	0.476	1.854	0.062	0.509	0.920	0.031	3.657	0.294	0.010	5.144	3.068	0.103	9.310
2027	26.3	0.560	0.021	0.033	1.293	0.049	0.476	1.854	0.070	0.509	0.920	0.035	3.657	0.294	0.011	5.144	3.068	0.117	9.310
2028	23.2	0.560	0.024	0.033	1.293	0.056	0.476	1.854	0.080	0.509	0.920	0.040	3.657	0.294	0.013	5.144	3.068	0.132	9.310
2029	20.4	0.560	0.027	0.033	1.293	0.063	0.476	1.854	0.091	0.509	0.920	0.045	3.657	0.294	0.014	5.144	3.068	0.150	9.310
2030	17.9	0.560	0.031	0.033	1.293	0.072	0.476	1.854	0.104	0.509	0.920	0.051	3.657	0.294	0.016	5.144	3.068	0.171	9.310
2031	15.8	0.560	0.035	0.026	1.293	0.082	0.424	1.854	0.117	0.449	0.920	0.058	3.314	0.294	0.019	4.859	3.068	0.194	8.622
2032	13.9	0.560	0.040	0.033	1.293	0.093	0.476	1.854	0.133	0.509	0.920	0.066	3.657	0.294	0.021	5.144	3.068	0.221	9.310
2033	12.2	0.560	0.046	0.033	1.293	0.106	0.476	1.854	0.152	0.509	0.920	0.075	3.657	0.294	0.024	5.144	3.068	0.251	9.310
2034	10.8	0.560	0.052	0.033	1.293	0.120	0.476	1.854	0.172	0.509	0.920	0.085	3.657	0.294	0.027	5.144	3.068	0.284	9.310
2035	9.5	0.560	0.059	0.033	1.293	0.136	0.476	1.854	0.195	0.509	0.920	0.097	3.657	0.294	0.031	5.144	3.068	0.323	9.310
2036	8.3	0.560	0.068	0.033	1.293	0.156	0.476	1.854	0.223	0.509	0.920	0.111	3.657	0.294	0.035	5.144	3.068	0.370	9.310
2037	7.3	0.560	0.077	0.033	1.293	0.177	0.476	1.854	0.254	0.509	0.920	0.126	3.657	0.294	0.040	5.144	3.068	0.420	9.310
2038	6.5	0.560	0.086	0.033	1.293	0.199	0.476	1.854	0.285	0.509	0.920	0.142	3.657	0.294	0.045	5.144	3.068	0.472	9.310

**Table 4.3.3
Arctic Spill Occurrence Beaufort Sea Sale 3 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2005	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2006	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2007	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2008	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2009	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2010	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2011	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2012	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2013	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2014	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2015	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2016	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2017	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								

**Table 4.3.3
Arctic Spill Occurrence Beaufort Sea Sale 3 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow			0.866			0.174		
	Medium	1	4	0.884	0.354	0.06	0.177	0.071	0.44
	Deep			0.913			0.182		
	Total	1	4		0.354	0.06		0.071	0.44
2019	Shallow			0.866			0.174		
	Medium	2	18	0.884	1.592	0.25	0.177	0.319	1.96
	Deep			0.913			0.182		
	Total	2	18		1.592	0.25		0.319	1.96
2020	Shallow			0.866			0.174		
	Medium	2	38	0.884	3.361	0.53	0.177	0.674	4.13
	Deep			0.913			0.182		
	Total	2	38		3.361	0.53		0.674	4.13
2021	Shallow			0.866			0.174		
	Medium	2	58	0.884	5.130	0.81	0.177	1.029	6.31
	Deep			0.913			0.182		
	Total	2	58		5.130	0.81		1.029	6.31
2022	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2023	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2024	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2025	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2026	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2027	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2028	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2029	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2030	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2031	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40

**Table 4.3.3
Arctic Spill Occurrence Beaufort Sea Sale 3 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2033	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2034	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2035	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2036	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2037	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2038	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40

**Table 4.3.4
Arctic Spill Occurrence Beaufort Sea Sale 3 Platforms Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004										
2005										
2006										
2007										
2008										
2009										
2010										
2011										
2012										
2013										
2014										
2015										
2016										
2017										
2018		0.354		0.056	0.071		0.435	0.425		0.491
2019	30.8	1.592	0.052	0.252	0.319	0.010	1.958	1.911	0.062	2.209
2020	38.6	3.361	0.087	0.531	0.674	0.017	4.133	4.035	0.105	4.664
2021	38.6	5.130	0.133	0.811	1.029	0.027	6.308	6.159	0.160	7.118
2022	38.6	6.014	0.156	0.950	1.206	0.031	7.395	7.221	0.187	8.346
2023	38.6	6.014	0.156	0.950	1.206	0.031	7.395	7.221	0.187	8.346
2024	38.6	6.014	0.156	0.950	1.206	0.031	7.395	7.221	0.187	8.346
2025	34.0	6.014	0.177	0.950	1.206	0.035	7.395	7.221	0.212	8.346
2026	29.9	6.014	0.201	0.950	1.206	0.040	7.395	7.221	0.242	8.346
2027	26.3	6.014	0.229	0.950	1.206	0.046	7.395	7.221	0.275	8.346
2028	23.2	6.014	0.259	0.950	1.206	0.052	7.395	7.221	0.311	8.346
2029	20.4	6.014	0.295	0.950	1.206	0.059	7.395	7.221	0.354	8.346
2030	17.9	6.014	0.336	0.950	1.206	0.067	7.395	7.221	0.403	8.346
2031	15.8	6.014	0.381	0.950	1.206	0.076	7.395	7.221	0.457	8.346
2032	13.9	6.014	0.433	0.950	1.206	0.087	7.395	7.221	0.519	8.346
2033	12.2	6.014	0.493	0.950	1.206	0.099	7.395	7.221	0.592	8.346
2034	10.8	6.014	0.557	0.950	1.206	0.112	7.395	7.221	0.669	8.346
2035	9.5	6.014	0.633	0.950	1.206	0.127	7.395	7.221	0.760	8.346
2036	8.3	6.014	0.725	0.950	1.206	0.145	7.395	7.221	0.870	8.346
2037	7.3	6.014	0.824	0.950	1.206	0.165	7.395	7.221	0.989	8.346
2038	6.5	6.014	0.925	0.950	1.206	0.186	7.395	7.221	1.111	8.346

**Table 4.3.5
Arctic Spill Occurrence Beaufort Sea Sale 3 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2009	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2010	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2011	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2012	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2013	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2014	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2015	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2016	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2017	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													

**Table 4.3.5
Arctic Spill Occurrence Beaufort Sea Sale 3 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		0.500			3.500			1.500			1.000		
	Medium	4	0.500	0.020	0.01	3.500	0.140	0.63	1.500	0.060	1.20	1.000	0.040	8.00
	Deep		0.500			3.500			1.500			1.000		
	Total	4		0.020	0.01		0.140	0.63		0.060	1.20		0.040	8.00
2019	Shallow		0.500			3.500			1.500			1.000		
	Medium	18	0.500	0.090	0.05	3.500	0.630	2.84	1.500	0.270	5.40	1.000	0.180	36.00
	Deep		0.500			3.500			1.500			1.000		
	Total	18		0.090	0.05		0.630	2.84		0.270	5.40		0.180	36.00
2020	Shallow		0.500			3.500			1.500			1.000		
	Medium	38	0.500	0.190	0.10	3.500	1.330	5.99	1.500	0.570	11.40	1.000	0.380	76.00
	Deep		0.500			3.500			1.500			1.000		
	Total	38		0.190	0.10		1.330	5.99		0.570	11.40		0.380	76.00
2021	Shallow		0.500			3.500			1.500			1.000		
	Medium	58	0.500	0.290	0.15	3.500	2.030	9.14	1.500	0.870	17.40	1.000	0.580	116.00
	Deep		0.500			3.500			1.500			1.000		
	Total	58		0.290	0.15		2.030	9.14		0.870	17.40		0.580	116.00
2022	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2023	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2024	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2025	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2026	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2027	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2028	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2029	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2030	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2031	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00

**Table 4.3.5
Arctic Spill Occurrence Beaufort Sea Sale 3 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2033	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2034	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2035	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2036	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2037	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2038	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00

Table 4.3.6

Arctic Spill Occurrence Beaufort Sea Sale 3 Production Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009													
2010													
2011													
2012													
2013													
2014													
2015													
2016													
2017													
2018		0.020		0.010	0.060		0.630	0.100		9.200	0.180		9.840
2019	30.8	0.090	0.003	0.045	0.270	0.009	2.835	0.450	0.015	41.400	0.810	0.026	44.280
2020	38.6	0.190	0.005	0.095	0.570	0.015	5.985	0.950	0.025	87.400	1.710	0.044	93.480
2021	38.6	0.290	0.008	0.145	0.870	0.023	9.135	1.450	0.038	133.400	2.610	0.068	142.680
2022	38.6	0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
2023	38.6	0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
2024	38.6	0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
2025	34.0	0.340	0.010	0.170	1.020	0.030	10.710	1.700	0.050	156.400	3.060	0.090	167.280
2026	29.9	0.340	0.011	0.170	1.020	0.034	10.710	1.700	0.057	156.400	3.060	0.102	167.280
2027	26.3	0.340	0.013	0.170	1.020	0.039	10.710	1.700	0.065	156.400	3.060	0.116	167.280
2028	23.2	0.340	0.015	0.170	1.020	0.044	10.710	1.700	0.073	156.400	3.060	0.132	167.280
2029	20.4	0.340	0.017	0.170	1.020	0.050	10.710	1.700	0.083	156.400	3.060	0.150	167.280
2030	17.9	0.340	0.019	0.170	1.020	0.057	10.710	1.700	0.095	156.400	3.060	0.171	167.280
2031	15.8	0.340	0.022	0.170	1.020	0.065	10.710	1.700	0.108	156.400	3.060	0.194	167.280
2032	13.9	0.340	0.024	0.170	1.020	0.073	10.710	1.700	0.122	156.400	3.060	0.220	167.280
2033	12.2	0.340	0.028	0.170	1.020	0.084	10.710	1.700	0.139	156.400	3.060	0.251	167.280
2034	10.8	0.340	0.031	0.170	1.020	0.094	10.710	1.700	0.157	156.400	3.060	0.283	167.280
2035	9.5	0.340	0.036	0.170	1.020	0.107	10.710	1.700	0.179	156.400	3.060	0.322	167.280
2036	8.3	0.340	0.041	0.170	1.020	0.123	10.710	1.700	0.205	156.400	3.060	0.369	167.280
2037	7.3	0.340	0.047	0.170	1.020	0.140	10.710	1.700	0.233	156.400	3.060	0.419	167.280
2038	6.5	0.340	0.052	0.170	1.020	0.157	10.710	1.700	0.262	156.400	3.060	0.471	167.280

**Table 4.3.7
Arctic Spill Occurrence Beaufort Sea Sale 3 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2005	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2006	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2007	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2008	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2010	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2011	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2012	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2013	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2014	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2015	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2016	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2017	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00

**Table 4.3.7
Arctic Spill Occurrence Beaufort Sea Sale 3 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2019	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2020	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2021	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2022	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2023	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2024	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2025	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2026	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2027	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2028	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2029	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2030	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2031	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

**Table 4.3.7
Arctic Spill Occurrence Beaufort Sea Sale 3 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2033	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2034	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2035	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2036	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2037	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2038	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.3.8

Arctic Spill Occurrence Beaufort Sea Sale 3 Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009													
2010		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2011													
2012		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2013		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2014													
2015		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2016													
2017		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2018		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2019	30.8												
2020	38.6												
2021	38.6												
2022	38.6												
2023	38.6												
2024	38.6												
2025	34.0												
2026	29.9												
2027	26.3												
2028	23.2												
2029	20.4												
2030	17.9												
2031	15.8												
2032	13.9												
2033	12.2												
2034	10.8												
2035	9.5												
2036	8.3												
2037	7.3												
2038	6.5												

**Table 4.3.9
Arctic Spill Occurrence Beaufort Sea Sale 3 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2009	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2011	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2012	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2013	Shallow		1.300			9.080			3.900			3.900		
	Medium	1	1.300	0.013	0.01	9.080	0.091	0.41	3.900	0.039	0.78	3.900	0.039	7.80
	Deep		1.300			9.080			3.900			3.900		
	Total	1		0.013	0.01		0.091	0.41		0.039	0.78		0.039	7.80
2014	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2015	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2016	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2017	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.3.9
Arctic Spill Occurrence Beaufort Sea Sale 3 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] = 500		Spill Index bbl	Average Spill [bbl] = 4500		Spill Index bbl	Average Spill [bbl] = 20000		Spill Index bbl	Average Spill [bbl] = 200000		Spill Index bbl
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2019	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2020	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2021	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2022	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2023	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2024	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2025	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2026	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2027	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2028	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2029	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2030	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2031	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.3.9
Arctic Spill Occurrence Beaufort Sea Sale 3 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2033	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2034	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2035	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2036	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2037	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2038	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.3.10

Arctic Spill Occurrence Beaufort Sea Sale 3 Development Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009													
2010													
2011													
2012													
2013		0.013	0.007	0.039	0.409	0.078	8.580	0.130	8.995				
2014		0.026	0.013	0.078	0.817	0.156	17.160	0.260	17.990				
2015		0.026	0.013	0.078	0.817	0.156	17.160	0.260	17.990				
2016													
2017													
2018													
2019	30.8												
2020	38.6												
2021	38.6												
2022	38.6												
2023	38.6												
2024	38.6												
2025	34.0												
2026	29.9												
2027	26.3												
2028	23.2												
2029	20.4												
2030	17.9												
2031	15.8												
2032	13.9												
2033	12.2												
2034	10.8												
2035	9.5												
2036	8.3												
2037	7.3												
2038	6.5												

**Table 4.3.11
Arctic Spill Occurrence Beaufort Sea Sale 3 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2005	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2006	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2007	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2008	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2009	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2010	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032	0.016	0.095	0.995	0.150	12.900	0.277	13.911				
	Total		0.032	0.016	0.095	0.995	0.150	12.900	0.277	13.911				
2011	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2012	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032	0.016	0.095	0.995	0.150	12.900	0.277	13.911				
	Total		0.032	0.016	0.095	0.995	0.150	12.900	0.277	13.911				
2013	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032	0.016	0.095	0.995	0.150	12.900	0.277	13.911				
	Development Wells		0.013	0.007	0.039	0.409	0.078	8.580	0.130	8.995				
Total		0.045	0.022	0.134	1.404	0.228	21.480	0.407	22.906					

**Table 4.3.11
Arctic Spill Occurrence Beaufort Sea Sale 3 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
2014	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
	Total		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2015	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
	Total		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901
2016	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2017	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
	Total		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2018	Pipeline													
	Platforms		0.354		0.056	0.071		0.435			0.425		0.491	
	Production Wells		0.020		0.010	0.060		0.630	0.100		9.200	0.180		9.840
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
	Total		0.405		0.082	0.226		2.060	0.250		22.100	0.881		24.242
2019	Pipeline	30.8	1.854	0.060	0.509	0.920	0.030	3.657	0.294	0.010	5.144	3.068	0.100	9.310
	Platforms		1.592	0.052	0.252	0.319	0.010	1.958				1.911	0.062	2.209
	Production Wells		0.090	0.003	0.045	0.270	0.009	2.835	0.450	0.015	41.400	0.810	0.026	44.280
	Exploration Wells													
	Development Wells													
	Total		3.536	0.115	0.806	1.509	0.049	8.449	0.744	0.024	46.544	5.789	0.188	55.799
2020	Pipeline	38.6	1.854	0.048	0.509	0.920	0.024	3.657	0.294	0.008	5.144	3.068	0.079	9.310
	Platforms		3.361	0.087	0.531	0.674	0.017	4.133				4.035	0.105	4.664
	Production Wells		0.190	0.005	0.095	0.570	0.015	5.985	0.950	0.025	87.400	1.710	0.044	93.480
	Exploration Wells													
	Development Wells													
	Total		5.405	0.140	1.135	2.164	0.056	13.774	1.244	0.032	92.544	8.813	0.228	107.453
2021	Pipeline	38.6	1.854	0.048	0.509	0.920	0.024	3.657	0.294	0.008	5.144	3.068	0.079	9.310
	Platforms		5.130	0.133	0.811	1.029	0.027	6.308				6.159	0.160	7.118
	Production Wells		0.290	0.008	0.145	0.870	0.023	9.135	1.450	0.038	133.400	2.610	0.068	142.680
	Exploration Wells													
	Development Wells													
	Total		7.274	0.188	1.464	2.819	0.073	19.099	1.744	0.045	138.544	11.837	0.307	159.108
2022	Pipeline	38.6	1.854	0.048	0.509	0.920	0.024	3.657	0.294	0.008	5.144	3.068	0.079	9.310
	Platforms		6.014	0.156	0.950	1.206	0.031	7.395				7.221	0.187	8.346
	Production Wells		0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.213	1.629	3.146	0.082	21.762	1.994	0.052	161.544	13.349	0.346	184.935
2023	Pipeline	38.6	1.854	0.048	0.509	0.920	0.024	3.657	0.294	0.008	5.144	3.068	0.079	9.310
	Platforms		6.014	0.156	0.950	1.206	0.031	7.395				7.221	0.187	8.346
	Production Wells		0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.213	1.629	3.146	0.082	21.762	1.994	0.052	161.544	13.349	0.346	184.935

**Table 4.3.11
Arctic Spill Occurrence Beaufort Sea Sale 3 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2024	Pipeline	38.6	1.854	0.048	0.509	0.920	0.024	3.657	0.294	0.008	5.144	3.068	0.079	9.310
	Platforms		6.014	0.156	0.950	1.206	0.031	7.395				7.221	0.187	8.346
	Production Wells		0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.213	1.629	3.146	0.082	21.762	1.994	0.052	161.544	13.349	0.346	184.935
2025	Pipeline	34.0	1.854	0.055	0.509	0.920	0.027	3.657	0.294	0.009	5.144	3.068	0.090	9.310
	Platforms		6.014	0.177	0.950	1.206	0.035	7.395				7.221	0.212	8.346
	Production Wells		0.340	0.010	0.170	1.020	0.030	10.710	1.700	0.050	156.400	3.060	0.090	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.241	1.629	3.146	0.093	21.762	1.994	0.059	161.544	13.349	0.393	184.935
2026	Pipeline	29.9	1.854	0.062	0.509	0.920	0.031	3.657	0.294	0.010	5.144	3.068	0.103	9.310
	Platforms		6.014	0.201	0.950	1.206	0.040	7.395				7.221	0.242	8.346
	Production Wells		0.340	0.011	0.170	1.020	0.034	10.710	1.700	0.057	156.400	3.060	0.102	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.275	1.629	3.146	0.105	21.762	1.994	0.067	161.544	13.349	0.446	184.935
2027	Pipeline	26.3	1.854	0.070	0.509	0.920	0.035	3.657	0.294	0.011	5.144	3.068	0.117	9.310
	Platforms		6.014	0.229	0.950	1.206	0.046	7.395				7.221	0.275	8.346
	Production Wells		0.340	0.013	0.170	1.020	0.039	10.710	1.700	0.065	156.400	3.060	0.116	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.312	1.629	3.146	0.120	21.762	1.994	0.076	161.544	13.349	0.508	184.935
2028	Pipeline	23.2	1.854	0.080	0.509	0.920	0.040	3.657	0.294	0.013	5.144	3.068	0.132	9.310
	Platforms		6.014	0.259	0.950	1.206	0.052	7.395				7.221	0.311	8.346
	Production Wells		0.340	0.015	0.170	1.020	0.044	10.710	1.700	0.073	156.400	3.060	0.132	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.354	1.629	3.146	0.136	21.762	1.994	0.086	161.544	13.349	0.575	184.935
2029	Pipeline	20.4	1.854	0.091	0.509	0.920	0.045	3.657	0.294	0.014	5.144	3.068	0.150	9.310
	Platforms		6.014	0.295	0.950	1.206	0.059	7.395				7.221	0.354	8.346
	Production Wells		0.340	0.017	0.170	1.020	0.050	10.710	1.700	0.083	156.400	3.060	0.150	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.402	1.629	3.146	0.154	21.762	1.994	0.098	161.544	13.349	0.654	184.935
2030	Pipeline	17.9	1.854	0.104	0.509	0.920	0.051	3.657	0.294	0.016	5.144	3.068	0.171	9.310
	Platforms		6.014	0.336	0.950	1.206	0.067	7.395				7.221	0.403	8.346
	Production Wells		0.340	0.019	0.170	1.020	0.057	10.710	1.700	0.095	156.400	3.060	0.171	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.459	1.629	3.146	0.176	21.762	1.994	0.111	161.544	13.349	0.746	184.935
2031	Pipeline	15.8	1.854	0.117	0.449	0.920	0.058	3.314	0.294	0.019	4.859	3.068	0.194	8.622
	Platforms		6.014	0.381	0.950	1.206	0.076	7.395				7.221	0.457	8.346
	Production Wells		0.340	0.022	0.170	1.020	0.065	10.710	1.700	0.108	156.400	3.060	0.194	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.520	1.570	3.146	0.199	21.419	1.994	0.126	161.259	13.349	0.845	184.248
2032	Pipeline	13.9	1.854	0.133	0.509	0.920	0.066	3.657	0.294	0.021	5.144	3.068	0.221	9.310
	Platforms		6.014	0.433	0.950	1.206	0.087	7.395				7.221	0.519	8.346
	Production Wells		0.340	0.024	0.170	1.020	0.073	10.710	1.700	0.122	156.400	3.060	0.220	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.591	1.629	3.146	0.226	21.762	1.994	0.143	161.544	13.349	0.960	184.935
2033	Pipeline	12.2	1.854	0.152	0.509	0.920	0.075	3.657	0.294	0.024	5.144	3.068	0.251	9.310
	Platforms		6.014	0.493	0.950	1.206	0.099	7.395				7.221	0.592	8.346
	Production Wells		0.340	0.028	0.170	1.020	0.084	10.710	1.700	0.139	156.400	3.060	0.251	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.673	1.629	3.146	0.258	21.762	1.994	0.163	161.544	13.349	1.094	184.935

**Table 4.3.11
Arctic Spill Occurrence Beaufort Sea Sale 3 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
2034	Pipeline	10.8	1.854	0.172	0.509	0.920	0.085	3.657	0.294	0.027	5.144	3.068	0.284	9.310
	Platforms		6.014	0.557	0.950	1.206	0.112	7.395				7.221	0.669	8.346
	Production Wells		0.340	0.031	0.170	1.020	0.094	10.710	1.700	0.157	156.400	3.060	0.283	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.760	1.629	3.146	0.291	21.762	1.994	0.185	161.544	13.349	1.236	184.935
2035	Pipeline	9.5	1.854	0.195	0.509	0.920	0.097	3.657	0.294	0.031	5.144	3.068	0.323	9.310
	Platforms		6.014	0.633	0.950	1.206	0.127	7.395				7.221	0.760	8.346
	Production Wells		0.340	0.036	0.170	1.020	0.107	10.710	1.700	0.179	156.400	3.060	0.322	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.864	1.629	3.146	0.331	21.762	1.994	0.210	161.544	13.349	1.405	184.935
2036	Pipeline	8.3	1.854	0.223	0.509	0.920	0.111	3.657	0.294	0.035	5.144	3.068	0.370	9.310
	Platforms		6.014	0.725	0.950	1.206	0.145	7.395				7.221	0.870	8.346
	Production Wells		0.340	0.041	0.170	1.020	0.123	10.710	1.700	0.205	156.400	3.060	0.369	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.989	1.629	3.146	0.379	21.762	1.994	0.240	161.544	13.349	1.608	184.935
2037	Pipeline	7.3	1.854	0.254	0.509	0.920	0.126	3.657	0.294	0.040	5.144	3.068	0.420	9.310
	Platforms		6.014	0.824	0.950	1.206	0.165	7.395				7.221	0.989	8.346
	Production Wells		0.340	0.047	0.170	1.020	0.140	10.710	1.700	0.233	156.400	3.060	0.419	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	1.124	1.629	3.146	0.431	21.762	1.994	0.273	161.544	13.349	1.829	184.935
2038	Pipeline	6.5	1.854	0.285	0.509	0.920	0.142	3.657	0.294	0.045	5.144	3.068	0.472	9.310
	Platforms		6.014	0.925	0.950	1.206	0.186	7.395				7.221	1.111	8.346
	Production Wells		0.340	0.052	0.170	1.020	0.157	10.710	1.700	0.262	156.400	3.060	0.471	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	1.263	1.629	3.146	0.484	21.762	1.994	0.307	161.544	13.349	2.054	184.935

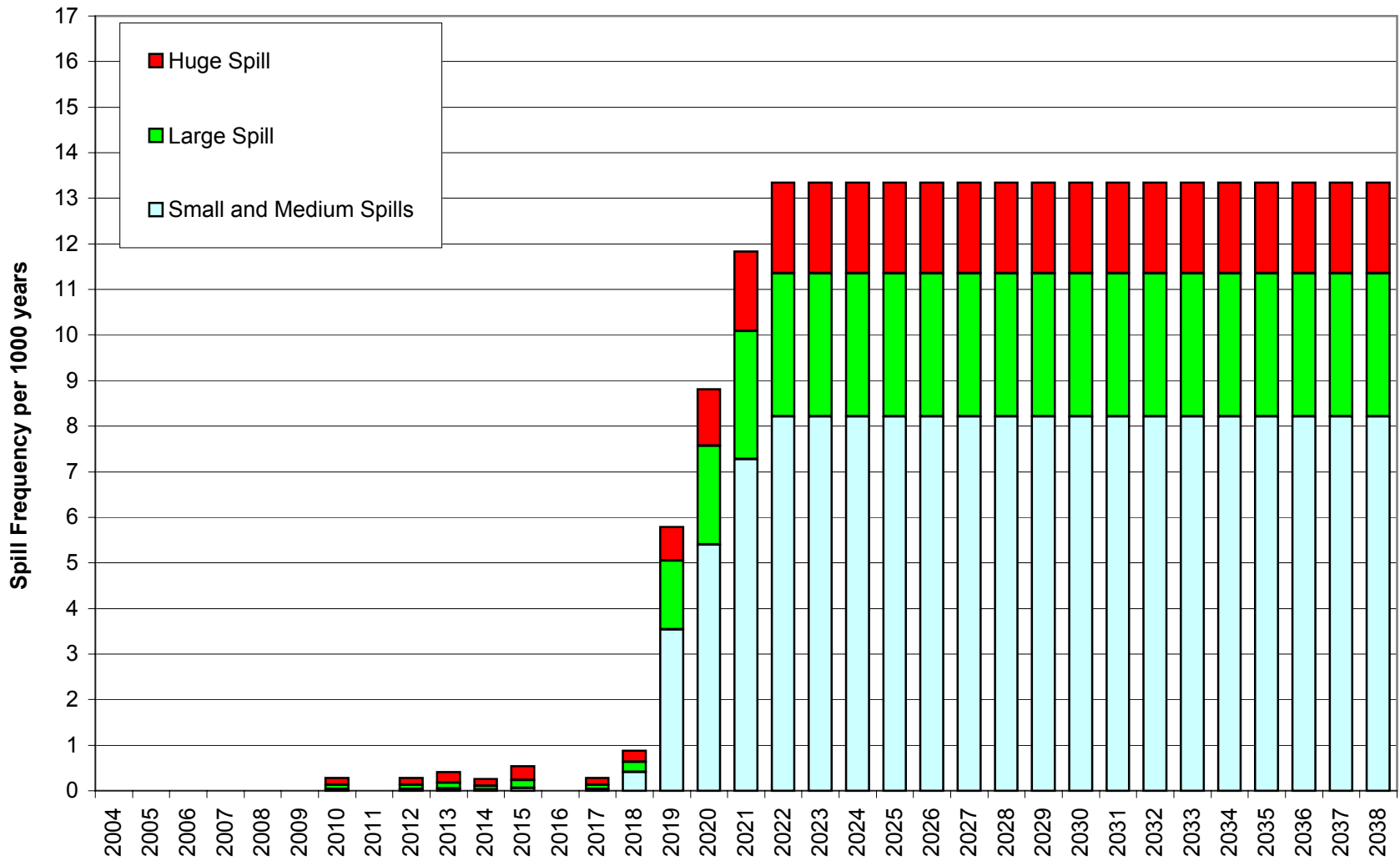
**Table 4.3.12
Arctic Spill Occurrence Beaufort Sea Sale 3 Annual Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009													
2010		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2011													
2012		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2013		0.04		0.022	0.13		1.404	0.228		21.48	0.407		22.906
2014		0.03		0.013	0.08		0.817	0.156		17.16	0.260		17.990
2015		0.06		0.029	0.17		1.812	0.306		30.06	0.537		31.901
2016													
2017		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2018		0.41		0.082	0.23		2.060	0.250		22.10	0.881		24.242
2019	30.8	3.54	0.115	0.806	1.51	0.049	8.449	0.744	0.024	46.54	5.789	0.188	55.799
2020	38.6	5.40	0.140	1.135	2.16	0.056	13.774	1.244	0.032	92.54	8.813	0.228	107.453
2021	38.6	7.27	0.188	1.464	2.82	0.073	19.099	1.744	0.045	138.54	11.837	0.307	159.108
2022	38.6	8.21	0.213	1.629	3.15	0.082	21.762	1.994	0.052	161.54	13.349	0.346	184.935
2023	38.6	8.21	0.213	1.629	3.15	0.082	21.762	1.994	0.052	161.54	13.349	0.346	184.935
2024	38.6	8.21	0.213	1.629	3.15	0.082	21.762	1.994	0.052	161.54	13.349	0.346	184.935
2025	34.0	8.21	0.241	1.629	3.15	0.093	21.762	1.994	0.059	161.54	13.349	0.393	184.935
2026	29.9	8.21	0.275	1.629	3.15	0.105	21.762	1.994	0.067	161.54	13.349	0.446	184.935
2027	26.3	8.21	0.312	1.629	3.15	0.120	21.762	1.994	0.076	161.54	13.349	0.508	184.935
2028	23.2	8.21	0.354	1.629	3.15	0.136	21.762	1.994	0.086	161.54	13.349	0.575	184.935
2029	20.4	8.21	0.402	1.629	3.15	0.154	21.762	1.994	0.098	161.54	13.349	0.654	184.935
2030	17.9	8.21	0.459	1.629	3.15	0.176	21.762	1.994	0.111	161.54	13.349	0.746	184.935
2031	15.8	8.21	0.520	1.570	3.15	0.199	21.419	1.994	0.126	161.26	13.349	0.845	184.248
2032	13.9	8.21	0.591	1.629	3.15	0.226	21.762	1.994	0.143	161.54	13.349	0.960	184.935
2033	12.2	8.21	0.673	1.629	3.15	0.258	21.762	1.994	0.163	161.54	13.349	1.094	184.935
2034	10.8	8.21	0.760	1.629	3.15	0.291	21.762	1.994	0.185	161.54	13.349	1.236	184.935
2035	9.5	8.21	0.864	1.629	3.15	0.331	21.762	1.994	0.210	161.54	13.349	1.405	184.935
2036	8.3	8.21	0.989	1.629	3.15	0.379	21.762	1.994	0.240	161.54	13.349	1.608	184.935
2037	7.3	8.21	1.124	1.629	3.15	0.431	21.762	1.994	0.273	161.54	13.349	1.829	184.935
2038	6.5	8.21	1.263	1.629	3.15	0.484	21.762	1.994	0.307	161.54	13.349	2.054	184.935

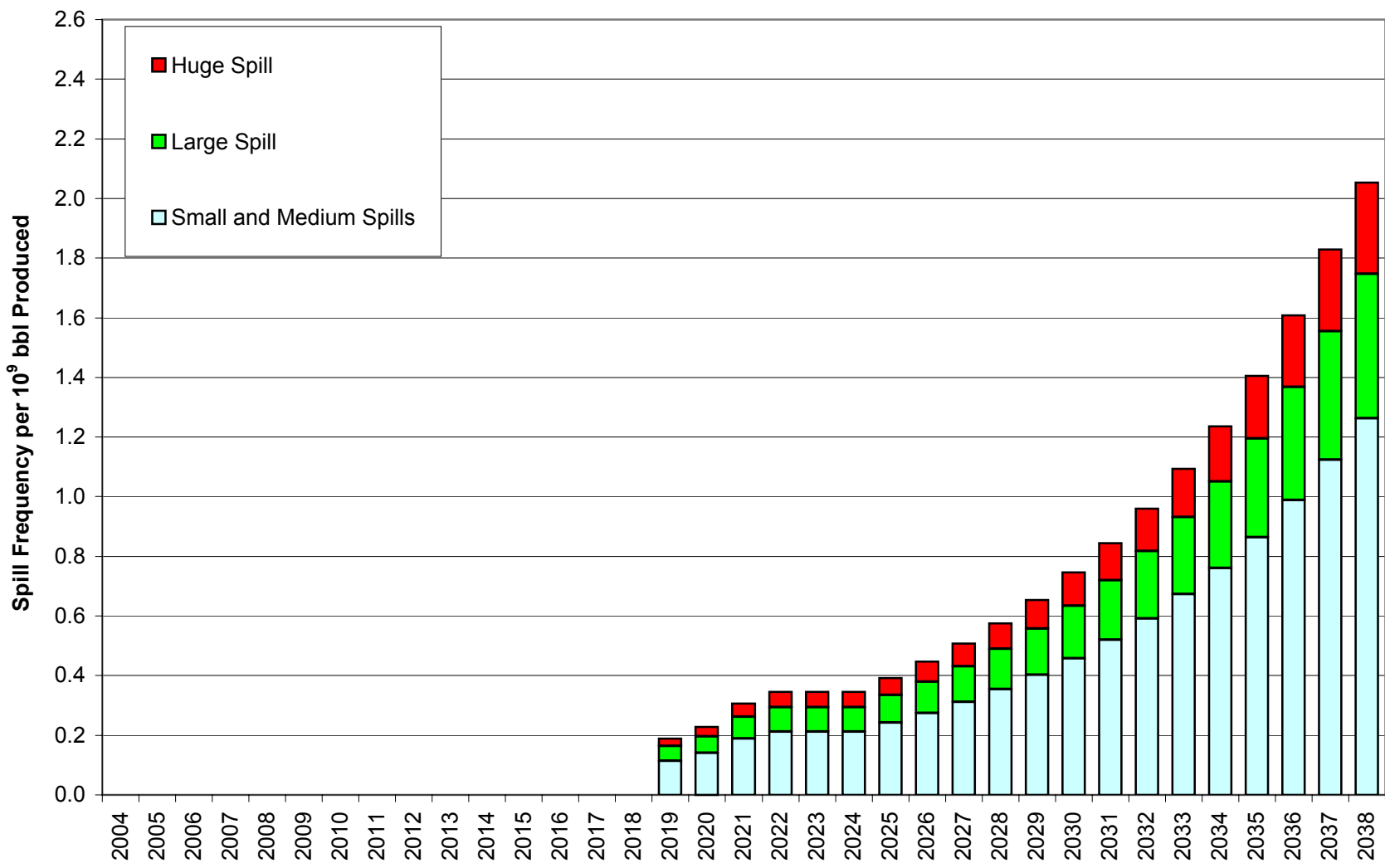
**Table 4.3.13
Arctic Spill Occurrence Beaufort Sea Sale 3 Wells Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009													
2010		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2011													
2012		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2013		0.045		0.022	0.134		1.404	0.228		21.480	0.407		22.906
2014		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2015		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901
2016													
2017		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2018		0.052		0.026	0.155		1.625	0.250		22.100	0.457		23.751
2019	30.8	0.090	0.003	0.045	0.270	0.009	2.835	0.450	0.015	41.400	0.810	0.026	44.280
2020	38.6	0.190	0.005	0.095	0.570	0.015	5.985	0.950	0.025	87.400	1.710	0.044	93.480
2021	38.6	0.290	0.008	0.145	0.870	0.023	9.135	1.450	0.038	133.400	2.610	0.068	142.680
2022	38.6	0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
2023	38.6	0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
2024	38.6	0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
2025	34.0	0.340	0.010	0.170	1.020	0.030	10.710	1.700	0.050	156.400	3.060	0.090	167.280
2026	29.9	0.340	0.011	0.170	1.020	0.034	10.710	1.700	0.057	156.400	3.060	0.102	167.280
2027	26.3	0.340	0.013	0.170	1.020	0.039	10.710	1.700	0.065	156.400	3.060	0.116	167.280
2028	23.2	0.340	0.015	0.170	1.020	0.044	10.710	1.700	0.073	156.400	3.060	0.132	167.280
2029	20.4	0.340	0.017	0.170	1.020	0.050	10.710	1.700	0.083	156.400	3.060	0.150	167.280
2030	17.9	0.340	0.019	0.170	1.020	0.057	10.710	1.700	0.095	156.400	3.060	0.171	167.280
2031	15.8	0.340	0.022	0.170	1.020	0.065	10.710	1.700	0.108	156.400	3.060	0.194	167.280
2032	13.9	0.340	0.024	0.170	1.020	0.073	10.710	1.700	0.122	156.400	3.060	0.220	167.280
2033	12.2	0.340	0.028	0.170	1.020	0.084	10.710	1.700	0.139	156.400	3.060	0.251	167.280
2034	10.8	0.340	0.031	0.170	1.020	0.094	10.710	1.700	0.157	156.400	3.060	0.283	167.280
2035	9.5	0.340	0.036	0.170	1.020	0.107	10.710	1.700	0.179	156.400	3.060	0.322	167.280
2036	8.3	0.340	0.041	0.170	1.020	0.123	10.710	1.700	0.205	156.400	3.060	0.369	167.280
2037	7.3	0.340	0.047	0.170	1.020	0.140	10.710	1.700	0.233	156.400	3.060	0.419	167.280
2038	6.5	0.340	0.052	0.170	1.020	0.157	10.710	1.700	0.262	156.400	3.060	0.471	167.280

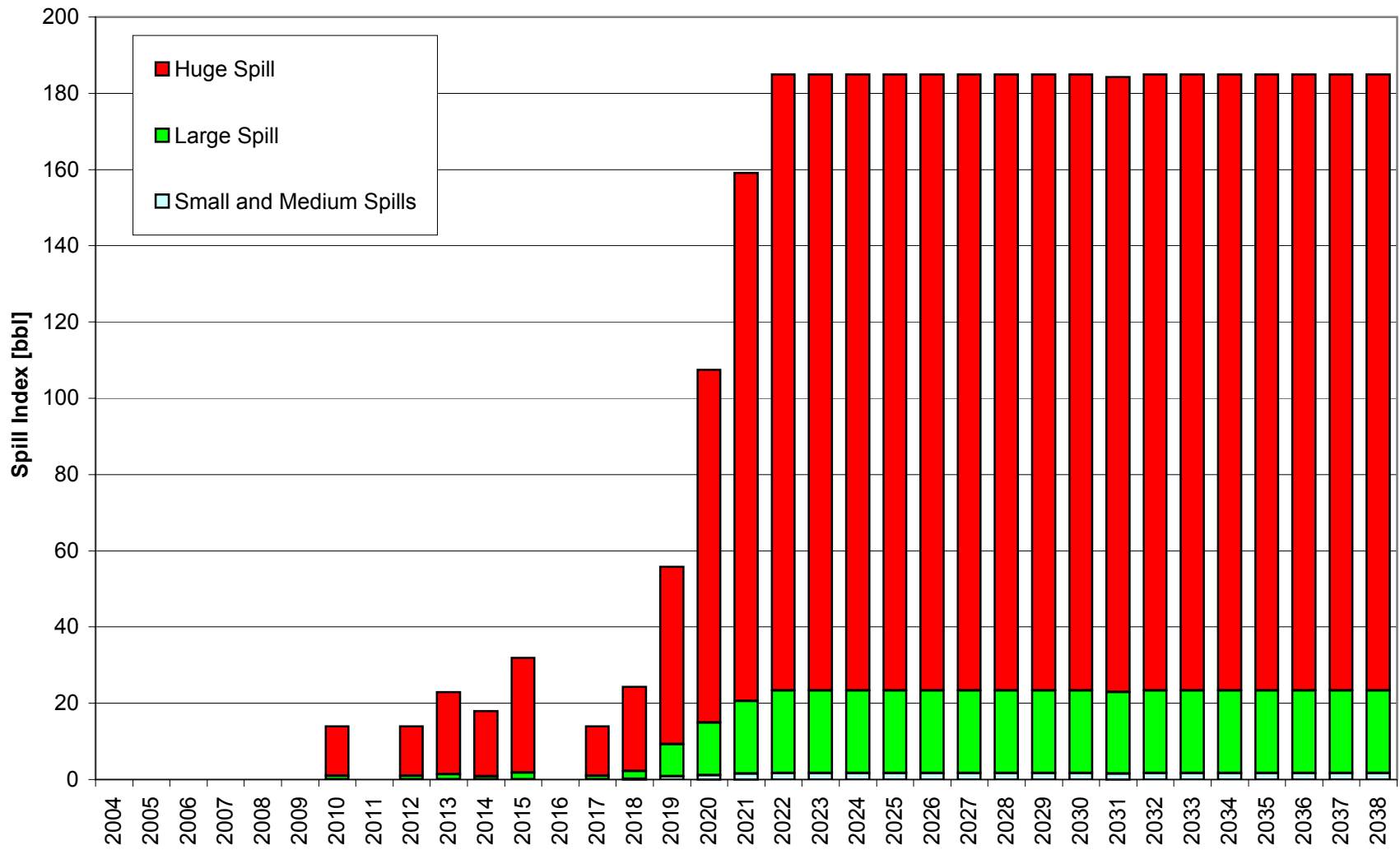
Beaufort Sea Sale 3 Spill Frequency



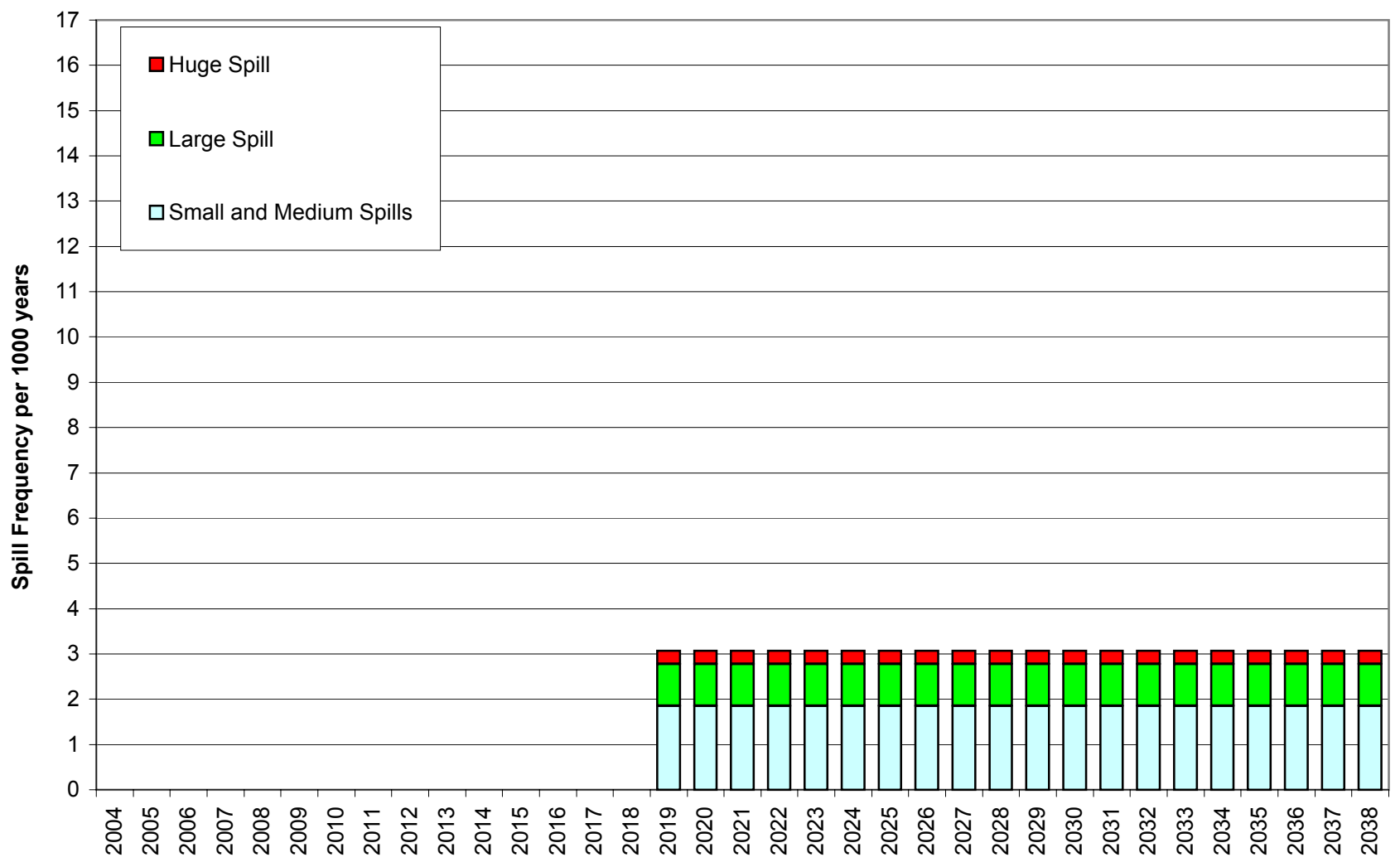
Beaufort Sea Sale 3 Spill Frequency per 10⁹ bbl Produced



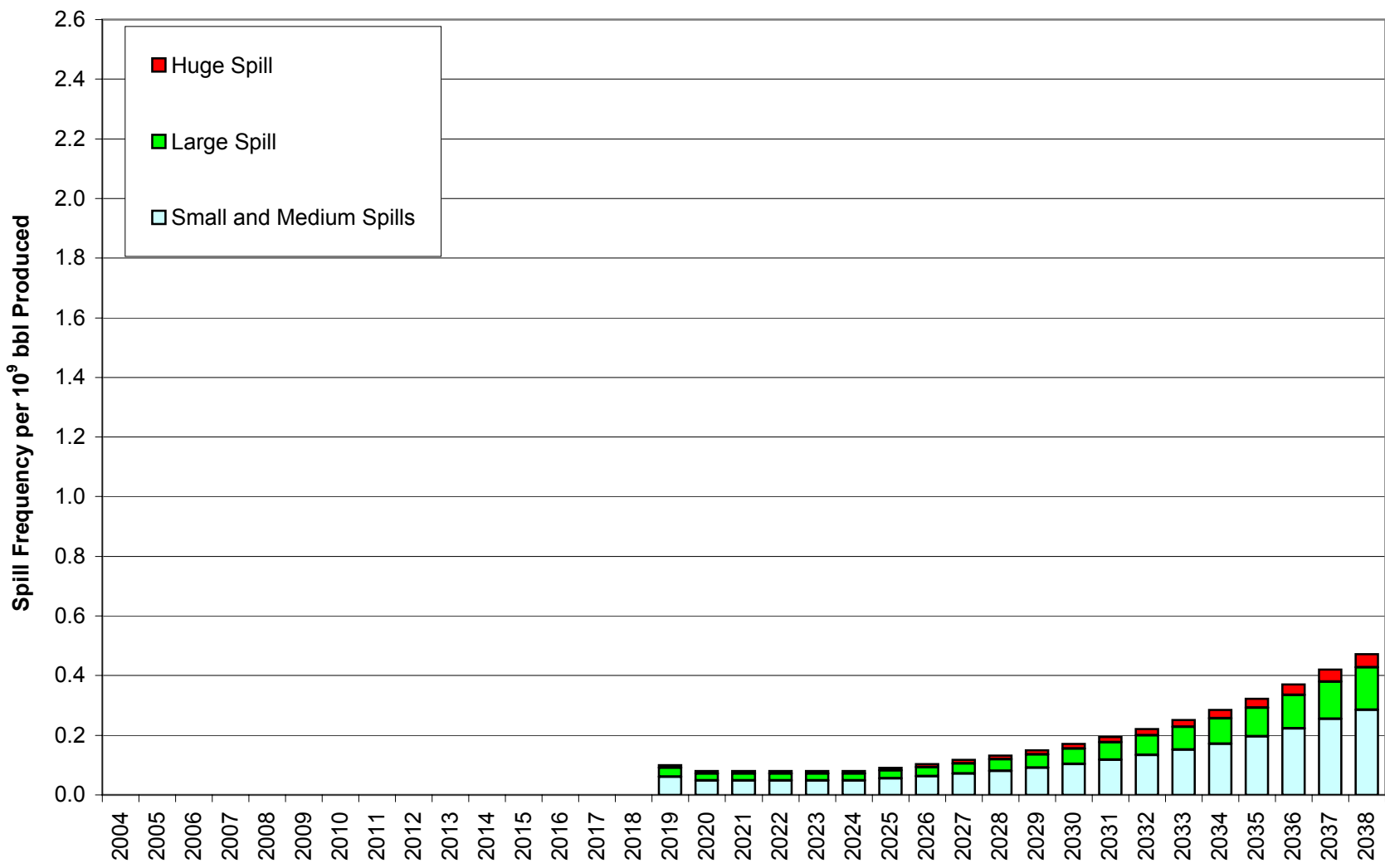
Beaufort Sea Sale 3 Spill Index



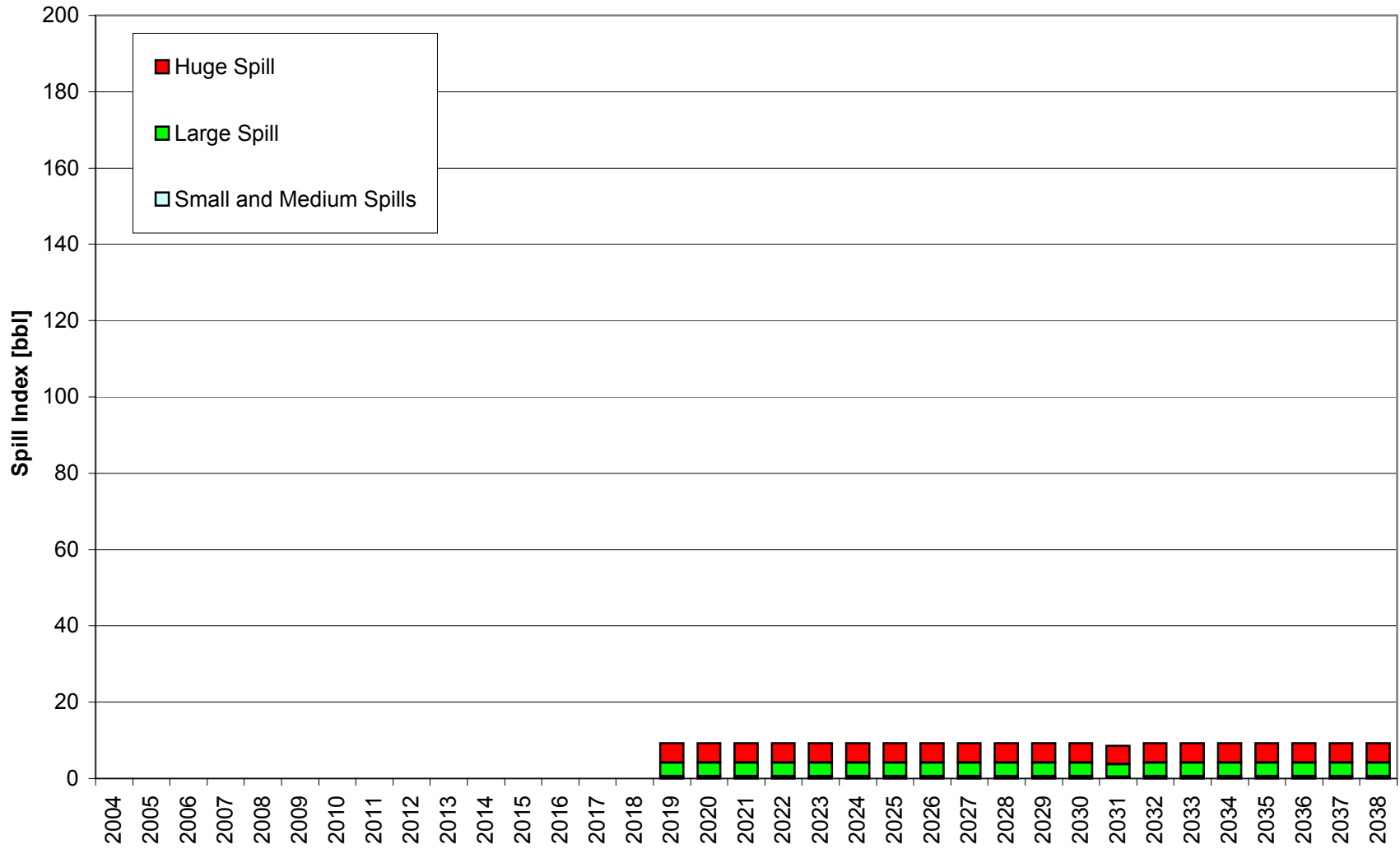
Beaufort Sea Sale 3 Spill Frequency - P/L



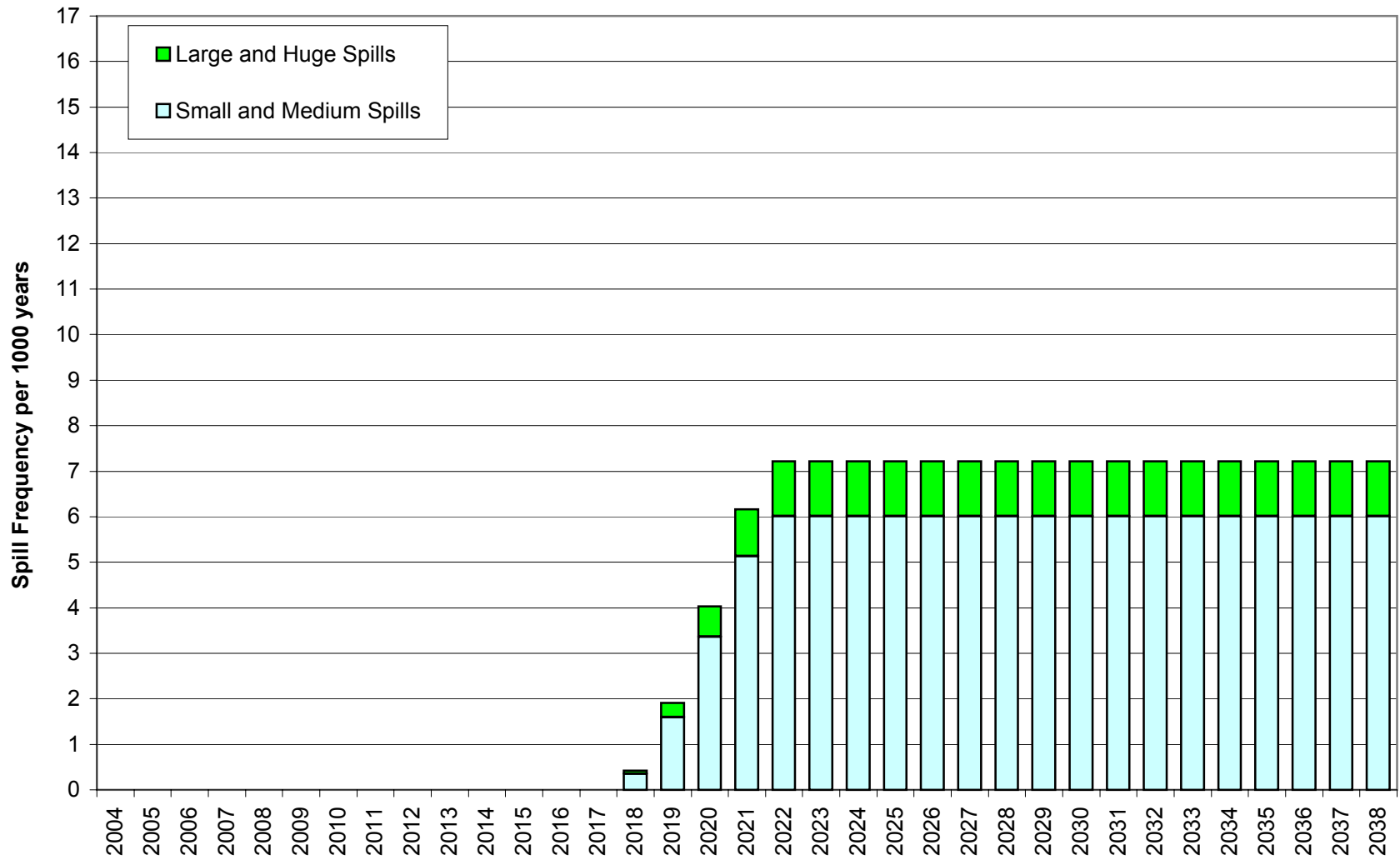
Beaufort Sea Sale 3 Spill Frequency per 10⁹ bbl Produced - P/L



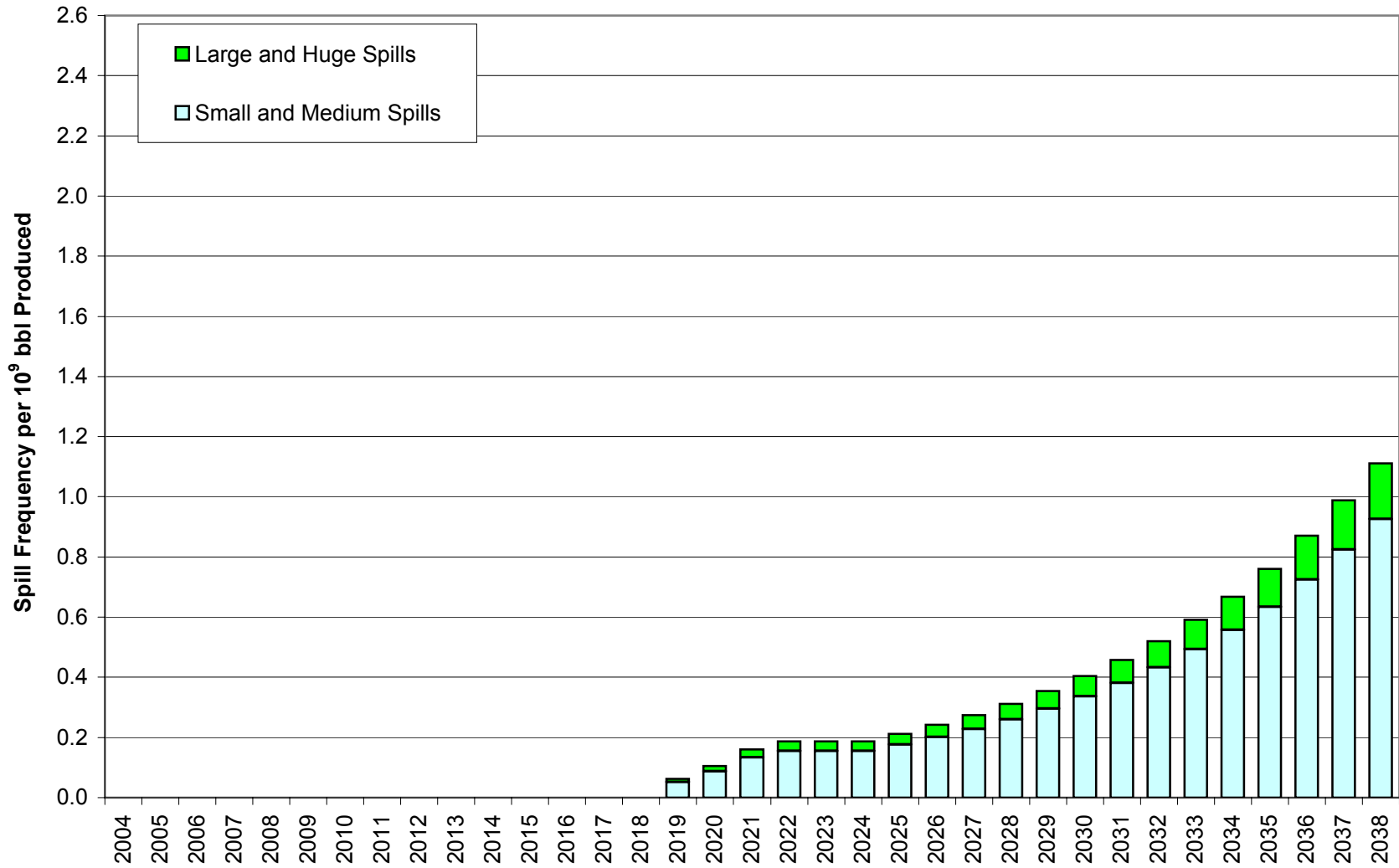
Beaufort Sea Sale 3 Spill Index - P/L



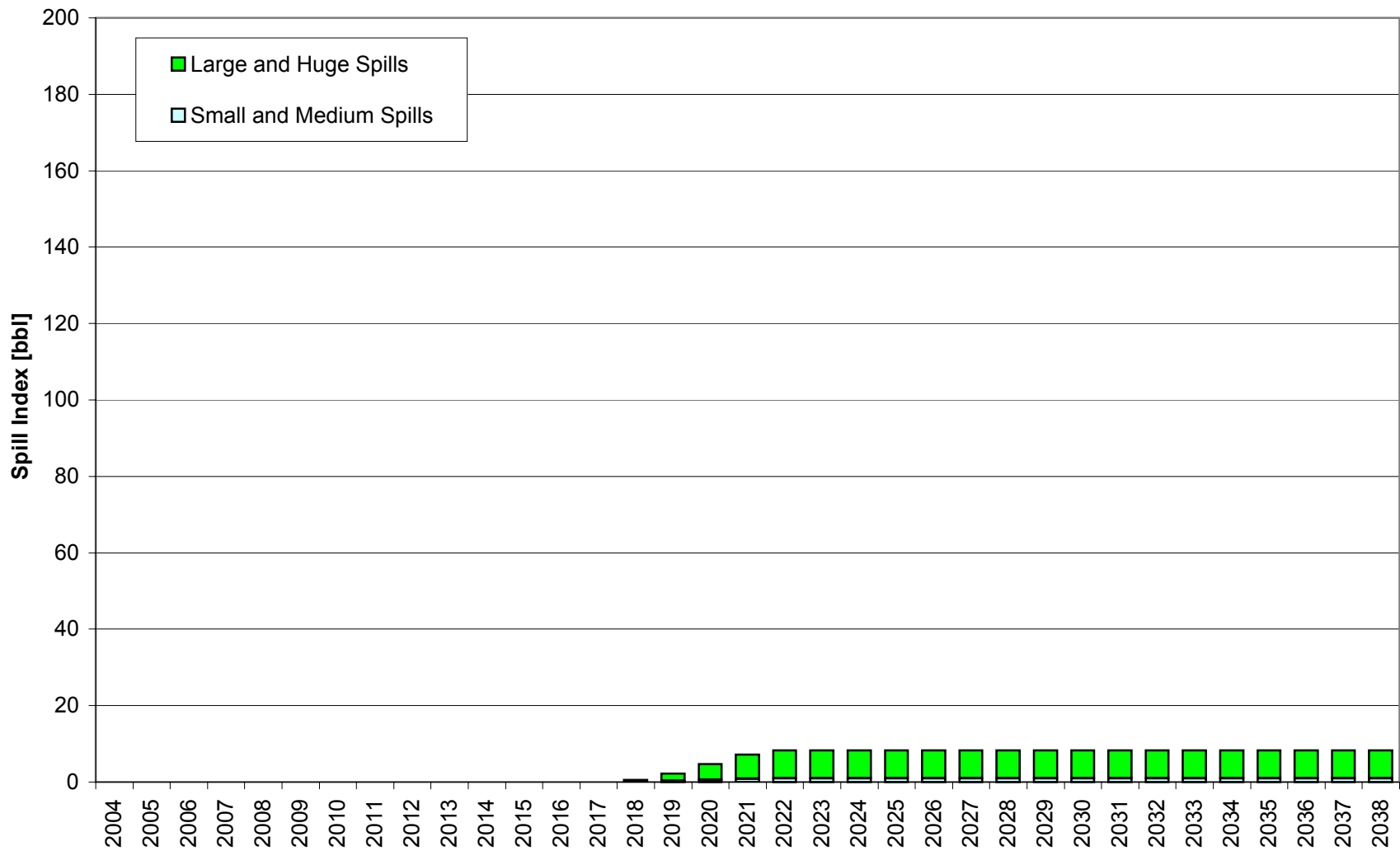
Beaufort Sea Sale 3 Spill Frequency - Platforms



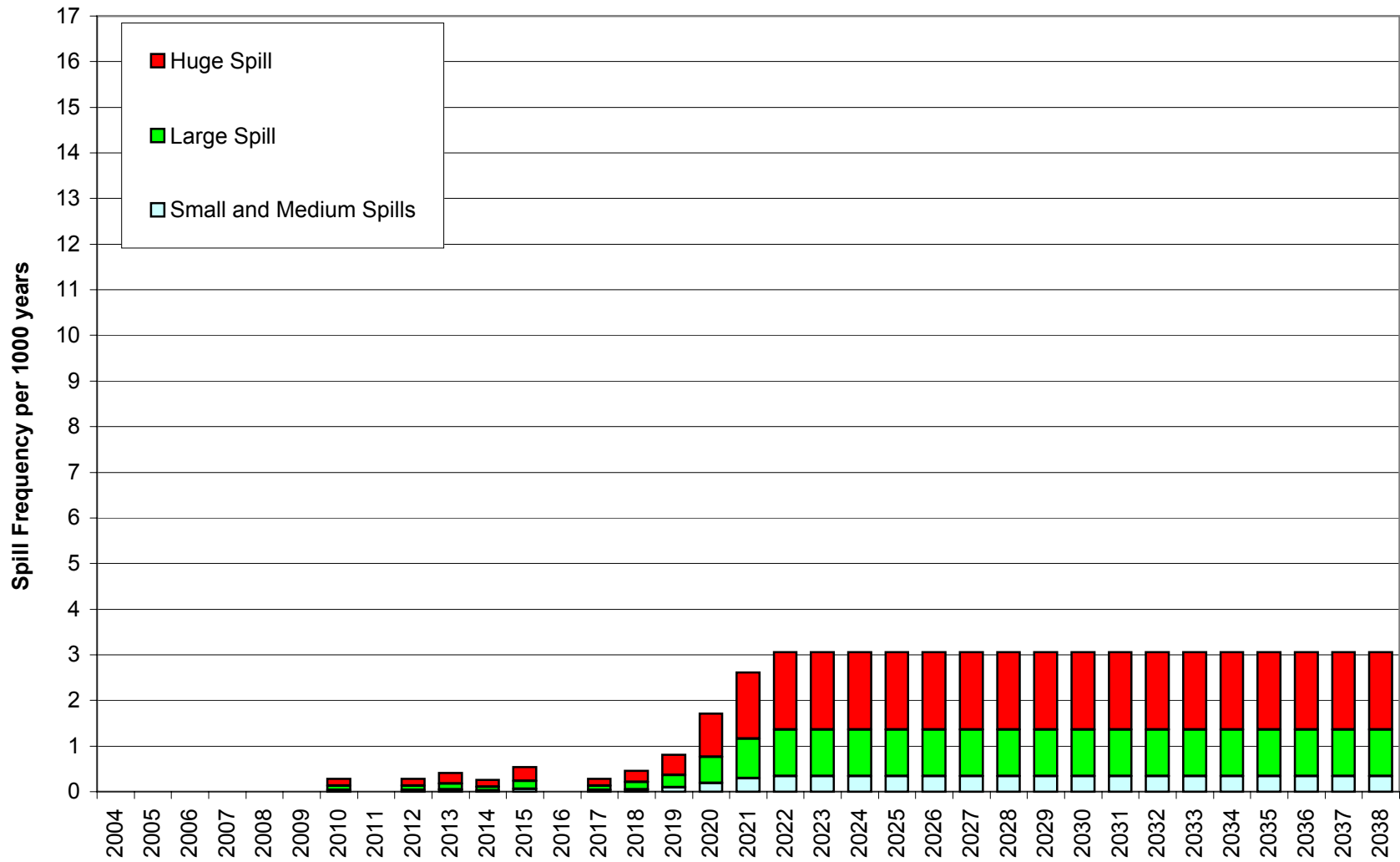
Beaufort Sea Sale 3 Spill Frequency per 10⁹ bbl Produced - Platforms



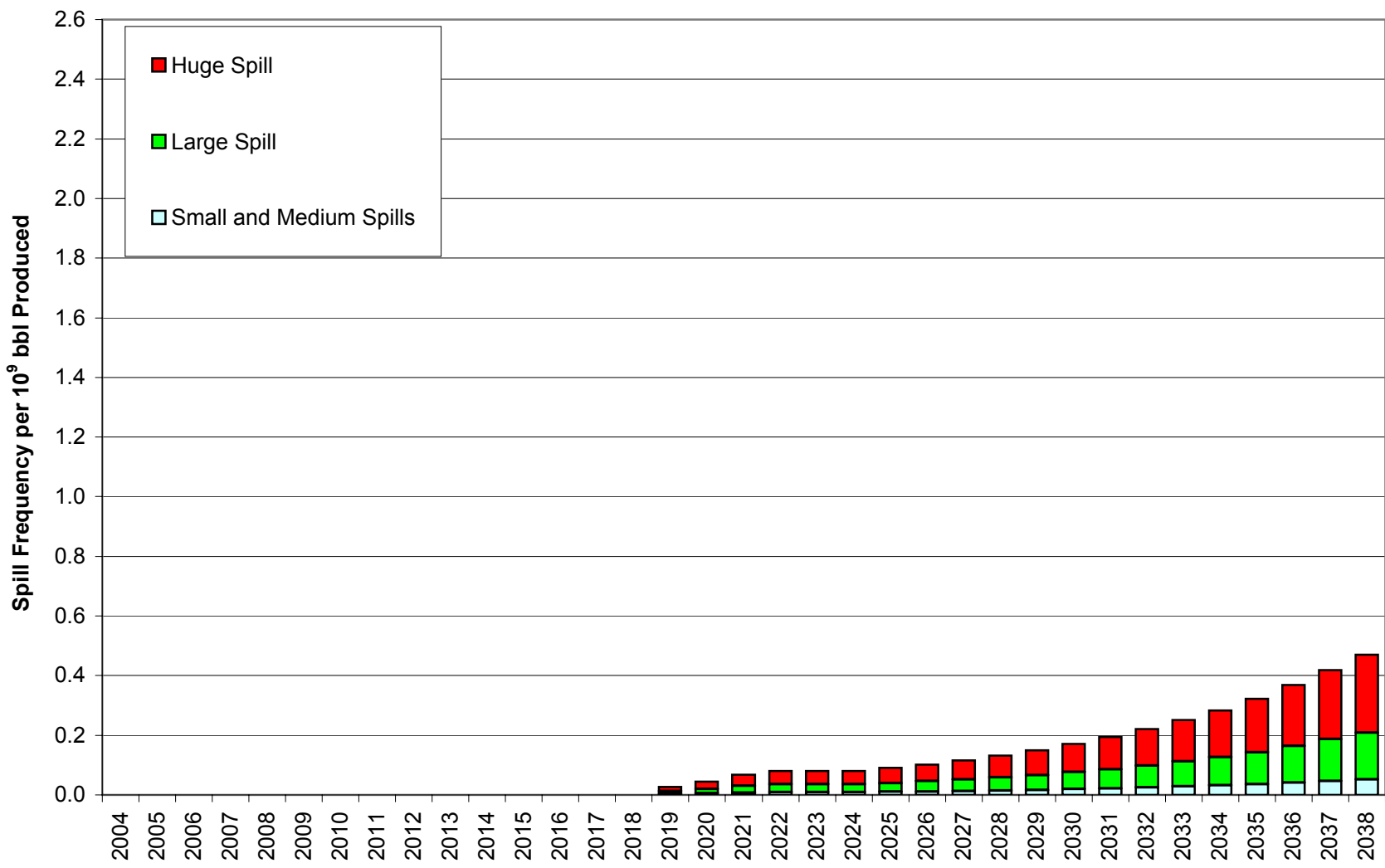
Beaufort Sea Sale 3 Spill Index - Platforms



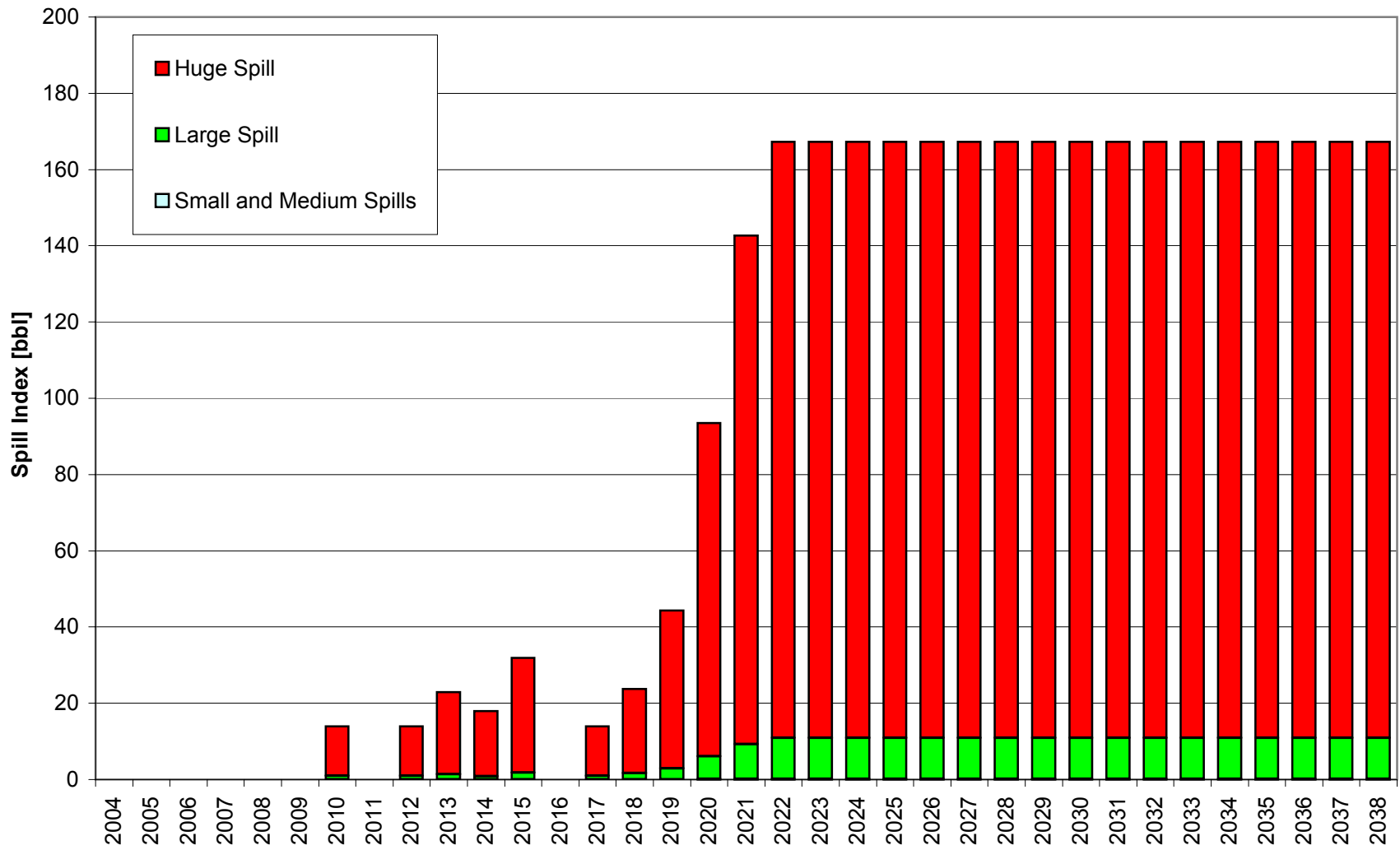
Beaufort Sea Sale 3 Spill Frequency - Wells



Beaufort Sea Sale 3 Spill Frequency per 10⁹ bbl Produced - Wells



Beaufort Sea Sale 3 Spill Index - Wells



**Table 4.4.1
 Artic Spill Occurrence Beaufort Sea Sale All P/L**

17705
Spill Index bbl
11.53
5.57
17.10
11.53
5.57
17.10
11.53
5.57
17.10
9.89
5.57
15.46
9.89
5.57
15.46
8.24
5.57
13.81
5.77
5.57
11.34
5.77
5.57
11.34
4.12
3.98
8.10
4.12
3.98
8.10
4.12
3.98
8.10
4.12
3.98
8.10
4.12
3.98
8.10
2.47
2.39
4.86
2.47
2.39
4.86
2.47
2.39
4.86

**Table 4.4.2
Arctic Spill Occurrence Beaufort Sea Sale All P/L Summary**

Year	Production [MMbbbl]	Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]
2004																			
2005																			
2006																			
2007																			
2008																			
2009																			
2010	10.9	0.149	0.014	0.009	0.363	0.033	0.141	0.512	0.047	0.149	0.288	0.026	1.132	0.093	0.009	1.648	0.893	0.082	2.928
2011	19.9	0.149	0.008	0.009	0.363	0.018	0.141	0.512	0.026	0.149	0.288	0.014	1.132	0.093	0.005	1.648	0.893	0.045	2.928
2012	30.8	0.299	0.010	0.017	0.726	0.024	0.281	1.025	0.033	0.298	0.576	0.019	2.263	0.186	0.006	3.295	1.786	0.058	5.857
2013	50.7	0.522	0.010	0.030	1.271	0.025	0.492	1.793	0.035	0.522	1.007	0.020	3.961	0.326	0.006	5.766	3.126	0.062	10.249
2014	56.2	0.522	0.009	0.030	1.271	0.023	0.492	1.793	0.032	0.522	1.007	0.018	3.961	0.326	0.006	5.766	3.126	0.056	10.249
2015	64.2	0.820	0.013	0.048	2.000	0.031	0.774	2.821	0.044	0.822	1.569	0.024	6.170	0.509	0.008	9.006	4.898	0.076	15.997
2016	67.4	0.820	0.012	0.048	2.000	0.030	0.774	2.821	0.042	0.822	1.569	0.023	6.170	0.509	0.008	9.006	4.898	0.073	15.997
2017	77.4	1.232	0.016	0.071	2.929	0.038	1.109	4.161	0.054	1.181	2.208	0.029	8.722	0.711	0.009	12.530	7.080	0.091	22.433
2018	82.9	1.232	0.015	0.071	2.929	0.035	1.109	4.161	0.050	1.181	2.208	0.027	8.722	0.711	0.009	12.530	7.080	0.085	22.433
2019	104.6	1.792	0.017	0.104	4.222	0.040	1.586	6.014	0.057	1.690	3.128	0.030	12.379	1.006	0.010	17.674	10.148	0.097	31.742
2020	104.8	1.792	0.017	0.104	4.222	0.040	1.586	6.014	0.057	1.690	3.128	0.030	12.379	1.006	0.010	17.674	10.148	0.097	31.742
2021	98.6	1.792	0.018	0.104	4.222	0.043	1.586	6.014	0.061	1.690	3.128	0.032	12.379	1.006	0.010	17.674	10.148	0.103	31.742
2022	89.2	1.792	0.020	0.104	4.222	0.047	1.586	6.014	0.067	1.690	3.128	0.035	12.379	1.006	0.011	17.674	10.148	0.114	31.742
2023	81.4	1.792	0.022	0.104	4.222	0.052	1.586	6.014	0.074	1.690	3.128	0.038	12.379	1.006	0.012	17.674	10.148	0.125	31.742
2024	74.8	1.792	0.024	0.104	4.222	0.056	1.586	6.014	0.080	1.690	3.128	0.042	12.379	1.006	0.013	17.674	10.148	0.136	31.742
2025	62.5	1.643	0.026	0.095	3.859	0.062	1.445	5.502	0.088	1.541	2.841	0.045	11.247	0.913	0.015	16.026	9.255	0.148	28.814
2026	54.1	1.643	0.030	0.095	3.859	0.071	1.445	5.502	0.102	1.541	2.841	0.053	11.247	0.913	0.017	16.026	9.255	0.171	28.814
2027	44.6	1.494	0.033	0.087	3.496	0.078	1.305	4.990	0.112	1.391	2.553	0.057	10.115	0.819	0.018	14.379	8.362	0.187	25.886
2028	36.9	1.270	0.034	0.074	2.951	0.080	1.094	4.221	0.114	1.168	2.121	0.057	8.418	0.680	0.018	11.908	7.022	0.190	21.493
2029	32.2	1.270	0.039	0.074	2.951	0.092	1.094	4.221	0.131	1.168	2.121	0.066	8.418	0.680	0.021	11.908	7.022	0.218	21.493
2030	25.8	0.972	0.038	0.056	2.222	0.086	0.812	3.194	0.124	0.868	1.559	0.060	6.209	0.497	0.019	8.668	5.250	0.203	15.745
2031	22.6	0.972	0.043	0.043	2.222	0.098	0.706	3.194	0.141	0.749	1.559	0.069	5.523	0.497	0.022	8.099	5.250	0.232	14.371
2032	19.7	0.972	0.049	0.056	2.222	0.113	0.812	3.194	0.162	0.868	1.559	0.079	6.209	0.497	0.025	8.668	5.250	0.266	15.745
2033	17.2	0.972	0.057	0.056	2.222	0.129	0.812	3.194	0.186	0.868	1.559	0.091	6.209	0.497	0.029	8.668	5.250	0.305	15.745
2034	15.1	0.972	0.064	0.056	2.222	0.147	0.812	3.194	0.211	0.868	1.559	0.103	6.209	0.497	0.033	8.668	5.250	0.348	15.745
2035	13.2	0.972	0.074	0.056	2.222	0.168	0.812	3.194	0.242	0.868	1.559	0.118	6.209	0.497	0.038	8.668	5.250	0.398	15.745
2036	8.3	0.560	0.068	0.033	1.293	0.156	0.476	1.854	0.223	0.509	0.920	0.111	3.657	0.294	0.035	5.144	3.068	0.370	9.310
2037	7.3	0.560	0.077	0.033	1.293	0.177	0.476	1.854	0.254	0.509	0.920	0.126	3.657	0.294	0.040	5.144	3.068	0.420	9.310
2038	6.5	0.560	0.086	0.033	1.293	0.199	0.476	1.854	0.285	0.509	0.920	0.142	3.657	0.294	0.045	5.144	3.068	0.472	9.310

**Table 4.4.3
Arctic Spill Occurrence Beaufort Sea Sale All Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2005	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2006	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2007	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2008	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2009	Shallow	1	3	0.866	0.260	0.04	0.174	0.052	0.32
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	1	3		0.260	0.04		0.052	0.32
2010	Shallow	1	13	0.866	1.126	0.18	0.174	0.226	1.39
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	1	13		1.126	0.18		0.226	1.39
2011	Shallow	2	26	0.866	2.251	0.36	0.174	0.453	2.77
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	2	26		2.251	0.36		0.453	2.77
2012	Shallow	3	39	0.866	3.377	0.53	0.174	0.679	4.16
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	3	39		3.377	0.53		0.679	4.16
2013	Shallow	3	59	0.866	5.108	0.81	0.174	1.027	6.30
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	3	59		5.108	0.81		1.027	6.30
2014	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	1	3	0.884	0.265	0.04	0.177	0.053	0.33
	Deep			0.913			0.182		
	Total	4	72		6.239	0.99		1.255	7.69
2015	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	1	13	0.884	1.150	0.18	0.177	0.231	1.41
	Deep			0.913			0.182		
	Total	4	82		7.124	1.13		1.432	8.78
2016	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	2	26	0.884	2.300	0.36	0.177	0.461	2.83
	Deep			0.913			0.182		
	Total	5	95		8.274	1.31		1.663	10.19
2017	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	3	39	0.884	3.449	0.55	0.177	0.692	4.24
	Deep			0.913			0.182		
	Total	6	108		9.423	1.49		1.893	11.61

**Table 4.4.3
Arctic Spill Occurrence Beaufort Sea Sale All Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	4	63	0.884	5.572	0.88	0.177	1.118	6.85
	Deep			0.913			0.182		
	Total	7	132		11.546	1.82		2.319	14.22
2019	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	5	87	0.884	7.695	1.22	0.177	1.543	9.46
	Deep			0.913			0.182		
	Total	8	156		13.669	2.16		2.745	16.83
2020	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	5	107	0.884	9.464	1.50	0.177	1.898	11.64
	Deep			0.913			0.182		
	Total	8	176		15.438	2.44		3.100	19.00
2021	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	5	127	0.884	11.233	1.77	0.177	2.253	13.81
	Deep			0.913			0.182		
	Total	8	196		17.207	2.72		3.454	21.18
2022	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	5	137	0.884	12.117	1.91	0.177	2.431	14.90
	Deep			0.913			0.182		
	Total	8	206		18.091	2.86		3.632	22.26
2023	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	5	137	0.884	12.117	1.91	0.177	2.431	14.90
	Deep			0.913			0.182		
	Total	8	206		18.091	2.86		3.632	22.26
2024	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	5	137	0.884	12.117	1.91	0.177	2.431	14.90
	Deep			0.913			0.182		
	Total	8	206		18.091	2.86		3.632	22.26
2025	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	5	137	0.884	12.117	1.91	0.177	2.431	14.90
	Deep			0.913			0.182		
	Total	7	183		16.100	2.54		3.231	19.81
2026	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	5	137	0.884	12.117	1.91	0.177	2.431	14.90
	Deep			0.913			0.182		
	Total	7	183		16.100	2.54		3.231	19.81
2027	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	5	137	0.884	12.117	1.91	0.177	2.431	14.90
	Deep			0.913			0.182		
	Total	6	160		14.109	2.23		2.831	17.35
2028	Shallow			0.866			0.174		
	Medium	5	137	0.884	12.117	1.91	0.177	2.431	14.90
	Deep			0.913			0.182		
	Total	5	137		12.117	1.91		2.431	14.90
2029	Shallow			0.866			0.174		
	Medium	5	137	0.884	12.117	1.91	0.177	2.431	14.90
	Deep			0.913			0.182		
	Total	5	137		12.117	1.91		2.431	14.90
2030	Shallow			0.866			0.174		
	Medium	4	114	0.884	10.083	1.59	0.177	2.022	12.40
	Deep			0.913			0.182		
	Total	4	114		10.083	1.59		2.022	12.40
2031	Shallow			0.866			0.174		
	Medium	4	114	0.884	10.083	1.59	0.177	2.022	12.40
	Deep			0.913			0.182		
	Total	4	114		10.083	1.59		2.022	12.40

**Table 4.4.3
Arctic Spill Occurrence Beaufort Sea Sale All Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow			0.866			0.174		
	Medium	4	114	0.884	10.083	1.59	0.177	2.022	12.40
	Deep			0.913			0.182		
	Total	4	114		10.083	1.59		2.022	12.40
2033	Shallow			0.866			0.174		
	Medium	4	114	0.884	10.083	1.59	0.177	2.022	12.40
	Deep			0.913			0.182		
	Total	4	114		10.083	1.59		2.022	12.40
2034	Shallow			0.866			0.174		
	Medium	4	114	0.884	10.083	1.59	0.177	2.022	12.40
	Deep			0.913			0.182		
	Total	4	114		10.083	1.59		2.022	12.40
2035	Shallow			0.866			0.174		
	Medium	4	114	0.884	10.083	1.59	0.177	2.022	12.40
	Deep			0.913			0.182		
	Total	4	114		10.083	1.59		2.022	12.40
2036	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2037	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2038	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40

**Table 4.4.4
Arctic Spill Occurrence Beaufort Sea Sale All Platforms Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]
2004										
2005										
2006										
2007										
2008										
2009		0.260		0.041	0.052		0.320	0.312		0.361
2010	10.9	1.126	0.103	0.178	0.226	0.021	1.387	1.352	0.124	1.565
2011	19.9	2.251	0.113	0.356	0.453	0.023	2.775	2.704	0.136	3.131
2012	30.8	3.377	0.110	0.533	0.679	0.022	4.162	4.056	0.132	4.696
2013	50.7	5.108	0.101	0.807	1.027	0.020	6.297	6.135	0.121	7.104
2014	56.2	6.239	0.111	0.986	1.255	0.022	7.691	7.494	0.133	8.676
2015	64.2	7.124	0.111	1.126	1.432	0.022	8.778	8.556	0.133	9.904
2016	67.4	8.274	0.123	1.307	1.663	0.025	10.192	9.936	0.147	11.499
2017	77.4	9.423	0.122	1.489	1.893	0.024	11.606	11.317	0.146	13.095
2018	82.9	11.546	0.139	1.824	2.319	0.028	14.216	13.865	0.167	16.040
2019	104.6	13.669	0.131	2.160	2.745	0.026	16.826	16.414	0.157	18.986
2020	104.8	15.438	0.147	2.439	3.100	0.030	19.001	18.537	0.177	21.440
2021	98.6	17.207	0.175	2.719	3.454	0.035	21.176	20.661	0.210	23.895
2022	89.2	18.091	0.203	2.858	3.632	0.041	22.264	21.723	0.244	25.122
2023	81.4	18.091	0.222	2.858	3.632	0.045	22.264	21.723	0.267	25.122
2024	74.8	18.091	0.242	2.858	3.632	0.049	22.264	21.723	0.290	25.122
2025	62.5	16.100	0.258	2.544	3.231	0.052	19.809	19.331	0.309	22.353
2026	54.1	16.100	0.298	2.544	3.231	0.060	19.809	19.331	0.357	22.353
2027	44.6	14.109	0.316	2.229	2.831	0.063	17.354	16.940	0.380	19.583
2028	36.9	12.117	0.328	1.915	2.431	0.066	14.899	14.548	0.394	16.814
2029	32.2	12.117	0.376	1.915	2.431	0.075	14.899	14.548	0.452	16.814
2030	25.8	10.083	0.391	1.593	2.022	0.078	12.398	12.106	0.469	13.991
2031	22.6	10.083	0.446	1.593	2.022	0.089	12.398	12.106	0.536	13.991
2032	19.7	10.083	0.512	1.593	2.022	0.103	12.398	12.106	0.614	13.991
2033	17.2	10.083	0.586	1.593	2.022	0.118	12.398	12.106	0.704	13.991
2034	15.1	10.083	0.668	1.593	2.022	0.134	12.398	12.106	0.802	13.991
2035	13.2	10.083	0.764	1.593	2.022	0.153	12.398	12.106	0.917	13.991
2036	8.3	6.014	0.725	0.950	1.206	0.145	7.395	7.221	0.870	8.346
2037	7.3	6.014	0.824	0.950	1.206	0.165	7.395	7.221	0.989	8.346
2038	6.5	6.014	0.925	0.950	1.206	0.186	7.395	7.221	1.111	8.346

**Table 4.4.5
Arctic Spill Occurrence Beaufort Sea Sale All Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2009	Shallow	3	0.500	0.015	0.01	3.500	0.105	0.47	1.500	0.045	0.90	1.000	0.030	6.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	3		0.015	0.01		0.105	0.47		0.045	0.90		0.030	6.00
2010	Shallow	13	0.500	0.065	0.03	3.500	0.455	2.05	1.500	0.195	3.90	1.000	0.130	26.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	13		0.065	0.03		0.455	2.05		0.195	3.90		0.130	26.00
2011	Shallow	26	0.500	0.130	0.07	3.500	0.910	4.10	1.500	0.390	7.80	1.000	0.260	52.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	26		0.130	0.07		0.910	4.10		0.390	7.80		0.260	52.00
2012	Shallow	39	0.500	0.195	0.10	3.500	1.365	6.14	1.500	0.585	11.70	1.000	0.390	78.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	39		0.195	0.10		1.365	6.14		0.585	11.70		0.390	78.00
2013	Shallow	59	0.500	0.295	0.15	3.500	2.065	9.29	1.500	0.885	17.70	1.000	0.590	118.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	59		0.295	0.15		2.065	9.29		0.885	17.70		0.590	118.00
2014	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	3	0.500	0.015	0.01	3.500	0.105	0.47	1.500	0.045	0.90	1.000	0.030	6.00
	Deep		0.500			3.500			1.500			1.000		
	Total	72		0.360	0.18		2.520	11.34		1.080	21.60		0.720	144.00
2015	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	13	0.500	0.065	0.03	3.500	0.455	2.05	1.500	0.195	3.90	1.000	0.130	26.00
	Deep		0.500			3.500			1.500			1.000		
	Total	82		0.410	0.21		2.870	12.92		1.230	24.60		0.820	164.00
2016	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	26	0.500	0.130	0.07	3.500	0.910	4.10	1.500	0.390	7.80	1.000	0.260	52.00
	Deep		0.500			3.500			1.500			1.000		
	Total	95		0.475	0.24		3.325	14.96		1.425	28.50		0.950	190.00
2017	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	39	0.500	0.195	0.10	3.500	1.365	6.14	1.500	0.585	11.70	1.000	0.390	78.00
	Deep		0.500			3.500			1.500			1.000		
	Total	108		0.540	0.27		3.780	17.01		1.620	32.40		1.080	216.00

**Table 4.4.5
Arctic Spill Occurrence Beaufort Sea Sale All Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	63	0.500	0.315	0.16	3.500	2.205	9.92	1.500	0.945	18.90	1.000	0.630	126.00
	Deep		0.500			3.500			1.500			1.000		
	Total	132		0.660	0.33		4.620	20.79		1.980	39.60		1.320	264.00
2019	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	87	0.500	0.435	0.22	3.500	3.045	13.70	1.500	1.305	26.10	1.000	0.870	174.00
	Deep		0.500			3.500			1.500			1.000		
	Total	156		0.780	0.39		5.460	24.57		2.340	46.80		1.560	312.00
2020	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	107	0.500	0.535	0.27	3.500	3.745	16.85	1.500	1.605	32.10	1.000	1.070	214.00
	Deep		0.500			3.500			1.500			1.000		
	Total	176		0.880	0.44		6.160	27.72		2.640	52.80		1.760	352.00
2021	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	127	0.500	0.635	0.32	3.500	4.445	20.00	1.500	1.905	38.10	1.000	1.270	254.00
	Deep		0.500			3.500			1.500			1.000		
	Total	196		0.980	0.49		6.860	30.87		2.940	58.80		1.960	392.00
2022	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	206		1.030	0.52		7.210	32.45		3.090	61.80		2.060	412.00
2023	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	206		1.030	0.52		7.210	32.45		3.090	61.80		2.060	412.00
2024	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	206		1.030	0.52		7.210	32.45		3.090	61.80		2.060	412.00
2025	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	183		0.915	0.46		6.405	28.82		2.745	54.90		1.830	366.00
2026	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	183		0.915	0.46		6.405	28.82		2.745	54.90		1.830	366.00
2027	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	160		0.800	0.40		5.600	25.20		2.400	48.00		1.600	320.00
2028	Shallow		0.500			3.500			1.500			1.000		
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	137		0.685	0.34		4.795	21.58		2.055	41.10		1.370	274.00
2029	Shallow		0.500			3.500			1.500			1.000		
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	137		0.685	0.34		4.795	21.58		2.055	41.10		1.370	274.00
2030	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00
2031	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00

**Table 4.4.5
Arctic Spill Occurrence Beaufort Sea Sale All Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00
2033	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00
2034	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00
2035	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00
2036	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2037	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2038	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00

Table 4.4.6

Arctic Spill Occurrence Beaufort Sea Sale All Production Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009		0.015		0.008	0.045		0.473	0.075		6.900	0.135		7.380
2010	10.9	0.065	0.006	0.033	0.195	0.018	2.048	0.325	0.030	29.900	0.585	0.054	31.980
2011	19.9	0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
2012	30.8	0.195	0.006	0.098	0.585	0.019	6.143	0.975	0.032	89.700	1.755	0.057	95.940
2013	50.7	0.295	0.006	0.148	0.885	0.017	9.293	1.475	0.029	135.700	2.655	0.052	145.140
2014	56.2	0.360	0.006	0.180	1.080	0.019	11.340	1.800	0.032	165.600	3.240	0.058	177.120
2015	64.2	0.410	0.006	0.205	1.230	0.019	12.915	2.050	0.032	188.600	3.690	0.057	201.720
2016	67.4	0.475	0.007	0.238	1.425	0.021	14.963	2.375	0.035	218.500	4.275	0.063	233.700
2017	77.4	0.540	0.007	0.270	1.620	0.021	17.010	2.700	0.035	248.400	4.860	0.063	265.680
2018	82.9	0.660	0.008	0.330	1.980	0.024	20.790	3.300	0.040	303.600	5.940	0.072	324.720
2019	104.6	0.780	0.007	0.390	2.340	0.022	24.570	3.900	0.037	358.800	7.020	0.067	383.760
2020	104.8	0.880	0.008	0.440	2.640	0.025	27.720	4.400	0.042	404.800	7.920	0.076	432.960
2021	98.6	0.980	0.010	0.490	2.940	0.030	30.870	4.900	0.050	450.800	8.820	0.089	482.160
2022	89.2	1.030	0.012	0.515	3.090	0.035	32.445	5.150	0.058	473.800	9.270	0.104	506.760
2023	81.4	1.030	0.013	0.515	3.090	0.038	32.445	5.150	0.063	473.800	9.270	0.114	506.760
2024	74.8	1.030	0.014	0.515	3.090	0.041	32.445	5.150	0.069	473.800	9.270	0.124	506.760
2025	62.5	0.915	0.015	0.458	2.745	0.044	28.823	4.575	0.073	420.900	8.235	0.132	450.180
2026	54.1	0.915	0.017	0.458	2.745	0.051	28.823	4.575	0.085	420.900	8.235	0.152	450.180
2027	44.6	0.800	0.018	0.400	2.400	0.054	25.200	4.000	0.090	368.000	7.200	0.161	393.600
2028	36.9	0.685	0.019	0.343	2.055	0.056	21.578	3.425	0.093	315.100	6.165	0.167	337.020
2029	32.2	0.685	0.021	0.343	2.055	0.064	21.578	3.425	0.106	315.100	6.165	0.191	337.020
2030	25.8	0.570	0.022	0.285	1.710	0.066	17.955	2.850	0.110	262.200	5.130	0.199	280.440
2031	22.6	0.570	0.025	0.285	1.710	0.076	17.955	2.850	0.126	262.200	5.130	0.227	280.440
2032	19.7	0.570	0.029	0.285	1.710	0.087	17.955	2.850	0.145	262.200	5.130	0.260	280.440
2033	17.2	0.570	0.033	0.285	1.710	0.099	17.955	2.850	0.166	262.200	5.130	0.298	280.440
2034	15.1	0.570	0.038	0.285	1.710	0.113	17.955	2.850	0.189	262.200	5.130	0.340	280.440
2035	13.2	0.570	0.043	0.285	1.710	0.130	17.955	2.850	0.216	262.200	5.130	0.389	280.440
2036	8.3	0.340	0.041	0.170	1.020	0.123	10.710	1.700	0.205	156.400	3.060	0.369	167.280
2037	7.3	0.340	0.047	0.170	1.020	0.140	10.710	1.700	0.233	156.400	3.060	0.419	167.280
2038	6.5	0.340	0.052	0.170	1.020	0.157	10.710	1.700	0.262	156.400	3.060	0.471	167.280

**Table 4.4.7
Arctic Spill Occurrence Beaufort Sea Sale All Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2005	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2006	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2007	Shallow	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2008	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2010	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2011	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2012	Shallow		3.160			22.110			9.500			5.500		
	Medium	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	3		0.095	0.05		0.663	2.98		0.285	5.70		0.165	33.00
2013	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2014	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2015	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2016	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2017	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00

**Table 4.4.7
Arctic Spill Occurrence Beaufort Sea Sale All Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2019	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2020	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2021	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2022	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2023	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2024	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2025	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2026	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2027	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2028	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2029	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2030	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2031	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

**Table 4.4.7
Arctic Spill Occurrence Beaufort Sea Sale All Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2033	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2034	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2035	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2036	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2037	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2038	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.4.8

Arctic Spill Occurrence Beaufort Sea Sale All Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]
2004		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2005		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2006		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2007		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2008		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2009		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2010	10.9	0.063	0.006	0.032	0.190	0.017	1.990	0.300	0.028	25.800	0.553	0.051	27.822
2011	19.9												
2012	30.8	0.095	0.003	0.047	0.285	0.009	2.985	0.450	0.015	38.700	0.830	0.027	41.732
2013	50.7	0.063	0.001	0.032	0.190	0.004	1.990	0.300	0.006	25.800	0.553	0.011	27.822
2014	56.2												
2015	64.2	0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.004	13.911
2016	67.4												
2017	77.4	0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.004	13.911
2018	82.9	0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.003	13.911
2019	104.6												
2020	104.8												
2021	98.6												
2022	89.2												
2023	81.4												
2024	74.8												
2025	62.5												
2026	54.1												
2027	44.6												
2028	36.9												
2029	32.2												
2030	25.8												
2031	22.6												
2032	19.7												
2033	17.2												
2034	15.1												
2035	13.2												
2036	8.3												
2037	7.3												
2038	6.5												

**Table 4.4.9
Arctic Spill Occurrence Beaufort Sea Sale All Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2009	Shallow	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2011	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2012	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2013	Shallow		1.300			9.080			3.900			3.900		
	Medium	3	1.300	0.039	0.02	9.080	0.272	1.23	3.900	0.117	2.34	3.900	0.117	23.40
	Deep		1.300			9.080			3.900			3.900		
	Total	3		0.039	0.02		0.272	1.23		0.117	2.34		0.117	23.40
2014	Shallow		1.300			9.080			3.900			3.900		
	Medium	4	1.300	0.052	0.03	9.080	0.363	1.63	3.900	0.156	3.12	3.900	0.156	31.20
	Deep		1.300			9.080			3.900			3.900		
	Total	4		0.052	0.03		0.363	1.63		0.156	3.12		0.156	31.20
2015	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2016	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2017	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.4.9
Arctic Spill Occurrence Beaufort Sea Sale All Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] = 500		Spill Index bbl	Average Spill [bbl] = 4500		Spill Index bbl	Average Spill [bbl] = 20000		Spill Index bbl	Average Spill [bbl] = 200000		Spill Index bbl
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2019	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2020	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2021	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2022	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2023	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2024	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2025	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2026	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2027	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2028	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2029	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2030	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2031	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.4.9
Arctic Spill Occurrence Beaufort Sea Sale All Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2033	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2034	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2035	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2036	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2037	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2038	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.4.10

Arctic Spill Occurrence Beaufort Sea Sale All Development Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004													
2005													
2006		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2007													
2008		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2009		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2010	10.9	0.026	0.002	0.013	0.078	0.007	0.817	0.156	0.014	17.160	0.260	0.024	17.990
2011	19.9												
2012	30.8												
2013	50.7	0.039	0.001	0.020	0.117	0.002	1.226	0.234	0.005	25.740	0.390	0.008	26.985
2014	56.2	0.052	0.001	0.026	0.156	0.003	1.634	0.312	0.006	34.320	0.520	0.009	35.980
2015	64.2	0.026	0.000	0.013	0.078	0.001	0.817	0.156	0.002	17.160	0.260	0.004	17.990
2016	67.4												
2017	77.4												
2018	82.9												
2019	104.6												
2020	104.8												
2021	98.6												
2022	89.2												
2023	81.4												
2024	74.8												
2025	62.5												
2026	54.1												
2027	44.6												
2028	36.9												
2029	32.2												
2030	25.8												
2031	22.6												
2032	19.7												
2033	17.2												
2034	15.1												
2035	13.2												
2036	8.3												
2037	7.3												
2038	6.5												

**Table 4.4.11
Arctic Spill Occurrence Beaufort Sea Sale All Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
2004	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
	Total		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2005	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
	Total		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2006	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
	Total		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901
2007	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
	Development Wells													
	Total		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2008	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
	Total		0.089		0.045	0.268		2.807	0.456		42.960	0.813		45.812
2009	Pipeline													
	Platforms		0.260		0.041	0.052		0.320			0.312		0.361	
	Production Wells		0.015		0.008	0.045		0.473	0.075		6.900	0.135		7.380
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
	Total		0.332		0.077	0.270		2.605	0.381		36.960	0.984		39.642
2010	Pipeline	10.9	0.512	0.047	0.149	0.288	0.026	1.132	0.093	0.009	1.648	0.893	0.082	2.928
	Platforms		1.126	0.103	0.178	0.226	0.021	1.387				1.352	0.124	1.565
	Production Wells		0.065	0.006	0.033	0.195	0.018	2.048	0.325	0.030	29.900	0.585	0.054	31.980
	Exploration Wells		0.063	0.006	0.032	0.190	0.017	1.990	0.300	0.028	25.800	0.553	0.051	27.822
	Development Wells		0.026	0.002	0.013	0.078	0.007	0.817	0.156	0.014	17.160	0.260	0.024	17.990
	Total		1.792	0.164	0.404	0.977	0.090	7.374	0.874	0.080	74.508	3.643	0.334	82.285
2011	Pipeline	19.9	0.512	0.026	0.149	0.288	0.014	1.132	0.093	0.005	1.648	0.893	0.045	2.928
	Platforms		2.251	0.113	0.356	0.453	0.023	2.775				2.704	0.136	3.131
	Production Wells		0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
	Exploration Wells													
	Development Wells													
	Total		2.893	0.145	0.570	1.130	0.057	8.002	0.743	0.037	61.448	4.767	0.240	70.019
2012	Pipeline	30.8	1.025	0.033	0.298	0.576	0.019	2.263	0.186	0.006	3.295	1.786	0.058	5.857
	Platforms		3.377	0.110	0.533	0.679	0.022	4.162				4.056	0.132	4.696
	Production Wells		0.195	0.006	0.098	0.585	0.019	6.143	0.975	0.032	89.700	1.755	0.057	95.940
	Exploration Wells		0.095	0.003	0.047	0.285	0.009	2.985	0.450	0.015	38.700	0.830	0.027	41.732
	Development Wells													
	Total		4.691	0.152	0.977	2.125	0.069	15.553	1.611	0.052	131.695	8.427	0.274	148.225
2013	Pipeline	50.7	1.793	0.035	0.522	1.007	0.020	3.961	0.326	0.006	5.766	3.126	0.062	10.249
	Platforms		5.108	0.101	0.807	1.027	0.020	6.297				6.135	0.121	7.104
	Production Wells		0.295	0.006	0.148	0.885	0.017	9.293	1.475	0.029	135.700	2.655	0.052	145.140
	Exploration Wells		0.063	0.001	0.032	0.190	0.004	1.990	0.300	0.006	25.800	0.553	0.011	27.822
	Development Wells		0.039	0.001	0.020	0.117	0.002	1.226	0.234	0.005	25.740	0.390	0.008	26.985
	Total		7.298	0.144	1.528	3.227	0.064	22.766	2.335	0.046	193.006	12.860	0.254	217.300

**Table 4.4.11
Arctic Spill Occurrence Beaufort Sea Sale All Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2014	Pipeline	56.2	1.793	0.032	0.522	1.007	0.018	3.961	0.326	0.006	5.766	3.126	0.056	10.249
	Platforms		6.239	0.111	0.986	1.255	0.022	7.691				7.494	0.133	8.676
	Production Wells		0.360	0.006	0.180	1.080	0.019	11.340	1.800	0.032	165.600	3.240	0.058	177.120
	Exploration Wells													
	Development Wells		0.052	0.001	0.026	0.156	0.003	1.634	0.312	0.006	34.320	0.520	0.009	35.980
	Total		8.444	0.150	1.714	3.498	0.062	24.626	2.438	0.043	205.686	14.380	0.256	232.026
2015	Pipeline	64.2	2.821	0.044	0.822	1.569	0.024	6.170	0.509	0.008	9.006	4.898	0.076	15.997
	Platforms		7.124	0.111	1.126	1.432	0.022	8.778				8.556	0.133	9.904
	Production Wells		0.410	0.006	0.205	1.230	0.019	12.915	2.050	0.032	188.600	3.690	0.057	201.720
	Exploration Wells		0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.004	13.911
	Development Wells		0.026	0.000	0.013	0.078	0.001	0.817	0.156	0.002	17.160	0.260	0.004	17.990
	Total		10.412	0.162	2.181	4.404	0.069	29.675	2.865	0.045	227.666	17.681	0.275	259.522
2016	Pipeline	67.4	2.821	0.042	0.822	1.569	0.023	6.170	0.509	0.008	9.006	4.898	0.073	15.997
	Platforms		8.274	0.123	1.307	1.663	0.025	10.192				9.936	0.147	11.499
	Production Wells		0.475	0.007	0.238	1.425	0.021	14.963	2.375	0.035	218.500	4.275	0.063	233.700
	Exploration Wells													
	Development Wells													
	Total		11.569	0.172	2.366	4.657	0.069	31.324	2.884	0.043	227.506	19.110	0.284	261.196
2017	Pipeline	77.4	4.161	0.054	1.181	2.208	0.029	8.722	0.711	0.009	12.530	7.080	0.091	22.433
	Platforms		9.423	0.122	1.489	1.893	0.024	11.606				11.317	0.146	13.095
	Production Wells		0.540	0.007	0.270	1.620	0.021	17.010	2.700	0.035	248.400	4.860	0.063	265.680
	Exploration Wells		0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.004	13.911
	Development Wells													
	Total		14.156	0.183	2.956	5.817	0.075	38.333	3.561	0.046	273.830	23.533	0.304	315.118
2018	Pipeline	82.9	4.161	0.050	1.181	2.208	0.027	8.722	0.711	0.009	12.530	7.080	0.085	22.433
	Platforms		11.546	0.139	1.824	2.319	0.028	14.216				13.865	0.167	16.040
	Production Wells		0.660	0.008	0.330	1.980	0.024	20.790	3.300	0.040	303.600	5.940	0.072	324.720
	Exploration Wells		0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.003	13.911
	Development Wells													
	Total		16.398	0.198	3.351	6.602	0.080	44.723	4.161	0.050	329.030	27.162	0.328	377.104
2019	Pipeline	104.6	6.014	0.057	1.690	3.128	0.030	12.379	1.006	0.010	17.674	10.148	0.097	31.742
	Platforms		13.669	0.131	2.160	2.745	0.026	16.826				16.414	0.157	18.986
	Production Wells		0.780	0.007	0.390	2.340	0.022	24.570	3.900	0.037	358.800	7.020	0.067	383.760
	Exploration Wells													
	Development Wells													
	Total		20.463	0.196	4.239	8.213	0.079	53.775	4.906	0.047	376.474	33.582	0.321	434.488
2020	Pipeline	104.8	6.014	0.057	1.690	3.128	0.030	12.379	1.006	0.010	17.674	10.148	0.097	31.742
	Platforms		15.438	0.147	2.439	3.100	0.030	19.001				18.537	0.177	21.440
	Production Wells		0.880	0.008	0.440	2.640	0.025	27.720	4.400	0.042	404.800	7.920	0.076	432.960
	Exploration Wells													
	Development Wells													
	Total		22.332	0.213	4.569	8.868	0.085	59.100	5.406	0.052	422.474	36.606	0.349	486.143
2021	Pipeline	98.6	6.014	0.061	1.690	3.128	0.032	12.379	1.006	0.010	17.674	10.148	0.103	31.742
	Platforms		17.207	0.175	2.719	3.454	0.035	21.176				20.661	0.210	23.895
	Production Wells		0.980	0.010	0.490	2.940	0.030	30.870	4.900	0.050	450.800	8.820	0.089	482.160
	Exploration Wells													
	Development Wells													
	Total		24.201	0.245	4.898	9.523	0.097	64.425	5.906	0.060	468.474	39.629	0.402	537.797
2022	Pipeline	89.2	6.014	0.067	1.690	3.128	0.035	12.379	1.006	0.011	17.674	10.148	0.114	31.742
	Platforms		18.091	0.203	2.858	3.632	0.041	22.264				21.723	0.244	25.122
	Production Wells		1.030	0.012	0.515	3.090	0.035	32.445	5.150	0.058	473.800	9.270	0.104	506.760
	Exploration Wells													
	Development Wells													
	Total		25.136	0.282	5.063	9.850	0.110	67.087	6.156	0.069	491.474	41.141	0.461	563.624
2023	Pipeline	81.4	6.014	0.074	1.690	3.128	0.038	12.379	1.006	0.012	17.674	10.148	0.125	31.742
	Platforms		18.091	0.222	2.858	3.632	0.045	22.264				21.723	0.267	25.122
	Production Wells		1.030	0.013	0.515	3.090	0.038	32.445	5.150	0.063	473.800	9.270	0.114	506.760
	Exploration Wells													
	Development Wells													
	Total		25.136	0.309	5.063	9.850	0.121	67.087	6.156	0.076	491.474	41.141	0.505	563.624

**Table 4.4.11
Arctic Spill Occurrence Beaufort Sea Sale All Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2024	Pipeline	74.8	6.014	0.080	1.690	3.128	0.042	12.379	1.006	0.013	17.674	10.148	0.136	31.742
	Platforms		18.091	0.242	2.858	3.632	0.049	22.264				21.723	0.290	25.122
	Production Wells		1.030	0.014	0.515	3.090	0.041	32.445	5.150	0.069	473.800	9.270	0.124	506.760
	Exploration Wells													
	Development Wells													
	Total		25.136	0.336	5.063	9.850	0.132	67.087	6.156	0.082	491.474	41.141	0.550	563.624
2025	Pipeline	62.5	5.502	0.088	1.541	2.841	0.045	11.247	0.913	0.015	16.026	9.255	0.148	28.814
	Platforms		16.100	0.258	2.544	3.231	0.052	19.809				19.331	0.309	22.353
	Production Wells		0.915	0.015	0.458	2.745	0.044	28.823	4.575	0.073	420.900	8.235	0.132	450.180
	Exploration Wells													
	Development Wells													
	Total		22.517	0.360	4.542	8.817	0.141	59.878	5.488	0.088	436.926	36.821	0.589	501.347
2026	Pipeline	54.1	5.502	0.102	1.541	2.841	0.053	11.247	0.913	0.017	16.026	9.255	0.171	28.814
	Platforms		16.100	0.298	2.544	3.231	0.060	19.809				19.331	0.357	22.353
	Production Wells		0.915	0.017	0.458	2.745	0.051	28.823	4.575	0.085	420.900	8.235	0.152	450.180
	Exploration Wells													
	Development Wells													
	Total		22.517	0.416	4.542	8.817	0.163	59.878	5.488	0.101	436.926	36.821	0.681	501.347
2027	Pipeline	44.6	4.990	0.112	1.391	2.553	0.057	10.115	0.819	0.018	14.379	8.362	0.187	25.886
	Platforms		14.109	0.316	2.229	2.831	0.063	17.354				16.940	0.380	19.583
	Production Wells		0.800	0.018	0.400	2.400	0.054	25.200	4.000	0.090	368.000	7.200	0.161	393.600
	Exploration Wells													
	Development Wells													
	Total		19.898	0.446	4.021	7.784	0.175	52.669	4.819	0.108	382.379	32.502	0.729	439.069
2028	Pipeline	36.9	4.221	0.114	1.168	2.121	0.057	8.418	0.680	0.018	11.908	7.022	0.190	21.493
	Platforms		12.117	0.328	1.915	2.431	0.066	14.899				14.548	0.394	16.814
	Production Wells		0.685	0.019	0.343	2.055	0.056	21.578	3.425	0.093	315.100	6.165	0.167	337.020
	Exploration Wells													
	Development Wells													
	Total		17.024	0.461	3.425	6.607	0.179	44.895	4.105	0.111	327.008	27.735	0.752	375.327
2029	Pipeline	32.2	4.221	0.131	1.168	2.121	0.066	8.418	0.680	0.021	11.908	7.022	0.218	21.493
	Platforms		12.117	0.376	1.915	2.431	0.075	14.899				14.548	0.452	16.814
	Production Wells		0.685	0.021	0.343	2.055	0.064	21.578	3.425	0.106	315.100	6.165	0.191	337.020
	Exploration Wells													
	Development Wells													
	Total		17.024	0.529	3.425	6.607	0.205	44.895	4.105	0.127	327.008	27.735	0.861	375.327
2030	Pipeline	25.8	3.194	0.124	0.868	1.559	0.060	6.209	0.497	0.019	8.668	5.250	0.203	15.745
	Platforms		10.083	0.391	1.593	2.022	0.078	12.398				12.106	0.469	13.991
	Production Wells		0.570	0.022	0.285	1.710	0.066	17.955	2.850	0.110	262.200	5.130	0.199	280.440
	Exploration Wells													
	Development Wells													
	Total		13.847	0.537	2.746	5.292	0.205	36.562	3.347	0.130	270.868	22.485	0.872	310.176
2031	Pipeline	22.6	3.194	0.141	0.749	1.559	0.069	5.523	0.497	0.022	8.099	5.250	0.232	14.371
	Platforms		10.083	0.446	1.593	2.022	0.089	12.398				12.106	0.536	13.991
	Production Wells		0.570	0.025	0.285	1.710	0.076	17.955	2.850	0.126	262.200	5.130	0.227	280.440
	Exploration Wells													
	Development Wells													
	Total		13.847	0.613	2.627	5.292	0.234	35.876	3.347	0.148	270.299	22.485	0.995	308.802
2032	Pipeline	19.7	3.194	0.162	0.868	1.559	0.079	6.209	0.497	0.025	8.668	5.250	0.266	15.745
	Platforms		10.083	0.512	1.593	2.022	0.103	12.398				12.106	0.614	13.991
	Production Wells		0.570	0.029	0.285	1.710	0.087	17.955	2.850	0.145	262.200	5.130	0.260	280.440
	Exploration Wells													
	Development Wells													
	Total		13.847	0.703	2.746	5.292	0.269	36.562	3.347	0.170	270.868	22.485	1.141	310.176
2033	Pipeline	17.2	3.194	0.186	0.868	1.559	0.091	6.209	0.497	0.029	8.668	5.250	0.305	15.745
	Platforms		10.083	0.586	1.593	2.022	0.118	12.398				12.106	0.704	13.991
	Production Wells		0.570	0.033	0.285	1.710	0.099	17.955	2.850	0.166	262.200	5.130	0.298	280.440
	Exploration Wells													
	Development Wells													
	Total		13.847	0.805	2.746	5.292	0.308	36.562	3.347	0.195	270.868	22.485	1.307	310.176

**Table 4.4.11
Arctic Spill Occurrence Beaufort Sea Sale All Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2034	Pipeline	15.1	3.194	0.211	0.868	1.559	0.103	6.209	0.497	0.033	8.668	5.250	0.348	15.745
	Platforms		10.083	0.668	1.593	2.022	0.134	12.398				12.106	0.802	13.991
	Production Wells		0.570	0.038	0.285	1.710	0.113	17.955	2.850	0.189	262.200	5.130	0.340	280.440
	Exploration Wells													
	Development Wells													
	Total		13.847	0.917	2.746	5.292	0.350	36.562	3.347	0.222	270.868	22.485	1.489	310.176
2035	Pipeline	13.2	3.194	0.242	0.868	1.559	0.118	6.209	0.497	0.038	8.668	5.250	0.398	15.745
	Platforms		10.083	0.764	1.593	2.022	0.153	12.398				12.106	0.917	13.991
	Production Wells		0.570	0.043	0.285	1.710	0.130	17.955	2.850	0.216	262.200	5.130	0.389	280.440
	Exploration Wells													
	Development Wells													
	Total		13.847	1.049	2.746	5.292	0.401	36.562	3.347	0.254	270.868	22.485	1.703	310.176
2036	Pipeline	8.3	1.854	0.223	0.509	0.920	0.111	3.657	0.294	0.035	5.144	3.068	0.370	9.310
	Platforms		6.014	0.725	0.950	1.206	0.145	7.395				7.221	0.870	8.346
	Production Wells		0.340	0.041	0.170	1.020	0.123	10.710	1.700	0.205	156.400	3.060	0.369	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.989	1.629	3.146	0.379	21.762	1.994	0.240	161.544	13.349	1.608	184.935
2037	Pipeline	7.3	1.854	0.254	0.509	0.920	0.126	3.657	0.294	0.040	5.144	3.068	0.420	9.310
	Platforms		6.014	0.824	0.950	1.206	0.165	7.395				7.221	0.989	8.346
	Production Wells		0.340	0.047	0.170	1.020	0.140	10.710	1.700	0.233	156.400	3.060	0.419	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	1.124	1.629	3.146	0.431	21.762	1.994	0.273	161.544	13.349	1.829	184.935
2038	Pipeline	6.5	1.854	0.285	0.509	0.920	0.142	3.657	0.294	0.045	5.144	3.068	0.472	9.310
	Platforms		6.014	0.925	0.950	1.206	0.186	7.395				7.221	1.111	8.346
	Production Wells		0.340	0.052	0.170	1.020	0.157	10.710	1.700	0.262	156.400	3.060	0.471	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	1.263	1.629	3.146	0.484	21.762	1.994	0.307	161.544	13.349	2.054	184.935

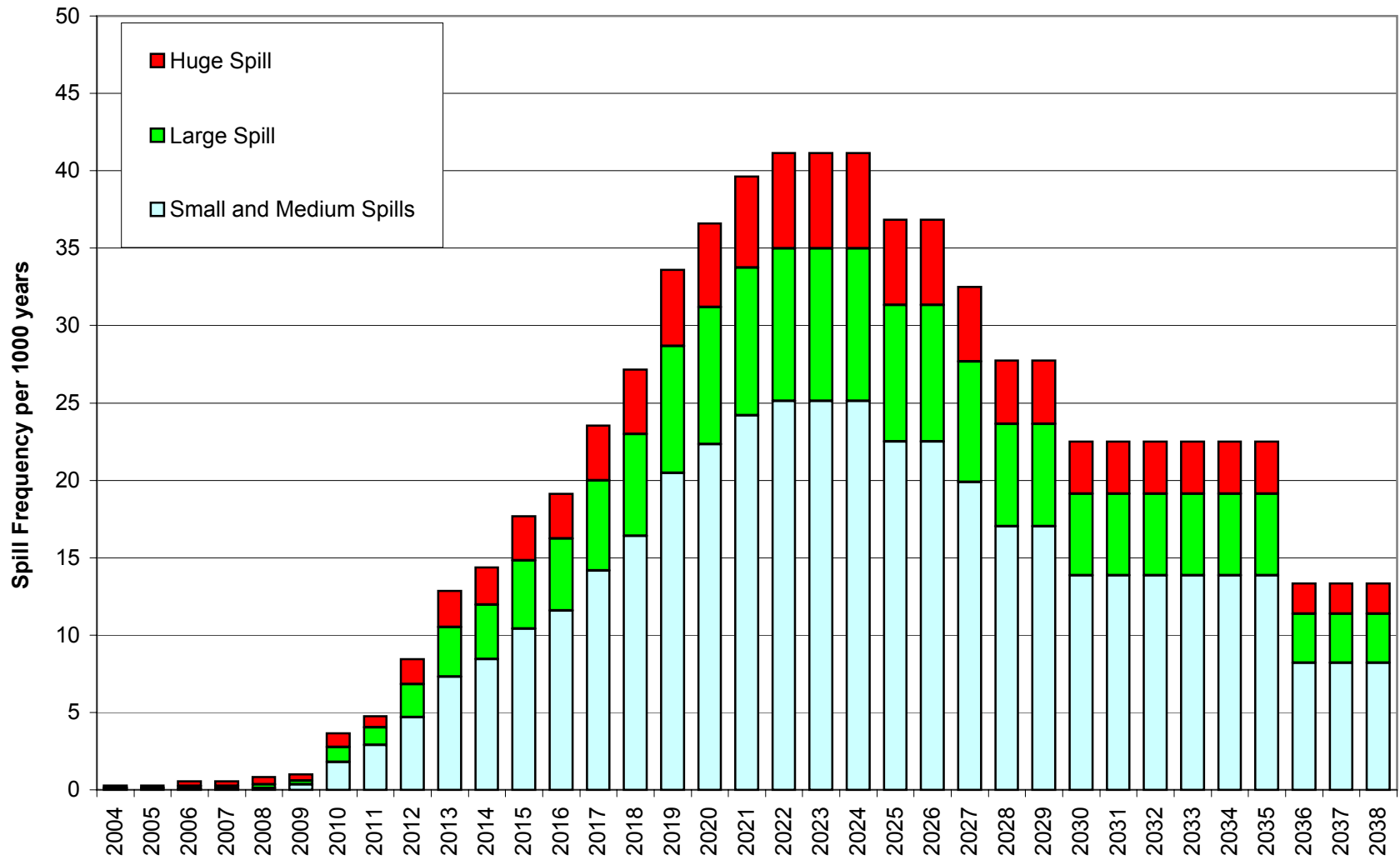
**Table 4.4.12
Arctic Spill Occurrence Beaufort Sea Sale All Annual Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2005		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2006		0.06		0.029	0.17		1.812	0.306		30.06	0.537		31.901
2007		0.06		0.032	0.19		1.990	0.300		25.80	0.553		27.822
2008		0.09		0.045	0.27		2.807	0.456		42.96	0.813		45.812
2009		0.33		0.077	0.27		2.605	0.381		36.96	0.984		39.642
2010	10.9	1.79	0.164	0.404	0.98	0.090	7.374	0.874	0.080	74.51	3.643	0.334	82.285
2011	19.9	2.89	0.145	0.570	1.13	0.057	8.002	0.743	0.037	61.45	4.767	0.240	70.019
2012	30.8	4.69	0.152	0.977	2.12	0.069	15.553	1.611	0.052	131.70	8.427	0.274	148.225
2013	50.7	7.30	0.144	1.528	3.23	0.064	22.766	2.335	0.046	193.01	12.860	0.254	217.300
2014	56.2	8.44	0.150	1.714	3.50	0.062	24.626	2.438	0.043	205.69	14.380	0.256	232.026
2015	64.2	10.41	0.162	2.181	4.40	0.069	29.675	2.865	0.045	227.67	17.681	0.275	259.522
2016	67.4	11.57	0.172	2.366	4.66	0.069	31.324	2.884	0.043	227.51	19.110	0.284	261.196
2017	77.4	14.16	0.183	2.956	5.82	0.075	38.333	3.561	0.046	273.83	23.533	0.304	315.118
2018	82.9	16.40	0.198	3.351	6.60	0.080	44.723	4.161	0.050	329.03	27.162	0.328	377.104
2019	104.6	20.46	0.196	4.239	8.21	0.079	53.775	4.906	0.047	376.47	33.582	0.321	434.488
2020	104.8	22.33	0.213	4.569	8.87	0.085	59.100	5.406	0.052	422.47	36.606	0.349	486.143
2021	98.6	24.20	0.245	4.898	9.52	0.097	64.425	5.906	0.060	468.47	39.629	0.402	537.797
2022	89.2	25.14	0.282	5.063	9.85	0.110	67.087	6.156	0.069	491.47	41.141	0.461	563.624
2023	81.4	25.14	0.309	5.063	9.85	0.121	67.087	6.156	0.076	491.47	41.141	0.505	563.624
2024	74.8	25.14	0.336	5.063	9.85	0.132	67.087	6.156	0.082	491.47	41.141	0.550	563.624
2025	62.5	22.52	0.360	4.542	8.82	0.141	59.878	5.488	0.088	436.93	36.821	0.589	501.347
2026	54.1	22.52	0.416	4.542	8.82	0.163	59.878	5.488	0.101	436.93	36.821	0.681	501.347
2027	44.6	19.90	0.446	4.021	7.78	0.175	52.669	4.819	0.108	382.38	32.502	0.729	439.069
2028	36.9	17.02	0.461	3.425	6.61	0.179	44.895	4.105	0.111	327.01	27.735	0.752	375.327
2029	32.2	17.02	0.529	3.425	6.61	0.205	44.895	4.105	0.127	327.01	27.735	0.861	375.327
2030	25.8	13.85	0.537	2.746	5.29	0.205	36.562	3.347	0.130	270.87	22.485	0.872	310.176
2031	22.6	13.85	0.613	2.627	5.29	0.234	35.876	3.347	0.148	270.30	22.485	0.995	308.802
2032	19.7	13.85	0.703	2.746	5.29	0.269	36.562	3.347	0.170	270.87	22.485	1.141	310.176
2033	17.2	13.85	0.805	2.746	5.29	0.308	36.562	3.347	0.195	270.87	22.485	1.307	310.176
2034	15.1	13.85	0.917	2.746	5.29	0.350	36.562	3.347	0.222	270.87	22.485	1.489	310.176
2035	13.2	13.85	1.049	2.746	5.29	0.401	36.562	3.347	0.254	270.87	22.485	1.703	310.176
2036	8.3	8.21	0.989	1.629	3.15	0.379	21.762	1.994	0.240	161.54	13.349	1.608	184.935
2037	7.3	8.21	1.124	1.629	3.15	0.431	21.762	1.994	0.273	161.54	13.349	1.829	184.935
2038	6.5	8.21	1.263	1.629	3.15	0.484	21.762	1.994	0.307	161.54	13.349	2.054	184.935

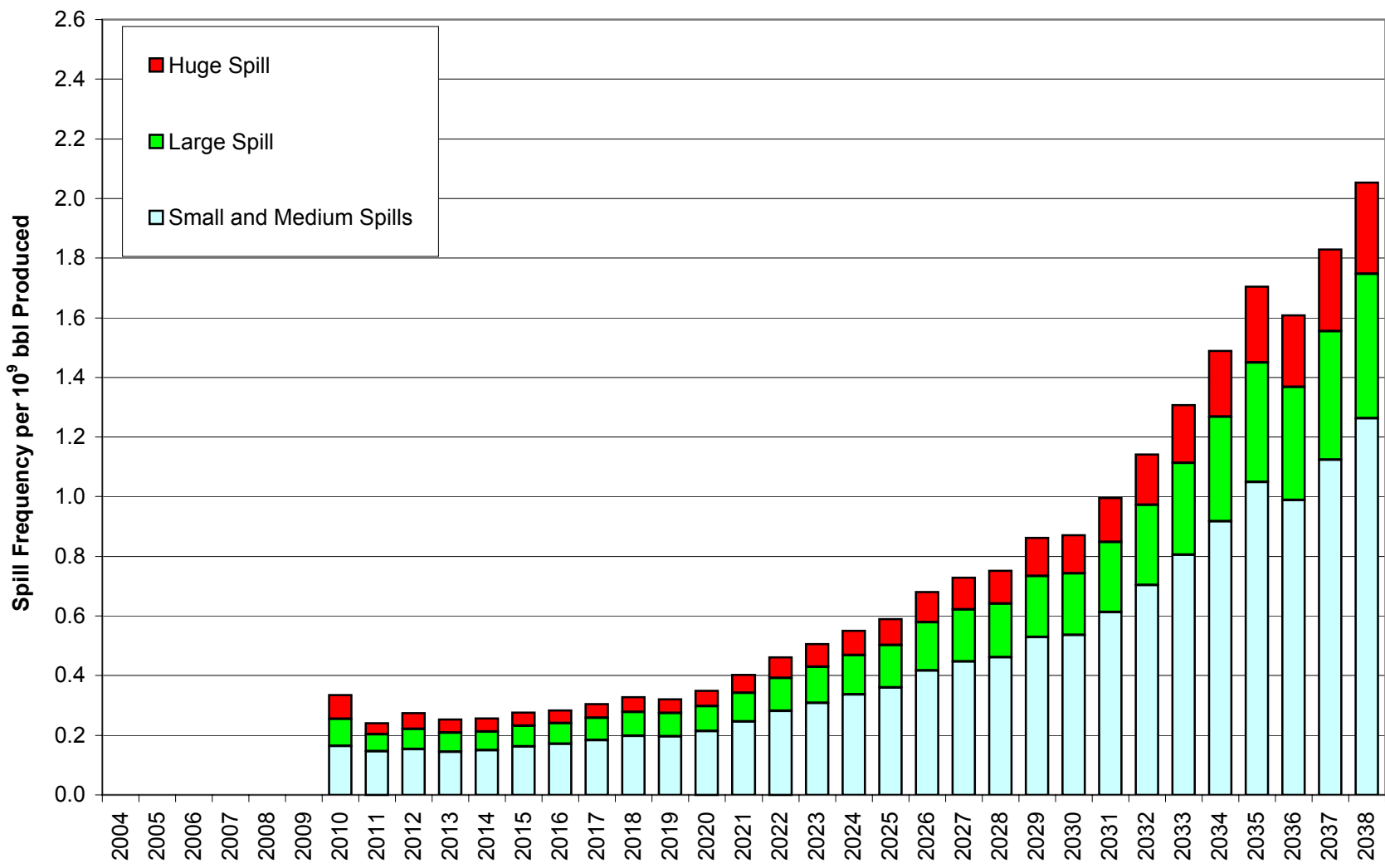
**Table 4.4.13
Arctic Spill Occurrence Beaufort Sea Sale All Wells Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]
2004		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2005		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2006		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901
2007		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2008		0.089		0.045	0.268		2.807	0.456		42.960	0.813		45.812
2009		0.073		0.036	0.218		2.285	0.381		36.960	0.672		39.281
2010	10.9	0.154	0.014	0.077	0.463	0.042	4.855	0.781	0.072	72.860	1.398	0.128	77.792
2011	19.9	0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
2012	30.8	0.290	0.009	0.145	0.870	0.028	9.127	1.425	0.046	128.400	2.585	0.084	137.672
2013	50.7	0.397	0.008	0.199	1.192	0.024	12.508	2.009	0.040	187.240	3.598	0.071	199.947
2014	56.2	0.412	0.007	0.206	1.236	0.022	12.974	2.112	0.038	199.920	3.760	0.067	213.100
2015	64.2	0.468	0.007	0.234	1.403	0.022	14.727	2.356	0.037	218.660	4.227	0.066	233.621
2016	67.4	0.475	0.007	0.238	1.425	0.021	14.963	2.375	0.035	218.500	4.275	0.063	233.700
2017	77.4	0.572	0.007	0.286	1.715	0.022	18.005	2.850	0.037	261.300	5.137	0.066	279.591
2018	82.9	0.692	0.008	0.346	2.075	0.025	21.785	3.450	0.042	316.500	6.217	0.075	338.631
2019	104.6	0.780	0.007	0.390	2.340	0.022	24.570	3.900	0.037	358.800	7.020	0.067	383.760
2020	104.8	0.880	0.008	0.440	2.640	0.025	27.720	4.400	0.042	404.800	7.920	0.076	432.960
2021	98.6	0.980	0.010	0.490	2.940	0.030	30.870	4.900	0.050	450.800	8.820	0.089	482.160
2022	89.2	1.030	0.012	0.515	3.090	0.035	32.445	5.150	0.058	473.800	9.270	0.104	506.760
2023	81.4	1.030	0.013	0.515	3.090	0.038	32.445	5.150	0.063	473.800	9.270	0.114	506.760
2024	74.8	1.030	0.014	0.515	3.090	0.041	32.445	5.150	0.069	473.800	9.270	0.124	506.760
2025	62.5	0.915	0.015	0.458	2.745	0.044	28.823	4.575	0.073	420.900	8.235	0.132	450.180
2026	54.1	0.915	0.017	0.458	2.745	0.051	28.823	4.575	0.085	420.900	8.235	0.152	450.180
2027	44.6	0.800	0.018	0.400	2.400	0.054	25.200	4.000	0.090	368.000	7.200	0.161	393.600
2028	36.9	0.685	0.019	0.343	2.055	0.056	21.578	3.425	0.093	315.100	6.165	0.167	337.020
2029	32.2	0.685	0.021	0.343	2.055	0.064	21.578	3.425	0.106	315.100	6.165	0.191	337.020
2030	25.8	0.570	0.022	0.285	1.710	0.066	17.955	2.850	0.110	262.200	5.130	0.199	280.440
2031	22.6	0.570	0.025	0.285	1.710	0.076	17.955	2.850	0.126	262.200	5.130	0.227	280.440
2032	19.7	0.570	0.029	0.285	1.710	0.087	17.955	2.850	0.145	262.200	5.130	0.260	280.440
2033	17.2	0.570	0.033	0.285	1.710	0.099	17.955	2.850	0.166	262.200	5.130	0.298	280.440
2034	15.1	0.570	0.038	0.285	1.710	0.113	17.955	2.850	0.189	262.200	5.130	0.340	280.440
2035	13.2	0.570	0.043	0.285	1.710	0.130	17.955	2.850	0.216	262.200	5.130	0.389	280.440
2036	8.3	0.340	0.041	0.170	1.020	0.123	10.710	1.700	0.205	156.400	3.060	0.369	167.280
2037	7.3	0.340	0.047	0.170	1.020	0.140	10.710	1.700	0.233	156.400	3.060	0.419	167.280
2038	6.5	0.340	0.052	0.170	1.020	0.157	10.710	1.700	0.262	156.400	3.060	0.471	167.280

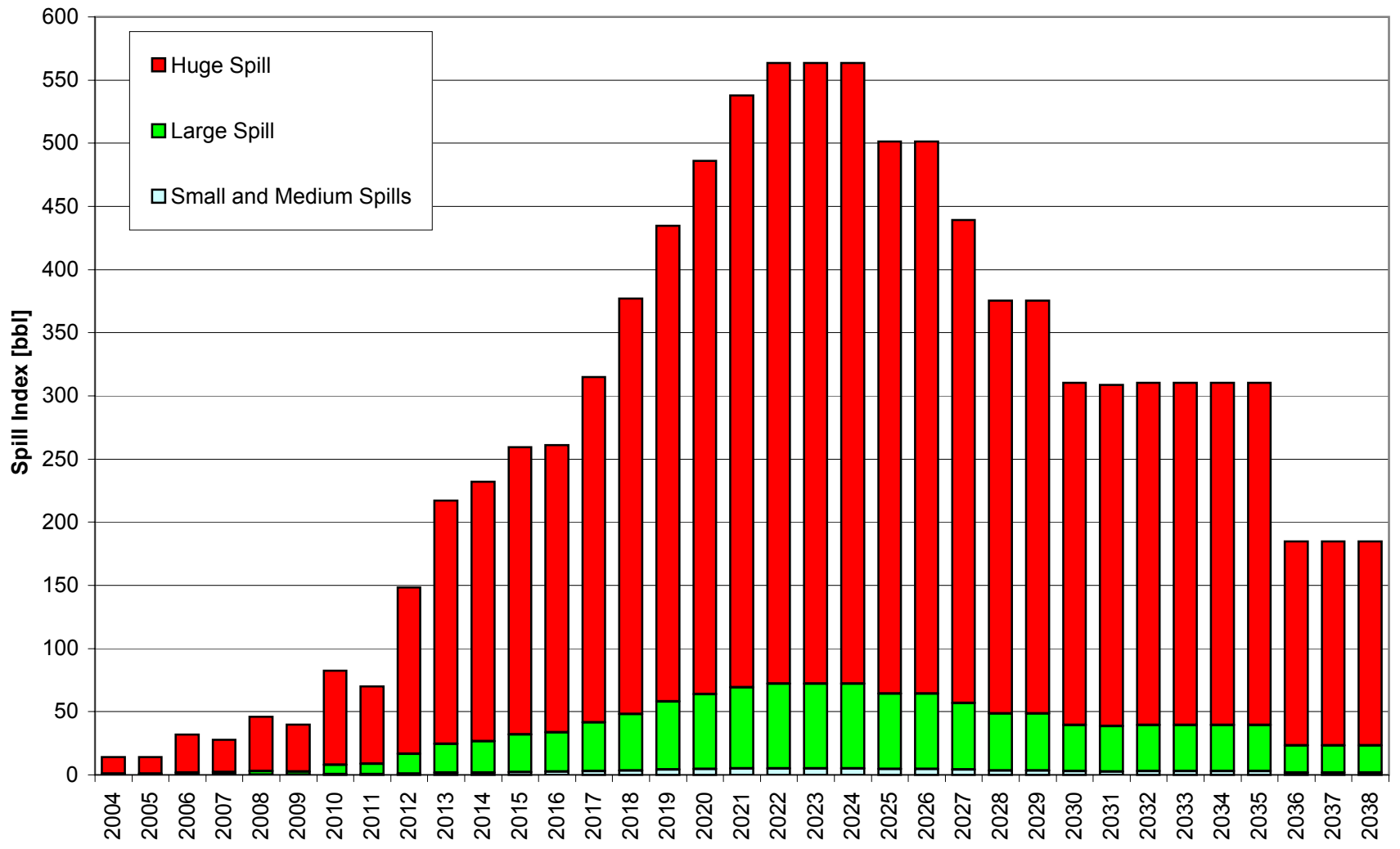
Beaufort Sea Sale All Spill Frequency



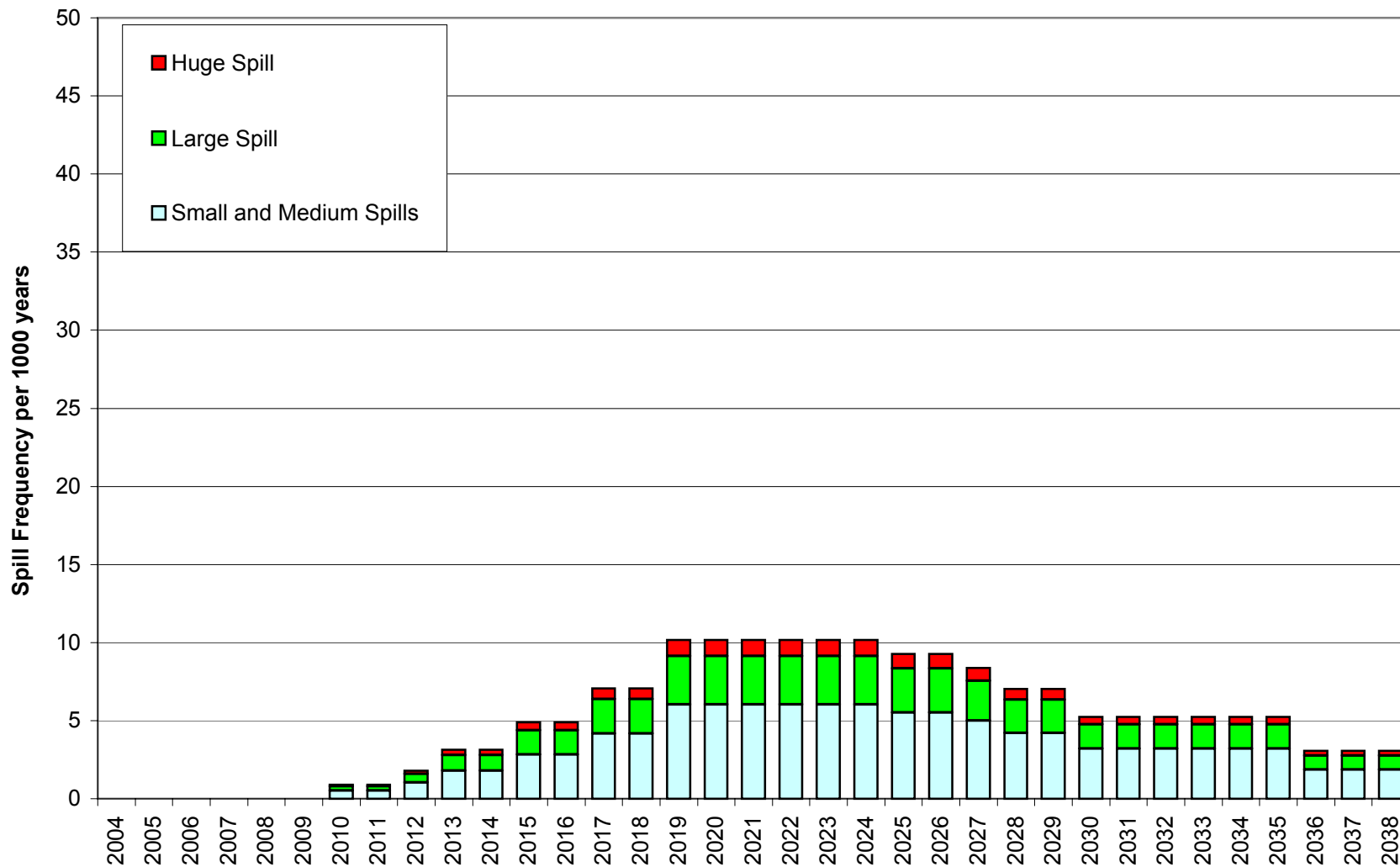
Beaufort Sea Sale All Spill Frequency per 10⁹ bbl Produced



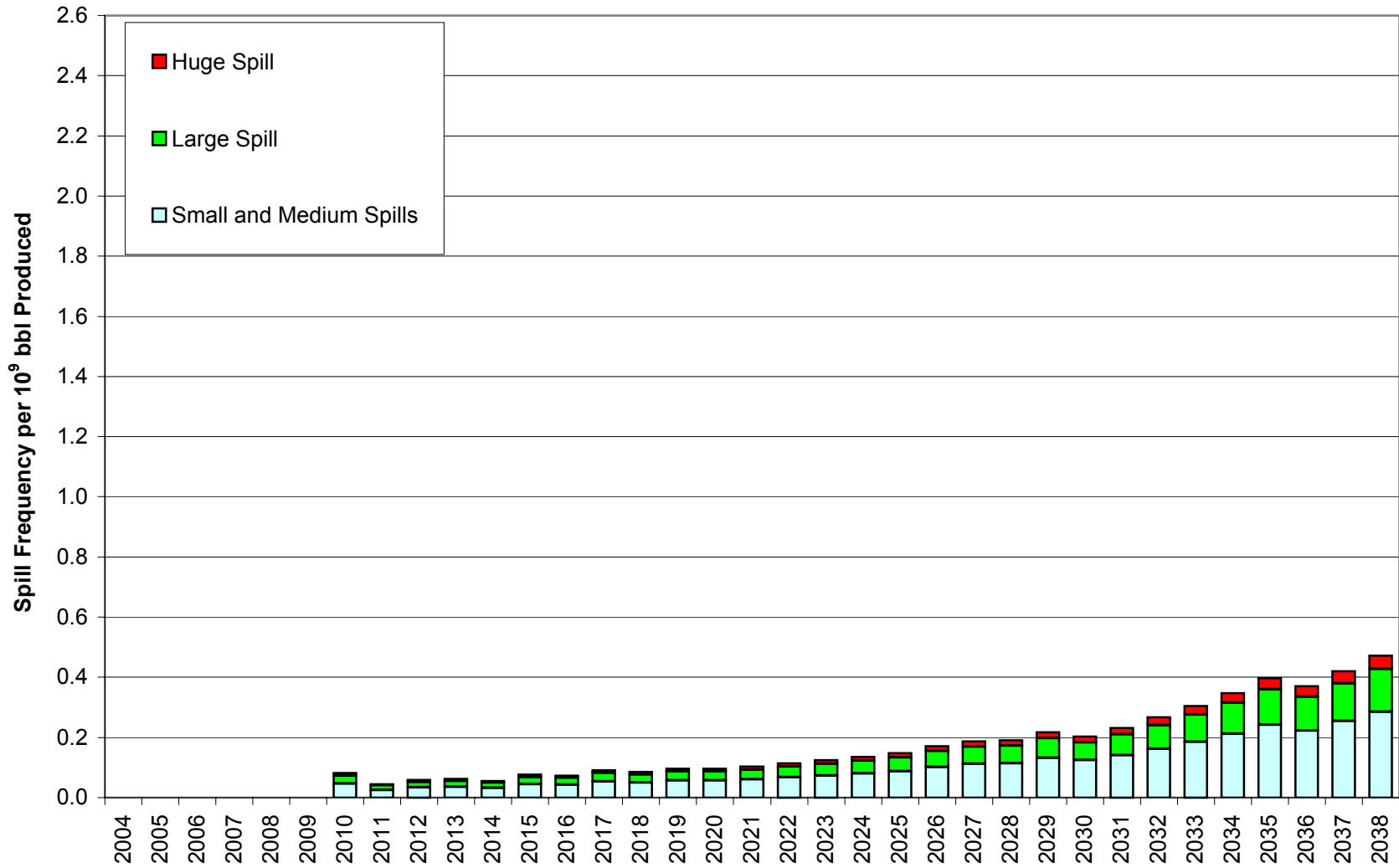
Beaufort Sea Sale All Spill Index



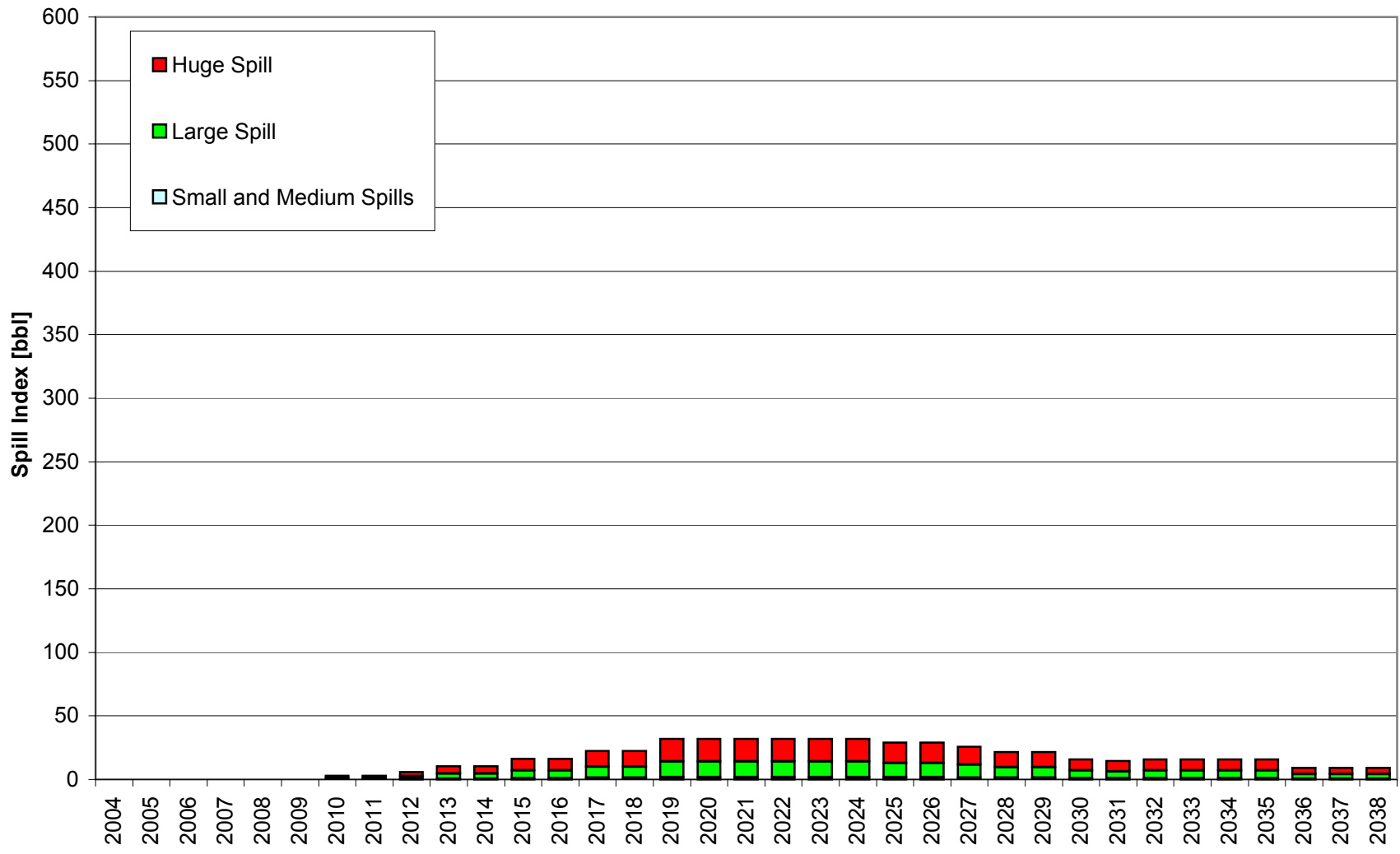
Beaufort Sea Sale All Spill Frequency - P/L



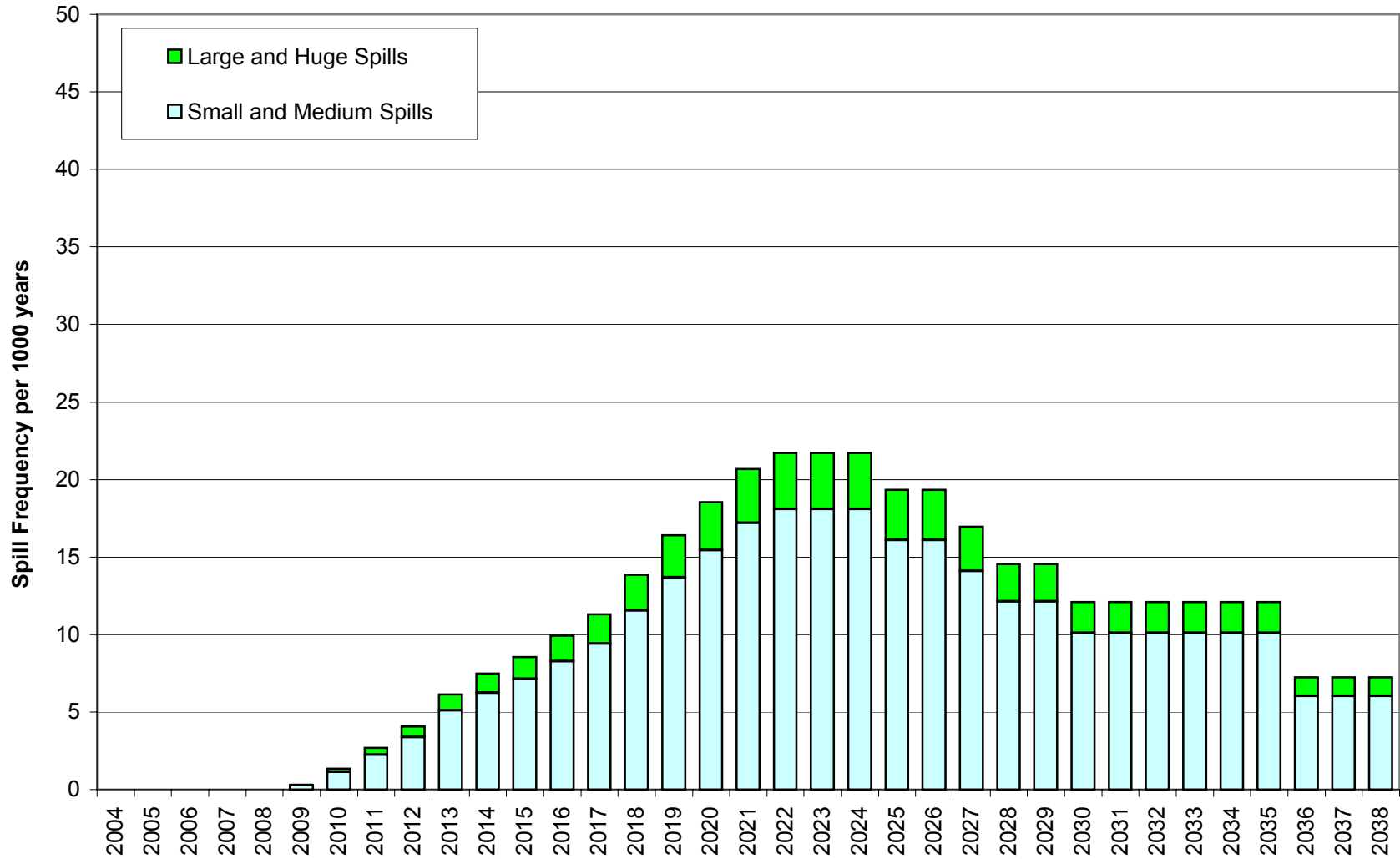
Beaufort Sea Sale All Spill Frequency per 10⁹ bbl Produced - P/L



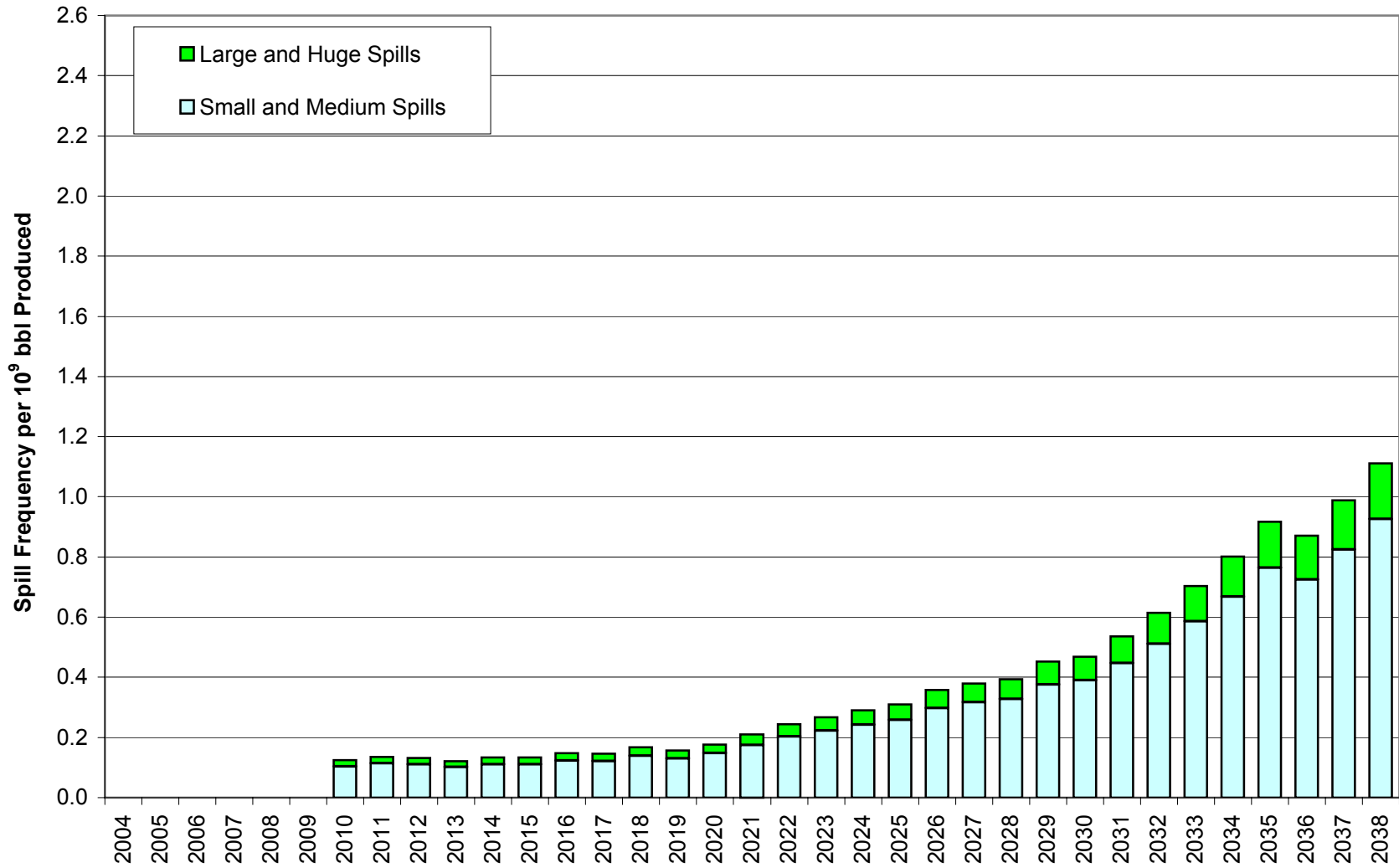
Beaufort Sea Sale All Spill Index - P/L



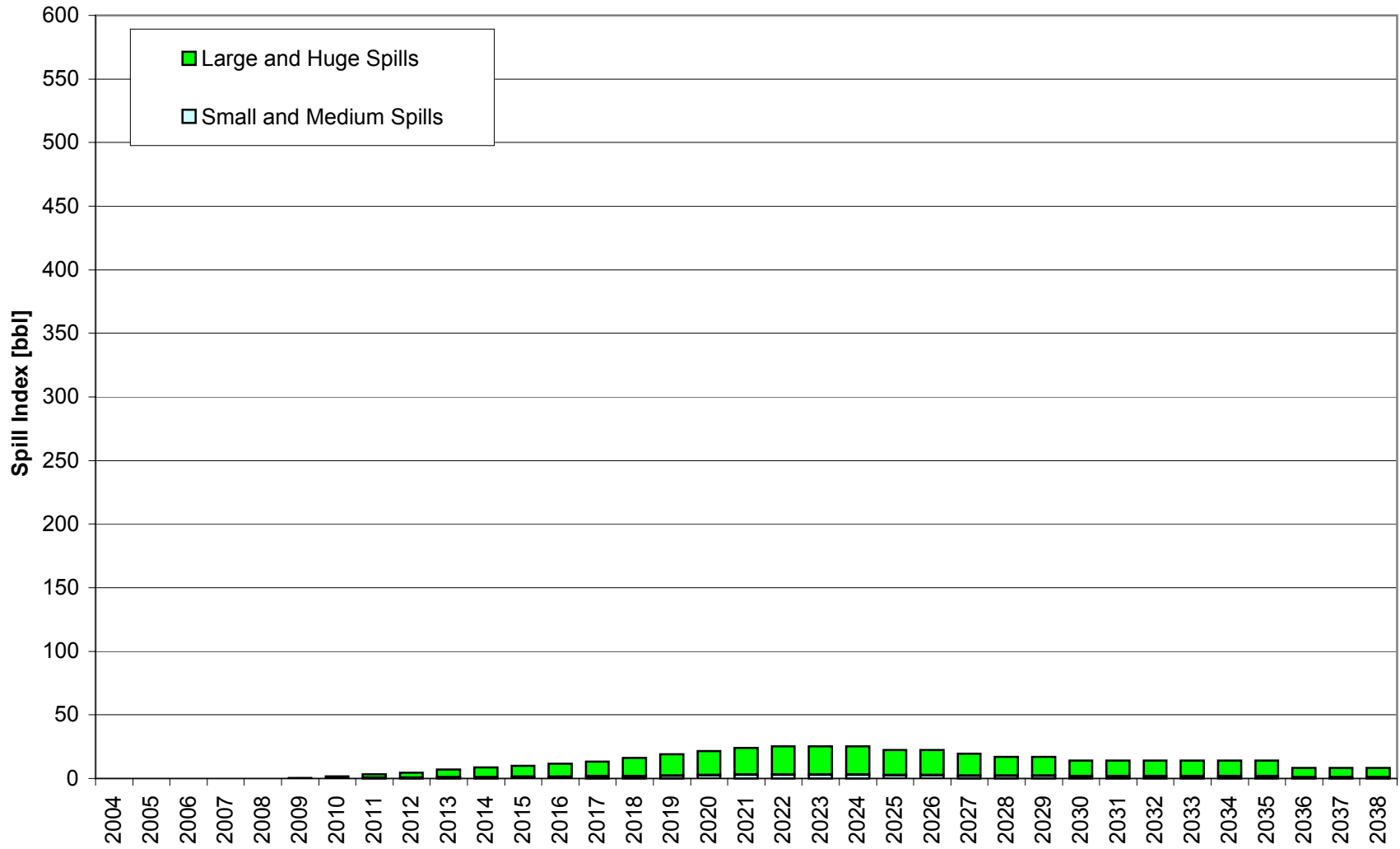
Beaufort Sea Sale All Spill Frequency - Platforms



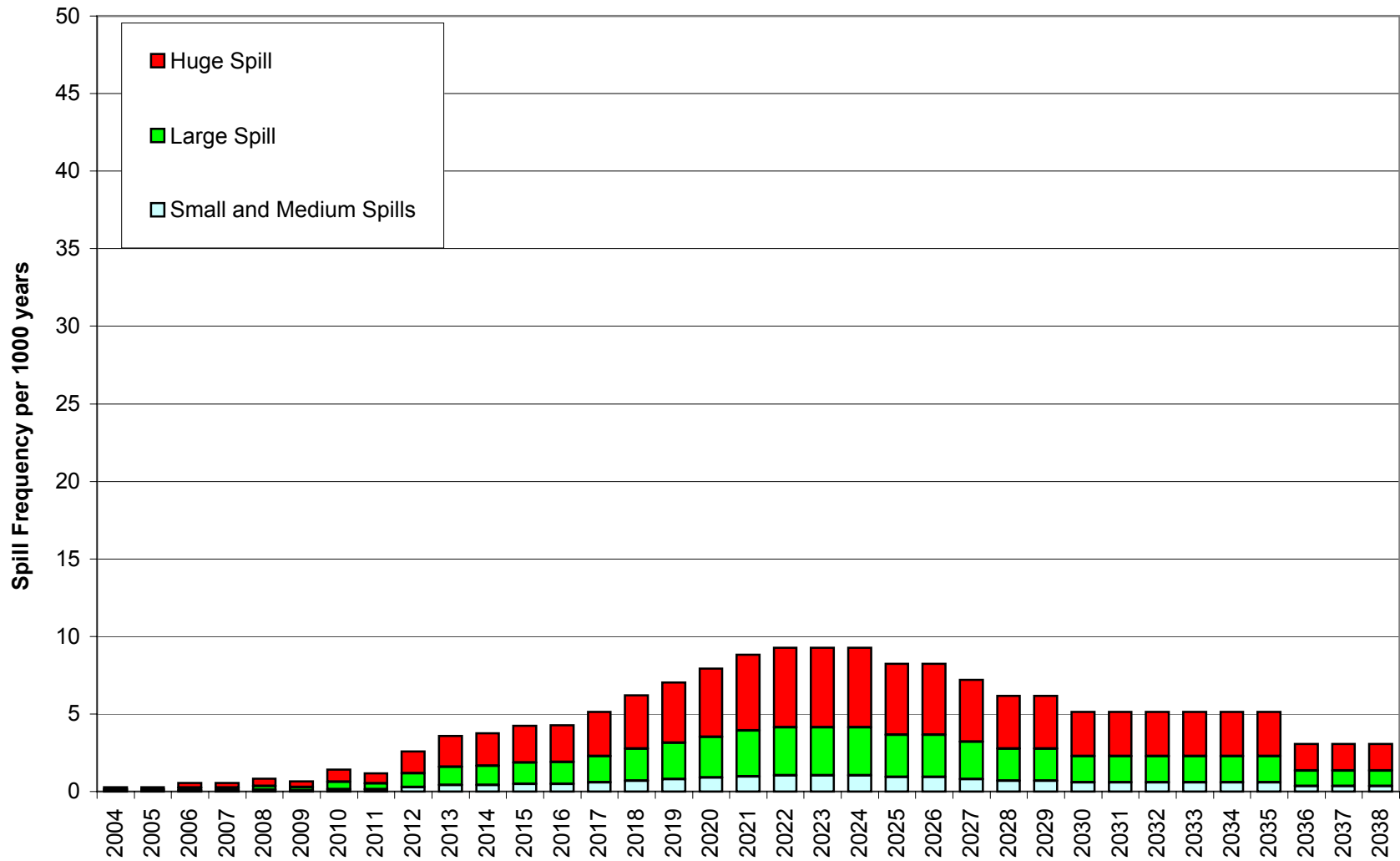
Beaufort Sea Sale All Spill Frequency per 10⁹ bbl Produced - Platforms



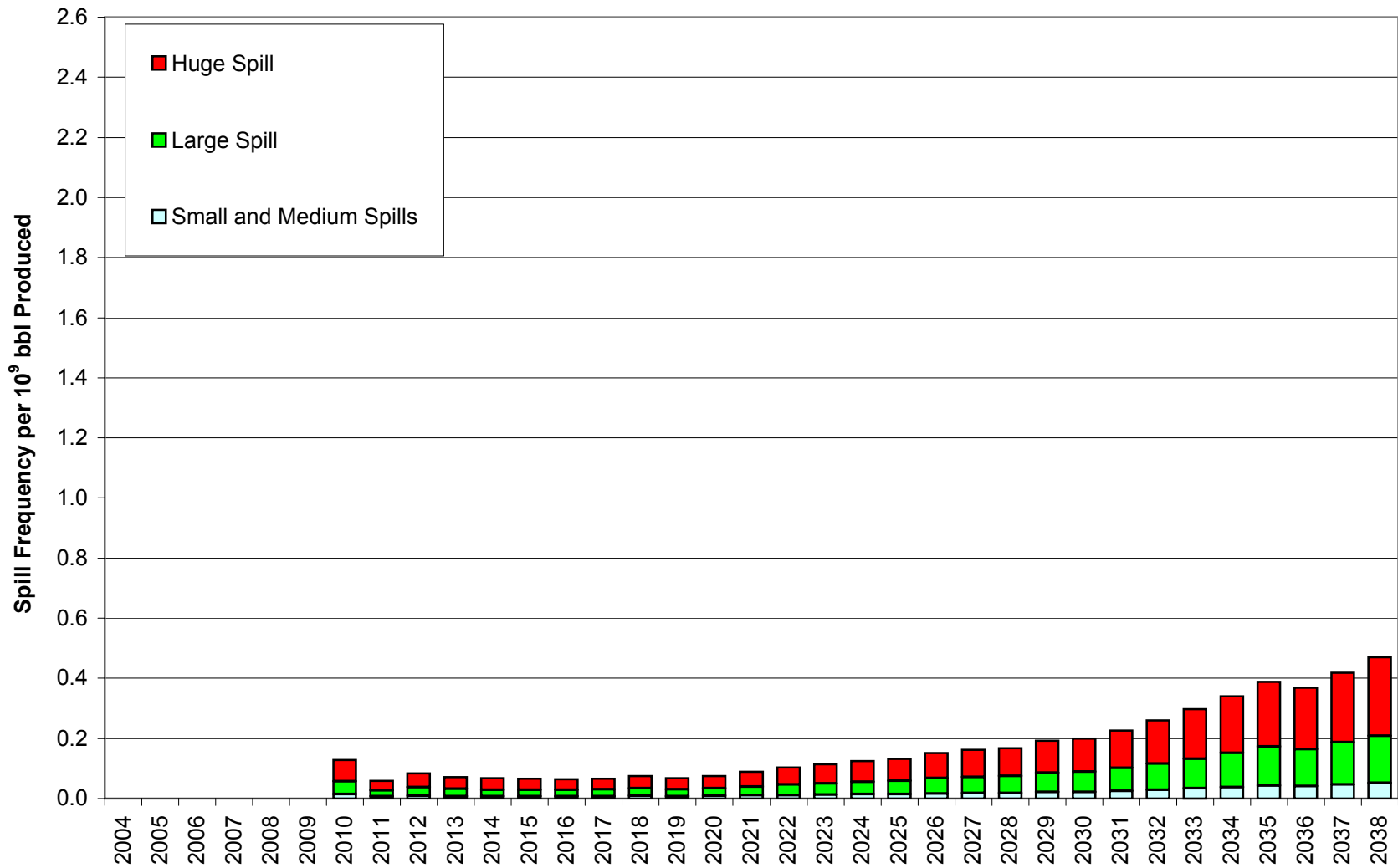
Beaufort Sea Sale All Spill Index - Platforms



Beaufort Sea Sale All Spill Frequency - Wells



Beaufort Sea Sale All Spill Frequency per 10⁹ bbl Produced - Wells



Beaufort Sea Sale All Spill Index - Wells

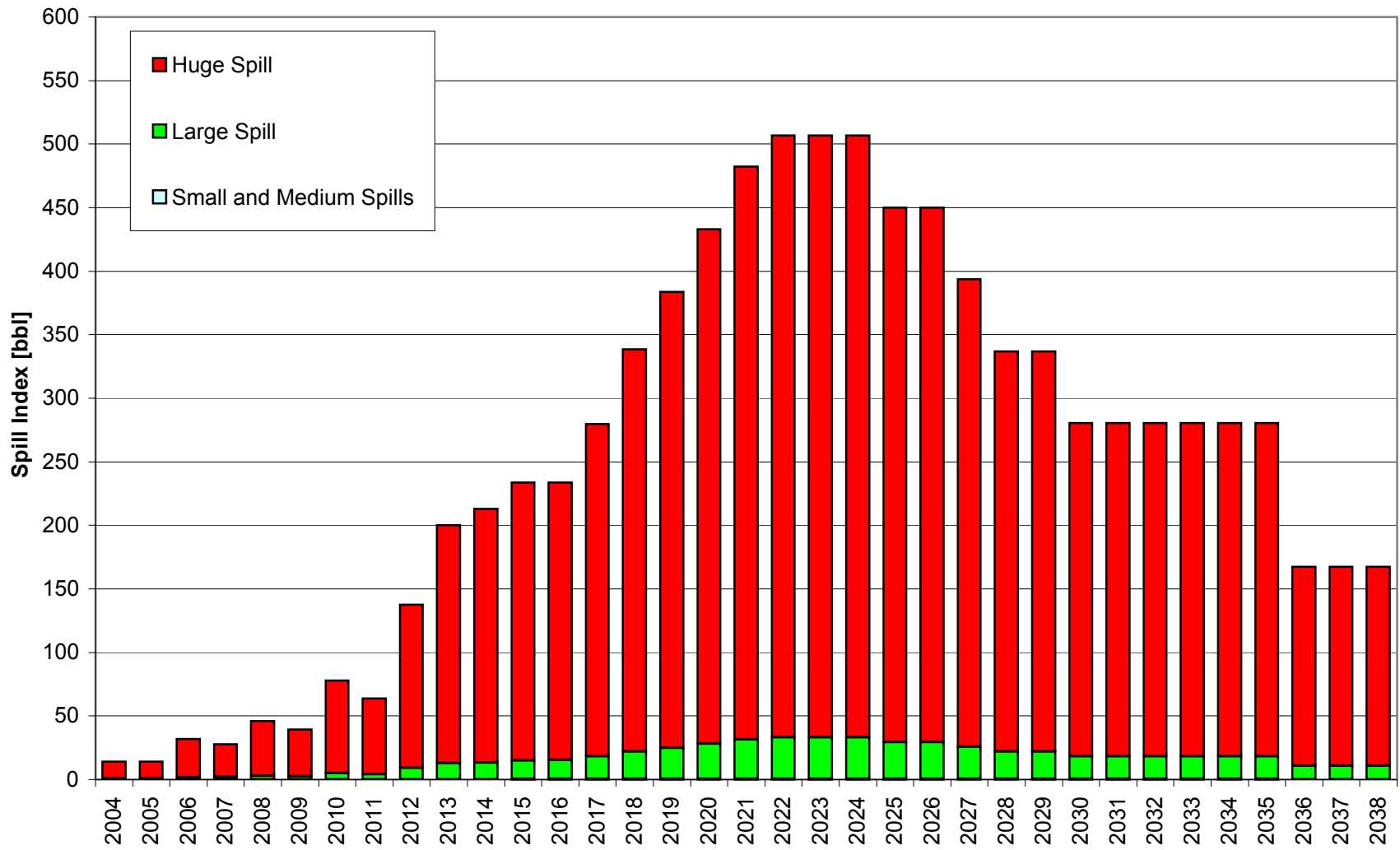


Table 4.5.1
Arctic Spill Occurrence Chukchi Sea BC P/L

17705
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0.82
9.55
20.80
31.18

**Table 4.5.2
Arctic Spill Occurrence Chukchi Sea BC P/L Summary**

Year	Production [MMbbl]	Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0																		
1999	0	2.968		0.172	7.383		2.857	10.351		3.029	5.314		20.894	1.761		31.180	17.426		55.103
2000	0	2.968		0.172	7.383		2.857	10.351		3.029	5.314		20.894	1.761		31.180	17.426		55.103
2001	0	2.968		0.172	7.383		2.857	10.351		3.029	5.314		20.894	1.761		31.180	17.426		55.103
2002	101	2.968	0.029	0.172	7.383	0.073	2.857	10.351	0.102	3.029	5.314	0.053	20.894	1.761	0.017	31.180	17.426	0.173	55.103
2003	135	2.968	0.022	0.172	7.383	0.055	2.857	10.351	0.077	3.029	5.314	0.039	20.894	1.761	0.013	31.180	17.426	0.129	55.103
2004	135	2.968	0.022	0.172	7.383	0.055	2.857	10.351	0.077	3.029	5.314	0.039	20.894	1.761	0.013	31.180	17.426	0.129	55.103
2005	135	2.968	0.022	0.172	7.383	0.055	2.857	10.351	0.077	3.029	5.314	0.039	20.894	1.761	0.013	31.180	17.426	0.129	55.103
2006	135	2.968	0.022	0.172	7.383	0.055	2.857	10.351	0.077	3.029	5.314	0.039	20.894	1.761	0.013	31.180	17.426	0.129	55.103
2007	135	2.968	0.022	0.172	7.383	0.055	2.857	10.351	0.077	3.029	5.314	0.039	20.894	1.761	0.013	31.180	17.426	0.129	55.103
2008	119	2.968	0.025	0.172	7.383	0.062	2.857	10.351	0.087	3.029	5.314	0.045	20.894	1.761	0.015	31.180	17.426	0.146	55.103
2009	103	2.968	0.029	0.172	7.383	0.072	2.857	10.351	0.100	3.029	5.314	0.052	20.894	1.761	0.017	31.180	17.426	0.169	55.103
2010	92	2.968	0.032	0.172	7.383	0.080	2.857	10.351	0.113	3.029	5.314	0.058	20.894	1.761	0.019	31.180	17.426	0.189	55.103

**Table 4.5.3
Arctic Spill Occurrence Chukchi Sea BC Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
1999	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2000	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	2	8	0.913	0.730	0.12	0.182	0.146	0.89
	Total	2	8		0.730	0.12		0.146	0.89
2001	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	4	48	0.913	4.380	0.69	0.182	0.875	5.37
	Total	4	48		4.380	0.69		0.875	5.37
2002	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	6	108	0.913	9.855	1.56	0.182	1.970	12.07
	Total	6	108		9.855	1.56		1.970	12.07
2003	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	6	188	0.913	17.156	2.71	0.182	3.428	21.02
	Total	6	188		17.156	2.71		3.428	21.02
2004	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	6	214	0.913	19.528	3.09	0.182	3.903	23.92
	Total	6	214		19.528	3.09		3.903	23.92
2005	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	6	214	0.913	19.528	3.09	0.182	3.903	23.92
	Total	6	214		19.528	3.09		3.903	23.92
2006	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	6	214	0.913	19.528	3.09	0.182	3.903	23.92
	Total	6	214		19.528	3.09		3.903	23.92
2007	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	6	214	0.913	19.528	3.09	0.182	3.903	23.92
	Total	6	214		19.528	3.09		3.903	23.92
2008	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	6	214	0.913	19.528	3.09	0.182	3.903	23.92
	Total	6	214		19.528	3.09		3.903	23.92
2009	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	6	214	0.913	19.528	3.09	0.182	3.903	23.92
	Total	6	214		19.528	3.09		3.903	23.92
2010	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	6	214	0.913	19.528	3.09	0.182	3.903	23.92
	Total	6	214		19.528	3.09		3.903	23.92

**Table 4.5.4
Arctic Spill Occurrence Chukchi Sea BC Platforms Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0									
1999	0									
2000	0	0.730		0.115	0.146		0.894	0.876		1.010
2001	0	4.380		0.692	0.875		5.366	5.255		6.058
2002	101	9.855	0.098	1.557	1.970	0.020	12.073	11.825	0.117	13.630
2003	135	17.156	0.127	2.711	3.428	0.025	21.016	20.584	0.152	23.727
2004	135	19.528	0.145	3.085	3.903	0.029	23.923	23.431	0.174	27.008
2005	135	19.528	0.145	3.085	3.903	0.029	23.923	23.431	0.174	27.008
2006	135	19.528	0.145	3.085	3.903	0.029	23.923	23.431	0.174	27.008
2007	135	19.528	0.145	3.085	3.903	0.029	23.923	23.431	0.174	27.008
2008	119	19.528	0.164	3.085	3.903	0.033	23.923	23.431	0.197	27.008
2009	103	19.528	0.190	3.085	3.903	0.038	23.923	23.431	0.227	27.008
2010	92	19.528	0.212	3.085	3.903	0.042	23.923	23.431	0.255	27.008

**Table 4.5.5
Arctic Spill Occurrence Chukchi Sea BC Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
1999	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2000	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	8	0.500	0.040	0.02	3.500	0.280	1.26	1.500	0.120	2.40	1.000	0.080	16.00
	Total	8		0.040	0.02		0.280	1.26		0.120	2.40		0.080	16.00
2001	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	48	0.500	0.240	0.12	3.500	1.680	7.56	1.500	0.720	14.40	1.000	0.480	96.00
	Total	48		0.240	0.12		1.680	7.56		0.720	14.40		0.480	96.00
2002	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	108	0.500	0.540	0.27	3.500	3.780	17.01	1.500	1.620	32.40	1.000	1.080	216.00
	Total	108		0.540	0.27		3.780	17.01		1.620	32.40		1.080	216.00
2003	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	188	0.500	0.940	0.47	3.500	6.580	29.61	1.500	2.820	56.40	1.000	1.880	376.00
	Total	188		0.940	0.47		6.580	29.61		2.820	56.40		1.880	376.00
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	214	0.500	1.070	0.54	3.500	7.490	33.71	1.500	3.210	64.20	1.000	2.140	428.00
	Total	214		1.070	0.54		7.490	33.71		3.210	64.20		2.140	428.00
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	214	0.500	1.070	0.54	3.500	7.490	33.71	1.500	3.210	64.20	1.000	2.140	428.00
	Total	214		1.070	0.54		7.490	33.71		3.210	64.20		2.140	428.00
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	214	0.500	1.070	0.54	3.500	7.490	33.71	1.500	3.210	64.20	1.000	2.140	428.00
	Total	214		1.070	0.54		7.490	33.71		3.210	64.20		2.140	428.00
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	214	0.500	1.070	0.54	3.500	7.490	33.71	1.500	3.210	64.20	1.000	2.140	428.00
	Total	214		1.070	0.54		7.490	33.71		3.210	64.20		2.140	428.00
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	214	0.500	1.070	0.54	3.500	7.490	33.71	1.500	3.210	64.20	1.000	2.140	428.00
	Total	214		1.070	0.54		7.490	33.71		3.210	64.20		2.140	428.00
2009	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	214	0.500	1.070	0.54	3.500	7.490	33.71	1.500	3.210	64.20	1.000	2.140	428.00
	Total	214		1.070	0.54		7.490	33.71		3.210	64.20		2.140	428.00
2010	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	214	0.500	1.070	0.54	3.500	7.490	33.71	1.500	3.210	64.20	1.000	2.140	428.00
	Total	214		1.070	0.54		7.490	33.71		3.210	64.20		2.140	428.00

Table 4.5.6

Arctic Spill Occurrence Chukchi Sea BC Production Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]
1998	0												
1999	0												
2000	0	0.040		0.020	0.120		1.260	0.200		18.400	0.360		19.680
2001	0	0.240		0.120	0.720		7.560	1.200		110.400	2.160		118.080
2002	101	0.540	0.005	0.270	1.620	0.016	17.010	2.700	0.027	248.400	4.860	0.048	265.680
2003	135	0.940	0.007	0.470	2.820	0.021	29.610	4.700	0.035	432.400	8.460	0.063	462.480
2004	135	1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
2005	135	1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
2006	135	1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
2007	135	1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
2008	119	1.070	0.009	0.535	3.210	0.027	33.705	5.350	0.045	492.200	9.630	0.081	526.440
2009	103	1.070	0.010	0.535	3.210	0.031	33.705	5.350	0.052	492.200	9.630	0.093	526.440
2010	92	1.070	0.012	0.535	3.210	0.035	33.705	5.350	0.058	492.200	9.630	0.105	526.440

**Table 4.5.7
Arctic Spill Occurrence Chukchi Sea BC Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
1999	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2000	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2001	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2002	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2003	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2004	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2005	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2006	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2007	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2008	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2010	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.5.8

Arctic Spill Occurrence Chukchi Sea BC Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0	0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
1999	0												
2000	0												
2001	0												
2002	101												
2003	135												
2004	135												
2005	135												
2006	135												
2007	135												
2008	119												
2009	103												
2010	92												

**Table 4.5.9
Arctic Spill Occurrence Chukchi Sea BC Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
1999	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2000	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2001	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2002	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2003	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2009	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.5.10

Arctic Spill Occurrence Chukchi Sea BC Development Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0	0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
1999	0												
2000	0												
2001	0												
2002	101												
2003	135												
2004	135												
2005	135												
2006	135												
2007	135												
2008	119												
2009	103												
2010	92												

**Table 4.5.11
Arctic Spill Occurrence Chukchi Sea BC Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]
1998	Pipeline	0												
	Platforms													
	Production Wells													
	Exploration Wells		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
	Total		0.089	0.045	0.268		2.807	0.456		42.960	0.813		45.812	
1999	Pipeline	0	10.351		3.029	5.314		20.894	1.761		31.180	17.426		55.103
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total		10.351	3.029	5.314		20.894	1.761		31.180	17.426		55.103	
2000	Pipeline	0	10.351		3.029	5.314		20.894	1.761		31.180	17.426		55.103
	Platforms		4.380		0.115	0.146		0.894				0.876		1.010
	Production Wells		0.040		0.020	0.120		1.260	0.200		18.400	0.360		19.680
	Exploration Wells													
	Development Wells													
	Total		11.121	3.165	5.580		23.048	1.961		49.580	18.662		75.793	
2001	Pipeline	0	10.351		3.029	5.314		20.894	1.761		31.180	17.426		55.103
	Platforms		4.380		0.692	0.875		5.366				5.255		6.058
	Production Wells		0.240		0.120	0.720		7.560	1.200		110.400	2.160		118.080
	Exploration Wells													
	Development Wells													
	Total		14.971	3.841	6.909		33.820	2.961		141.580	24.841		179.241	
2002	Pipeline	101.0	10.351	0.102	3.029	5.314	0.053	20.894	1.761	0.017	31.180	17.426	0.173	55.103
	Platforms		9.855	0.098	1.557	1.970	0.020	12.073				11.825	0.117	13.630
	Production Wells		0.540	0.005	0.270	1.620	0.016	17.010	2.700	0.027	248.400	4.860	0.048	265.680
	Exploration Wells													
	Development Wells													
	Total		20.746	0.205	4.857	8.903	0.088	49.977	4.461	0.044	279.580	34.110	0.338	334.413
2003	Pipeline	135.0	10.351	0.077	3.029	5.314	0.039	20.894	1.761	0.013	31.180	17.426	0.129	55.103
	Platforms		17.156	0.127	2.711	3.428	0.025	21.016				20.584	0.152	23.727
	Production Wells		0.940	0.007	0.470	2.820	0.021	29.610	4.700	0.035	432.400	8.460	0.063	462.480
	Exploration Wells													
	Development Wells													
	Total		28.446	0.211	6.210	11.562	0.086	71.520	6.461	0.048	463.580	46.470	0.344	541.310
2004	Pipeline	135.0	10.351	0.077	3.029	5.314	0.039	20.894	1.761	0.013	31.180	17.426	0.129	55.103
	Platforms		19.528	0.145	3.085	3.903	0.029	23.923				23.431	0.174	27.008
	Production Wells		1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
	Exploration Wells													
	Development Wells													
	Total		30.949	0.229	6.650	12.426	0.092	78.521	7.111	0.053	523.380	50.486	0.374	608.551
2005	Pipeline	135.0	10.351	0.077	3.029	5.314	0.039	20.894	1.761	0.013	31.180	17.426	0.129	55.103
	Platforms		19.528	0.145	3.085	3.903	0.029	23.923				23.431	0.174	27.008
	Production Wells		1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
	Exploration Wells													
	Development Wells													
	Total		30.949	0.229	6.650	12.426	0.092	78.521	7.111	0.053	523.380	50.486	0.374	608.551
2006	Pipeline	135.0	10.351	0.077	3.029	5.314	0.039	20.894	1.761	0.013	31.180	17.426	0.129	55.103
	Platforms		19.528	0.145	3.085	3.903	0.029	23.923				23.431	0.174	27.008
	Production Wells		1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
	Exploration Wells													
	Development Wells													
	Total		30.949	0.229	6.650	12.426	0.092	78.521	7.111	0.053	523.380	50.486	0.374	608.551
2007	Pipeline	135.0	10.351	0.077	3.029	5.314	0.039	20.894	1.761	0.013	31.180	17.426	0.129	55.103
	Platforms		19.528	0.145	3.085	3.903	0.029	23.923				23.431	0.174	27.008
	Production Wells		1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
	Exploration Wells													
	Development Wells													
	Total		30.949	0.229	6.650	12.426	0.092	78.521	7.111	0.053	523.380	50.486	0.374	608.551

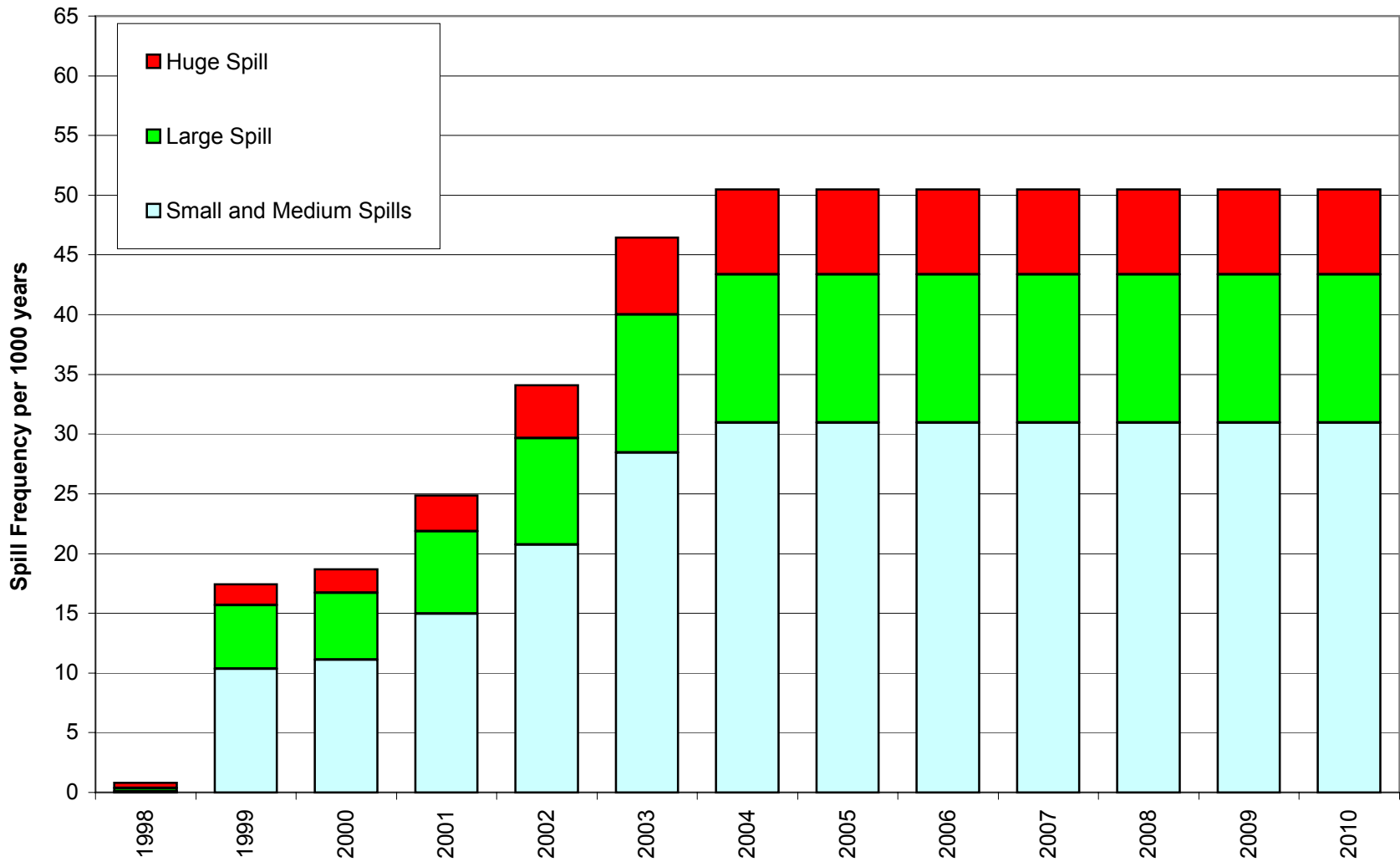
**Table 4.5.11
Arctic Spill Occurrence Chukchi Sea BC Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills			
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	
2008	Pipeline	119.0	10.351	0.087	3.029	5.314	0.045	20.894	1.761	0.015	31.180	17.426	0.146	55.103	
	Platforms		19.528	0.164	3.085	3.903	0.033	23.923				23.431	0.197	27.008	
	Production Wells		1.070	0.009	0.535	3.210	0.027	33.705	5.350	0.045	492.200	9.630	0.081	526.440	
	Exploration Wells														
	Development Wells														
	Total		30.949	0.260	6.650	12.426	0.104	78.521	7.111	0.060	523.380	50.486	0.424	608.551	
2009	Pipeline	103.0	10.351	0.100	3.029	5.314	0.052	20.894	1.761	0.017	31.180	17.426	0.169	55.103	
	Platforms		19.528	0.190	3.085	3.903	0.038	23.923				23.431	0.227	27.008	
	Production Wells		1.070	0.010	0.535	3.210	0.031	33.705	5.350	0.052	492.200	9.630	0.093	526.440	
	Exploration Wells														
	Development Wells														
	Total		30.949	0.300	6.650	12.426	0.121	78.521	7.111	0.069	523.380	50.486	0.490	608.551	
2010	Pipeline	92.0	10.351	0.113	3.029	5.314	0.058	20.894	1.761	0.019	31.180	17.426	0.189	55.103	
	Platforms		19.528	0.212	3.085	3.903	0.042	23.923				23.431	0.255	27.008	
	Production Wells		1.070	0.012	0.535	3.210	0.035	33.705	5.350	0.058	492.200	9.630	0.105	526.440	
	Exploration Wells														
	Development Wells														
	Total		30.949	0.336	6.650	12.426	0.135	78.521	7.111	0.077	523.380	50.486	0.549	608.551	

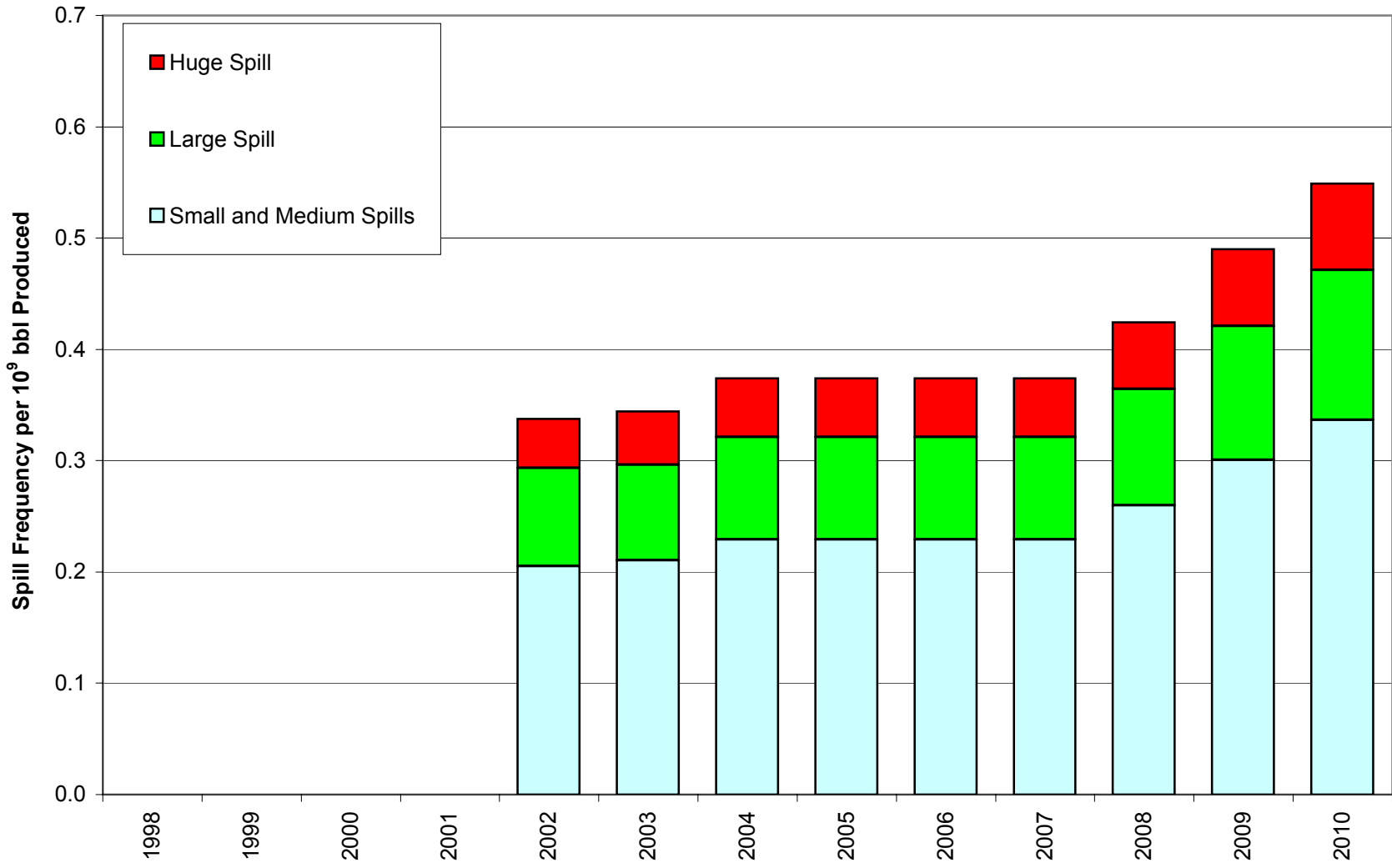
**Table 4.5.12
Arctic Spill Occurrence Chukchi Sea BC Annual Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
1998	0	0.09		0.045	0.27		2.807	0.456		42.96	0.813		45.812
1999	0	10.35		3.029	5.31		20.894	1.761		31.18	17.426		55.103
2000	0	11.12		3.165	5.58		23.048	1.961		49.58	18.662		75.793
2001	0	14.97		3.841	6.91		33.820	2.961		141.58	24.841		179.241
2002	101.0	20.75	0.205	4.857	8.90	0.088	49.977	4.461	0.044	279.58	34.110	0.338	334.413
2003	135.0	28.45	0.211	6.210	11.56	0.086	71.520	6.461	0.048	463.58	46.470	0.344	541.310
2004	135.0	30.95	0.229	6.650	12.43	0.092	78.521	7.111	0.053	523.38	50.486	0.374	608.551
2005	135.0	30.95	0.229	6.650	12.43	0.092	78.521	7.111	0.053	523.38	50.486	0.374	608.551
2006	135.0	30.95	0.229	6.650	12.43	0.092	78.521	7.111	0.053	523.38	50.486	0.374	608.551
2007	135.0	30.95	0.229	6.650	12.43	0.092	78.521	7.111	0.053	523.38	50.486	0.374	608.551
2008	119.0	30.95	0.260	6.650	12.43	0.104	78.521	7.111	0.060	523.38	50.486	0.424	608.551
2009	103.0	30.95	0.300	6.650	12.43	0.121	78.521	7.111	0.069	523.38	50.486	0.490	608.551
2010	92.0	30.95	0.336	6.650	12.43	0.135	78.521	7.111	0.077	523.38	50.486	0.549	608.551

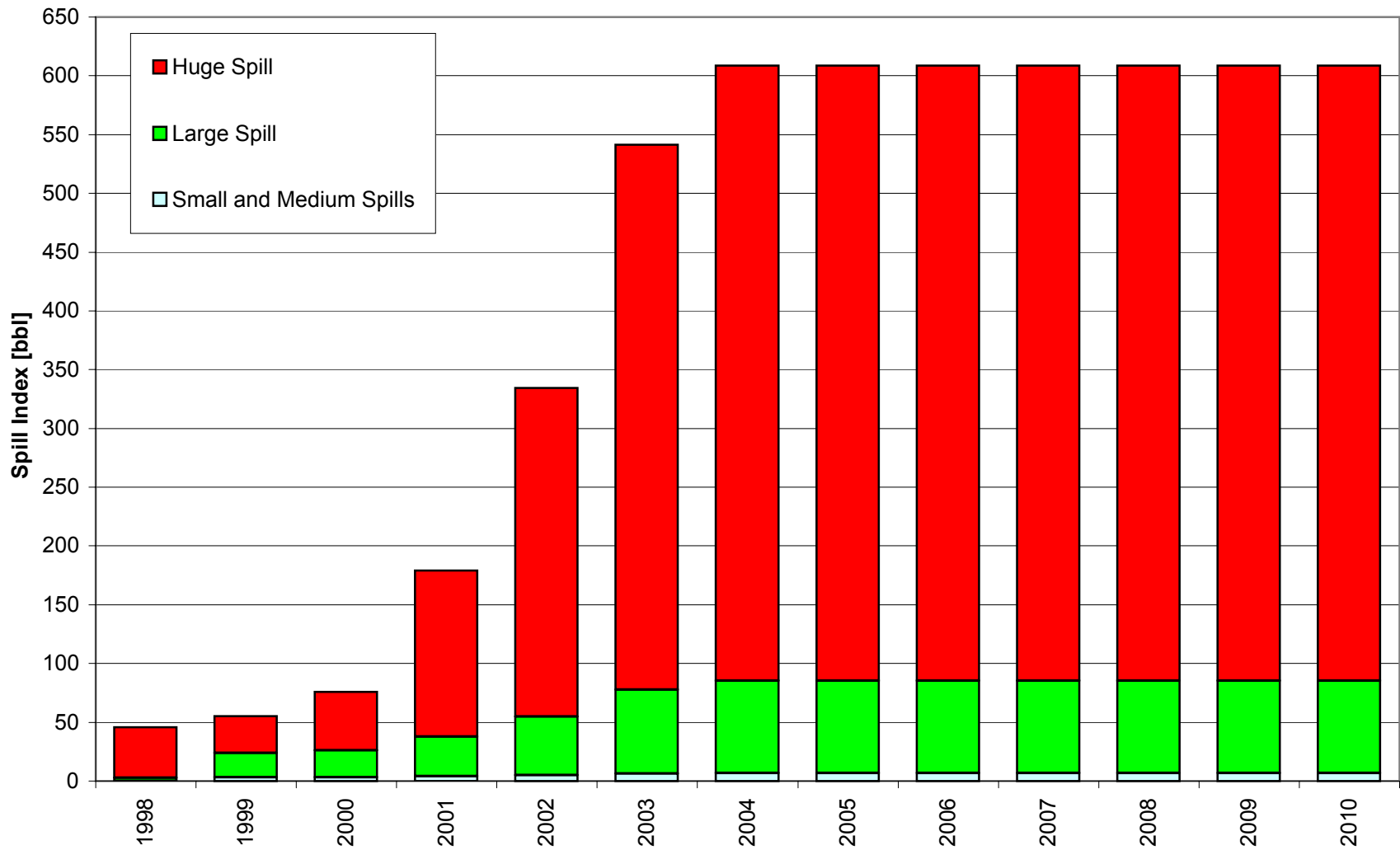
Chukchi Sea BC Spill Frequency



Chukchi Sea BC Spill Frequency per 10⁹ bbl Produced



Chukchi Sea BC Spill Index



**Table 4.6.1
Arctic Spill Occurrence Chukchi Sea HC P/L**

Year	Water Depth	P/L Dia <10"												P/L Dia >= 10"												
		P/L [miles]	Small Spills			Medium Spills			Large Spills			Huge Spills			P/L [miles]	Small Spills			Medium Spills			Large Spills			Huge Spills	
			Average Spill [bbl] = 58	Average Spill [bbl] = 266	Average Spill [bbl] = 4436	Average Spill [bbl] = 14423	Average Spill [bbl] = 58	Average Spill [bbl] = 387	Average Spill [bbl] = 3932	Average Spill [bbl] =																
			Cumm.	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years		Spill Index bbl	Cumm.	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	
1998	Shallow	1.393			2.441			1.087			0.282				0.928				2.256			1.789			0.578	
	Medium	1.411			2.471			0.962			0.245				0.924				2.278			1.703			0.559	
	Deep	1.431			2.505			0.841			0.210				0.921				2.303			1.623			0.541	
	Total																									
1999	Shallow	1.393			2.441			1.087			0.282				0.928				2.256			1.789			0.578	
	Medium	1.411			2.471			0.962			0.245				0.924				2.278			1.703			0.559	
	Deep	1.431			2.505			0.841			0.210				0.921				2.303			1.623			0.541	
	Total																									
2000	Shallow	1.393			2.441			1.087			0.282			5	0.928	0.075	0.00	2.256	0.182	0.07	1.789	0.144	0.57	0.578	0.047	
	Medium	1.411			2.471			0.962			0.245			60	0.924	0.892	0.05	2.278	2.200	0.85	1.703	1.644	6.46	0.559	0.540	
	Deep	1.431			2.505			0.841			0.210			135	0.921	2.001	0.12	2.303	5.002	1.94	1.623	3.526	13.86	0.541	1.175	
	Total													200	2.968	0.17		7.383	2.86		5.314	20.89		1.761		
2001	Shallow	1.393			2.441			1.087			0.282			5	0.928	0.075	0.00	2.256	0.182	0.07	1.789	0.144	0.57	0.578	0.047	
	Medium	1.411			2.471			0.962			0.245			60	0.924	0.892	0.05	2.278	2.200	0.85	1.703	1.644	6.46	0.559	0.540	
	Deep	1.431			2.505			0.841			0.210			135	0.921	2.001	0.12	2.303	5.002	1.94	1.623	3.526	13.86	0.541	1.175	
	Total													200	2.968	0.17		7.383	2.86		5.314	20.89		1.761		
2002	Shallow	1.393			2.441			1.087			0.282			5	0.928	0.075	0.00	2.256	0.182	0.07	1.789	0.144	0.57	0.578	0.047	
	Medium	1.411			2.471			0.962			0.245			60	0.924	0.892	0.05	2.278	2.200	0.85	1.703	1.644	6.46	0.559	0.540	
	Deep	1.431			2.505			0.841			0.210			135	0.921	2.001	0.12	2.303	5.002	1.94	1.623	3.526	13.86	0.541	1.175	
	Total													200	2.968	0.17		7.383	2.86		5.314	20.89		1.761		
2003	Shallow	1.393			2.441			1.087			0.282			5	0.928	0.075	0.00	2.256	0.182	0.07	1.789	0.144	0.57	0.578	0.047	
	Medium	1.411			2.471			0.962			0.245			60	0.924	0.892	0.05	2.278	2.200	0.85	1.703	1.644	6.46	0.559	0.540	
	Deep	1.431			2.505			0.841			0.210			135	0.921	2.001	0.12	2.303	5.002	1.94	1.623	3.526	13.86	0.541	1.175	
	Total													200	2.968	0.17		7.383	2.86		5.314	20.89		1.761		
2004	Shallow	1.393			2.441			1.087			0.282			5	0.928	0.075	0.00	2.256	0.182	0.07	1.789	0.144	0.57	0.578	0.047	
	Medium	1.411			2.471			0.962			0.245			60	0.924	0.892	0.05	2.278	2.200	0.85	1.703	1.644	6.46	0.559	0.540	
	Deep	1.431			2.505			0.841			0.210			135	0.921	2.001	0.12	2.303	5.002	1.94	1.623	3.526	13.86	0.541	1.175	
	Total													200	2.968	0.17		7.383	2.86		5.314	20.89		1.761		
2005	Shallow	1.393			2.441			1.087			0.282			5	0.928	0.075	0.00	2.256	0.182	0.07	1.789	0.144	0.57	0.578	0.047	
	Medium	1.411			2.471			0.962			0.245			60	0.924	0.892	0.05	2.278	2.200	0.85	1.703	1.644	6.46	0.559	0.540	
	Deep	1.431			2.505			0.841			0.210			135	0.921	2.001	0.12	2.303	5.002	1.94	1.623	3.526	13.86	0.541	1.175	
	Total													200	2.968	0.17		7.383	2.86		5.314	20.89		1.761		
2006	Shallow	1.393			2.441			1.087			0.282			5	0.928	0.075	0.00	2.256	0.182	0.07	1.789	0.144	0.57	0.578	0.047	
	Medium	1.411			2.471			0.962			0.245			60	0.924	0.892	0.05	2.278	2.200	0.85	1.703	1.644	6.46	0.559	0.540	
	Deep	1.431			2.505			0.841			0.210			135	0.921	2.001	0.12	2.303	5.002	1.94	1.623	3.526	13.86	0.541	1.175	
	Total													200	2.968	0.17		7.383	2.86		5.314	20.89		1.761		
2007	Shallow	1.393			2.441			1.087			0.282			5	0.928	0.075	0.00	2.256	0.182	0.07	1.789	0.144	0.57	0.578	0.047	
	Medium	1.411			2.471			0.962			0.245			60	0.924	0.892	0.05	2.278	2.200	0.85	1.703	1.644	6.46	0.559	0.540	
	Deep	1.431			2.505			0.841			0.210			135	0.921	2.001	0.12	2.303	5.002	1.94	1.623	3.526	13.86	0.541	1.175	
	Total													200	2.968	0.17		7.383	2.86		5.314	20.89		1.761		
2008	Shallow	1.393			2.441			1.087			0.282			5	0.928	0.075	0.00	2.256	0.182	0.07	1.789	0.144	0.57	0.578	0.047	
	Medium	1.411			2.471			0.962			0.245			60	0.924	0.892	0.05	2.278	2.200	0.85	1.703	1.644	6.46	0.559	0.540	
	Deep	1.431			2.505			0.841			0.210			135	0.921	2.001	0.12	2.303	5.002	1.94	1.623	3.526	13.86	0.541	1.175	
	Total													200	2.968	0.17		7.383	2.86		5.314	20.89		1.761		
2009	Shallow	1.393			2.441			1.087			0.282			5	0.928	0.075	0.00	2.256	0.182	0.07	1.789	0.144	0.57	0.578	0.047	
	Medium	1.411			2.471			0.962			0.245			60	0.924	0.892	0.05	2.278	2.200	0.85	1.703	1.644	6.46	0.559	0.540	
	Deep	1.431			2.505			0.841			0.210			135	0.921	2.001	0.12	2.303	5.002	1.94	1.623	3.526	13.86	0.541	1.175	
	Total													200	2.968	0.17		7.383	2.86		5.314	20.89		1.761		
2010	Shallow	1.393			2.441			1.087			0.282			5	0.928	0.075	0.00	2.256	0.182	0.07	1.789	0.144	0.57	0.578	0.047	
	Medium	1.411			2.471			0.962			0.245			60	0.924	0.892	0.05	2.278	2.200	0.85	1.703	1.644	6.46	0.559	0.540	
	Deep	1.431			2.505			0.841			0.210			135	0.921	2.001	0.12	2.303	5.002	1.94	1.623	3.526	13.86	0.541	1.175	
	Total													200	2.968	0.17		7.383	2.86		5.314	20.89		1.761		

**Table 4.6.2
Arctic Spill Occurrence Chukchi Sea HC P/L Summary**

Year	Production [MMbbbl]	Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0																		
1999	0																		
2000	0	2.968		0.172	7.383		2.857	10.351		3.029	5.314		20.894	1.761		31.180	17.426		55.103
2001	0	2.968		0.172	7.383		2.857	10.351		3.029	5.314		20.894	1.761		31.180	17.426		55.103
2002	0	2.968		0.172	7.383		2.857	10.351		3.029	5.314		20.894	1.761		31.180	17.426		55.103
2003	223	2.968	0.013	0.172	7.383	0.033	2.857	10.351	0.046	3.029	5.314	0.024	20.894	1.761	0.008	31.180	17.426	0.078	55.103
2004	297	2.968	0.010	0.172	7.383	0.025	2.857	10.351	0.035	3.029	5.314	0.018	20.894	1.761	0.006	31.180	17.426	0.059	55.103
2005	297	2.968	0.010	0.172	7.383	0.025	2.857	10.351	0.035	3.029	5.314	0.018	20.894	1.761	0.006	31.180	17.426	0.059	55.103
2006	297	2.968	0.010	0.172	7.383	0.025	2.857	10.351	0.035	3.029	5.314	0.018	20.894	1.761	0.006	31.180	17.426	0.059	55.103
2007	297	2.968	0.010	0.172	7.383	0.025	2.857	10.351	0.035	3.029	5.314	0.018	20.894	1.761	0.006	31.180	17.426	0.059	55.103
2008	297	2.968	0.010	0.172	7.383	0.025	2.857	10.351	0.035	3.029	5.314	0.018	20.894	1.761	0.006	31.180	17.426	0.059	55.103
2009	262	2.968	0.011	0.172	7.383	0.028	2.857	10.351	0.040	3.029	5.314	0.020	20.894	1.761	0.007	31.180	17.426	0.067	55.103
2010	227	2.968	0.013	0.172	7.383	0.033	2.857	10.351	0.046	3.029	5.314	0.023	20.894	1.761	0.008	31.180	17.426	0.077	55.103

**Table 4.6.3
Arctic Spill Occurrence Chukchi Sea HC Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
1999	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2000	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	2		0.913			0.182		
	Total	2							
2001	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	8	50	0.913	4.563	0.72	0.182	0.912	5.59
	Total	8	50		4.563	0.72		0.912	5.59
2002	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	12	130	0.913	11.863	1.87	0.182	2.371	14.53
	Total	12	130		11.863	1.87		2.371	14.53
2003	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	12	270	0.913	24.638	3.89	0.182	4.924	30.18
	Total	12	270		24.638	3.89		4.924	30.18
2004	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	12	410	0.913	37.414	5.91	0.182	7.477	45.83
	Total	12	410		37.414	5.91		7.477	45.83
2005	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	12	482	0.913	43.984	6.95	0.182	8.790	53.88
	Total	12	482		43.984	6.95		8.790	53.88
2006	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	12	482	0.913	43.984	6.95	0.182	8.790	53.88
	Total	12	482		43.984	6.95		8.790	53.88
2007	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	12	482	0.913	43.984	6.95	0.182	8.790	53.88
	Total	12	482		43.984	6.95		8.790	53.88
2008	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	12	482	0.913	43.984	6.95	0.182	8.790	53.88
	Total	12	482		43.984	6.95		8.790	53.88
2009	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	12	482	0.913	43.984	6.95	0.182	8.790	53.88
	Total	12	482		43.984	6.95		8.790	53.88
2010	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	12	482	0.913	43.984	6.95	0.182	8.790	53.88
	Total	12	482		43.984	6.95		8.790	53.88

**Table 4.6.4
Arctic Spill Occurrence Chukchi Sea HC Platforms Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
1998	0									
1999	0									
2000	0									
2001	0	4.563		0.721	0.912		5.589	5.474		6.310
2002	0	11.863		1.874	2.371		14.532	14.234		16.407
2003	223	24.638	0.110	3.893	4.924	0.022	30.183	29.562	0.133	34.076
2004	297	37.414	0.126	5.911	7.477	0.025	45.833	44.891	0.151	51.744
2005	297	43.984	0.148	6.949	8.790	0.030	53.882	52.774	0.178	60.831
2006	297	43.984	0.148	6.949	8.790	0.030	53.882	52.774	0.178	60.831
2007	297	43.984	0.148	6.949	8.790	0.030	53.882	52.774	0.178	60.831
2008	297	43.984	0.148	6.949	8.790	0.030	53.882	52.774	0.178	60.831
2009	262	43.984	0.168	6.949	8.790	0.034	53.882	52.774	0.201	60.831
2010	227	43.984	0.194	6.949	8.790	0.039	53.882	52.774	0.232	60.831

**Table 4.6.5
Arctic Spill Occurrence Chukchi Sea HC Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
1999	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2000	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2001	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	50	0.500	0.250	0.13	3.500	1.750	7.88	1.500	0.750	15.00	1.000	0.500	100.00
	Total	50		0.250	0.13		1.750	7.88		0.750	15.00		0.500	100.00
2002	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	130	0.500	0.650	0.33	3.500	4.550	20.48	1.500	1.950	39.00	1.000	1.300	260.00
	Total	130		0.650	0.33		4.550	20.48		1.950	39.00		1.300	260.00
2003	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	270	0.500	1.350	0.68	3.500	9.450	42.53	1.500	4.050	81.00	1.000	2.700	540.00
	Total	270		1.350	0.68		9.450	42.53		4.050	81.00		2.700	540.00
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	410	0.500	2.050	1.03	3.500	14.350	64.58	1.500	6.150	123.00	1.000	4.100	820.00
	Total	410		2.050	1.03		14.350	64.58		6.150	123.00		4.100	820.00
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2009	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2010	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00

Table 4.6.6

Arctic Spill Occurrence Chukchi Sea HC Production Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0												
1999	0												
2000	0												
2001	0	0.250		0.125	0.750		7.875	1.250		115.000	2.250		123.000
2002	0	0.650		0.325	1.950		20.475	3.250		299.000	5.850		319.800
2003	223	1.350	0.006	0.675	4.050	0.018	42.525	6.750	0.030	621.000	12.150	0.054	664.200
2004	297	2.050	0.007	1.025	6.150	0.021	64.575	10.250	0.035	943.000	18.450	0.062	1008.600
2005	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2006	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2007	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2008	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2009	262	2.410	0.009	1.205	7.230	0.028	75.915	12.050	0.046	1108.600	21.690	0.083	1185.720
2010	227	2.410	0.011	1.205	7.230	0.032	75.915	12.050	0.053	1108.600	21.690	0.096	1185.720

**Table 4.6.7
Arctic Spill Occurrence Chukchi Sea HC Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	3	3.160	0.095	0.05	22.110	0.663	2.98	9.500	0.285	5.70	5.500	0.165	33.00
	Total	3		0.095	0.05		0.663	2.98		0.285	5.70		0.165	33.00
1999	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2000	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2001	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2002	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2003	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2004	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2005	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2006	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2007	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2008	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2010	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.6.8

Arctic Spill Occurrence Chukchi Sea HC Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0	0.095		0.047	0.285		2.985	0.450		38.700	0.830		41.732
1999	0	0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2000	0	0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2001	0												
2002	0												
2003	223												
2004	297												
2005	297												
2006	297												
2007	297												
2008	297												
2009	262												
2010	227												

**Table 4.6.9
Arctic Spill Occurrence Chukchi Sea HC Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep	1	1.300	0.013	0.01	9.080	0.091	0.41	3.900	0.039	0.78	3.900	0.039	7.80
	Total	1		0.013	0.01		0.091	0.41		0.039	0.78		0.039	7.80
1999	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep	1	1.300	0.013	0.01	9.080	0.091	0.41	3.900	0.039	0.78	3.900	0.039	7.80
	Total	1		0.013	0.01		0.091	0.41		0.039	0.78		0.039	7.80
2000	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2001	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2002	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2003	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2009	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.6.10

Arctic Spill Occurrence Chukchi Sea HC Development Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0	0.013		0.007	0.039		0.409	0.078		8.580	0.130		8.995
1999	0	0.013		0.007	0.039		0.409	0.078		8.580	0.130		8.995
2000	0												
2001	0												
2002	0												
2003	223												
2004	297												
2005	297												
2006	297												
2007	297												
2008	297												
2009	262												
2010	227												

**Table 4.6.11
Arctic Spill Occurrence Chukchi Sea HC Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]
1998	Pipeline	0												
	Platforms													
	Production Wells													
	Exploration Wells		0.095	0.047	0.285	2.985	0.450	38.700	0.830	41.732				
	Development Wells		0.013	0.007	0.039	0.409	0.078	8.580	0.130	8.995				
Total	0.108	0.054	0.324	3.393	0.528	47.280	0.960	50.727						
1999	Pipeline	0												
	Platforms													
	Production Wells													
	Exploration Wells		0.063	0.032	0.190	1.990	0.300	25.800	0.553	27.822				
	Development Wells		0.013	0.007	0.039	0.409	0.078	8.580	0.130	8.995				
Total	0.076	0.038	0.229	2.399	0.378	34.380	0.683	36.817						
2000	Pipeline	0	10.351	3.029	5.314	20.894	1.761	31.180	17.426	55.103				
	Platforms													
	Production Wells													
	Exploration Wells		0.063	0.032	0.190	1.990	0.300	25.800	0.553	27.822				
	Development Wells													
Total	10.414	3.061	5.504	22.884	2.061	56.980	17.979	82.925						
2001	Pipeline	0	10.351	3.029	5.314	20.894	1.761	31.180	17.426	55.103				
	Platforms		4.563	0.721	0.912	5.589			5.474	6.310				
	Production Wells		0.250	0.125	0.750	7.875	1.250	115.000	2.250	123.000				
	Exploration Wells													
	Development Wells													
Total	15.163	3.875	6.976	34.358	3.011	146.180	25.150	184.414						
2002	Pipeline	0	10.351	3.029	5.314	20.894	1.761	31.180	17.426	55.103				
	Platforms		11.863	1.874	2.371	14.532			14.234	16.407				
	Production Wells		0.650	0.325	1.950	20.475	3.250	299.000	5.850	319.800				
	Exploration Wells													
	Development Wells													
Total	22.864	5.229	9.634	55.901	5.011	330.180	37.509	391.310						
2003	Pipeline	223.0	10.351	0.046	3.029	5.314	0.024	20.894	1.761	0.008	31.180	17.426	0.078	55.103
	Platforms		24.638	0.110	3.893	4.924	0.022	30.183				29.562	0.133	34.076
	Production Wells		1.350	0.006	0.675	4.050	0.018	42.525	6.750	0.030	621.000	12.150	0.054	664.200
	Exploration Wells													
	Development Wells													
Total	36.339	0.163	7.597	14.288	0.064	93.601	8.511	0.038	652.180	59.138	0.265	753.379		
2004	Pipeline	297.0	10.351	0.035	3.029	5.314	0.018	20.894	1.761	0.006	31.180	17.426	0.059	55.103
	Platforms		37.414	0.126	5.911	7.477	0.025	45.833				44.891	0.151	51.744
	Production Wells		2.050	0.007	1.025	6.150	0.021	64.575	10.250	0.035	943.000	18.450	0.062	1008.600
	Exploration Wells													
	Development Wells													
Total	49.814	0.168	9.966	18.941	0.064	131.302	12.011	0.040	974.180	80.766	0.272	1115.448		
2005	Pipeline	297.0	10.351	0.035	3.029	5.314	0.018	20.894	1.761	0.006	31.180	17.426	0.059	55.103
	Platforms		43.984	0.148	6.949	8.790	0.030	53.882				52.774	0.178	60.831
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
	Exploration Wells													
	Development Wells													
Total	56.745	0.191	11.184	21.334	0.072	150.690	13.811	0.047	1139.780	91.889	0.309	1301.654		
2006	Pipeline	297.0	10.351	0.035	3.029	5.314	0.018	20.894	1.761	0.006	31.180	17.426	0.059	55.103
	Platforms		43.984	0.148	6.949	8.790	0.030	53.882				52.774	0.178	60.831
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
	Exploration Wells													
	Development Wells													
Total	56.745	0.191	11.184	21.334	0.072	150.690	13.811	0.047	1139.780	91.889	0.309	1301.654		
2007	Pipeline	297.0	10.351	0.035	3.029	5.314	0.018	20.894	1.761	0.006	31.180	17.426	0.059	55.103
	Platforms		43.984	0.148	6.949	8.790	0.030	53.882				52.774	0.178	60.831
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
	Exploration Wells													
	Development Wells													
Total	56.745	0.191	11.184	21.334	0.072	150.690	13.811	0.047	1139.780	91.889	0.309	1301.654		

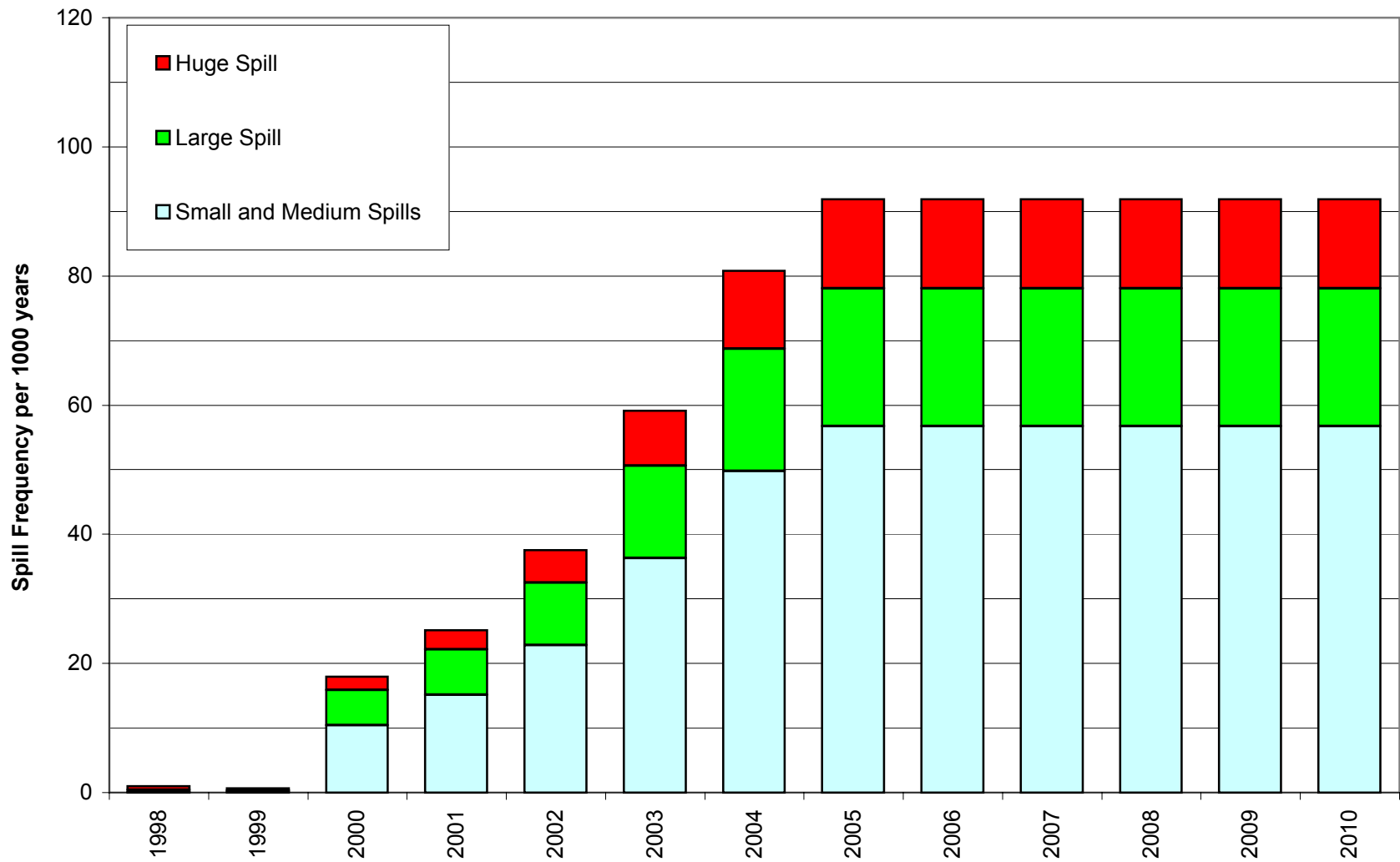
**Table 4.6.11
Arctic Spill Occurrence Chukchi Sea HC Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills			
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	
2008	Pipeline	297.0	10.351	0.035	3.029	5.314	0.018	20.894	1.761	0.006	31.180	17.426	0.059	55.103	
	Platforms		43.984	0.148	6.949	8.790	0.030	53.882				52.774	0.178	60.831	
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720	
	Exploration Wells														
	Development Wells														
	Total		56.745	0.191	11.184	21.334	0.072	150.690	13.811	0.047	1139.780	91.889	0.309	1301.654	
2009	Pipeline	262.0	10.351	0.040	3.029	5.314	0.020	20.894	1.761	0.007	31.180	17.426	0.067	55.103	
	Platforms		43.984	0.168	6.949	8.790	0.034	53.882				52.774	0.201	60.831	
	Production Wells		2.410	0.009	1.205	7.230	0.028	75.915	12.050	0.046	1108.600	21.690	0.083	1185.720	
	Exploration Wells														
	Development Wells														
	Total		56.745	0.217	11.184	21.334	0.081	150.690	13.811	0.053	1139.780	91.889	0.351	1301.654	
2010	Pipeline	227.0	10.351	0.046	3.029	5.314	0.023	20.894	1.761	0.008	31.180	17.426	0.077	55.103	
	Platforms		43.984	0.194	6.949	8.790	0.039	53.882				52.774	0.232	60.831	
	Production Wells		2.410	0.011	1.205	7.230	0.032	75.915	12.050	0.053	1108.600	21.690	0.096	1185.720	
	Exploration Wells														
	Development Wells														
	Total		56.745	0.250	11.184	21.334	0.094	150.690	13.811	0.061	1139.780	91.889	0.405	1301.654	

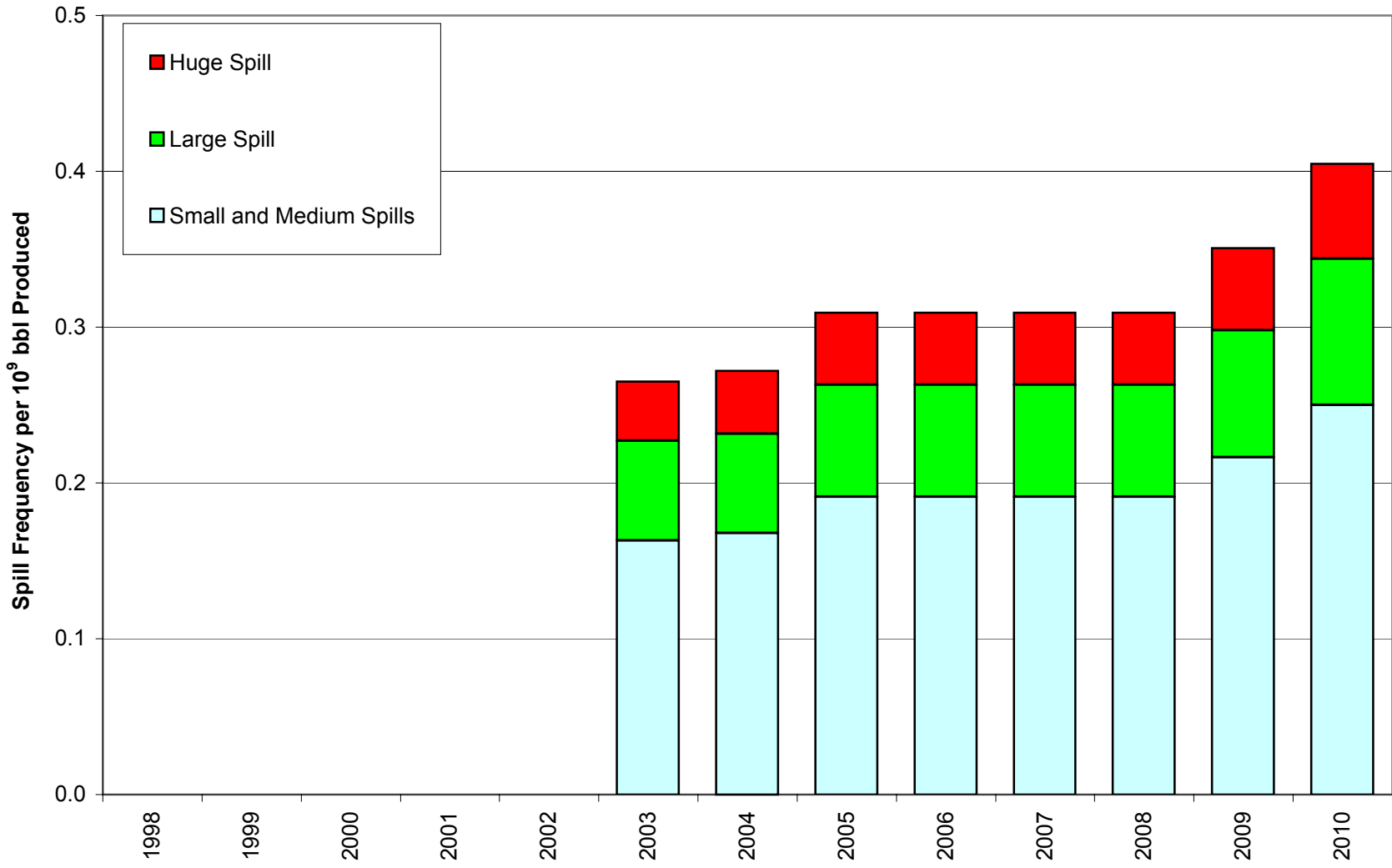
**Table 4.6.12
Arctic Spill Occurrence Chukchi Sea HC Annual Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
1998	0	0.11		0.054	0.32		3.393	0.528		47.28	0.960		50.727
1999	0	0.08		0.038	0.23		2.399	0.378		34.38	0.683		36.817
2000	0	10.41		3.061	5.50		22.884	2.061		56.98	17.979		82.925
2001	0	15.16		3.875	6.98		34.358	3.011		146.18	25.150		184.414
2002	0	22.86		5.229	9.63		55.901	5.011		330.18	37.509		391.310
2003	223	36.34	0.163	7.597	14.29	0.064	93.601	8.511	0.038	652.18	59.138	0.265	753.379
2004	297	49.81	0.168	9.966	18.94	0.064	131.302	12.011	0.040	974.18	80.766	0.272	1115.448
2005	297	56.74	0.191	11.184	21.33	0.072	150.690	13.811	0.047	1139.78	91.889	0.309	1301.654
2006	297	56.74	0.191	11.184	21.33	0.072	150.690	13.811	0.047	1139.78	91.889	0.309	1301.654
2007	297	56.74	0.191	11.184	21.33	0.072	150.690	13.811	0.047	1139.78	91.889	0.309	1301.654
2008	297	56.74	0.191	11.184	21.33	0.072	150.690	13.811	0.047	1139.78	91.889	0.309	1301.654
2009	262	56.74	0.217	11.184	21.33	0.081	150.690	13.811	0.053	1139.78	91.889	0.351	1301.654
2010	227	56.74	0.250	11.184	21.33	0.094	150.690	13.811	0.061	1139.78	91.889	0.405	1301.654

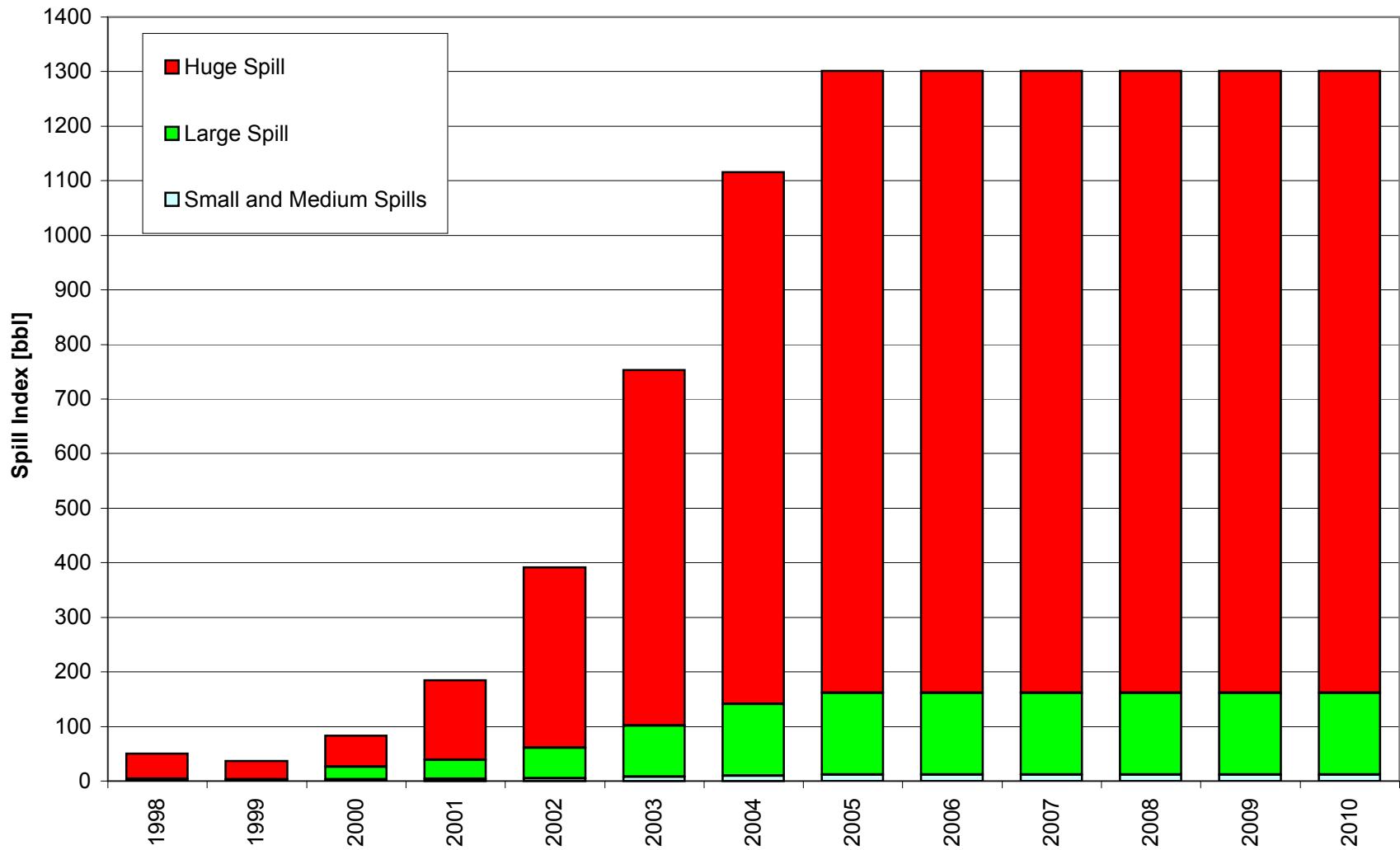
Chukchi Sea HC Spill Frequency



Chukchi Sea HC Spill Frequency per 10⁹ bbl Produced



Chukchi Sea HC Spill Index



**Table 4.6A.1
Non Arctic Spill Occurrence Chukchi Sea HC P/L**

Year	Water Depth	P/L [miles]	P/L Dia <10"											P/L [miles]	P/L Dia >= 10"												
			Small Spills			Medium Spills			Large Spills			Huge Spills			Small Spills			Medium Spills			Large Spills			Huge Spills			
			Average Spill [bbl] = 58	Frequency spills per 10 ³ km-year	Spill Index bbl	Average Spill [bbl] = 266	Frequency spills per 10 ³ km-year	Spill Index bbl	Average Spill [bbl] = 4436	Frequency spills per 10 ³ km-year	Spill Index bbl	Average Spill [bbl] = 14423	Frequency spills per 10 ³ km-year		Spill Index bbl	Average Spill [bbl] = 58	Frequency spills per 10 ³ km-year	Spill Index bbl	Average Spill [bbl] = 387	Frequency spills per 10 ³ km-year	Spill Index bbl	Average Spill [bbl] = 3932	Frequency spills per 10 ³ km-year	Spill Index bbl	Average Spill [bbl] =	Frequency spills per 10 ³ km-year	Spill Index bbl
1998	Shallow	2.799			4.899			2.799			0.700			1.802			4.504			5.405			1.802				
	Medium	2.799			4.899			2.799			0.700			1.802			4.504			5.405			1.802				
	Deep	2.799			4.899			2.799			0.700			1.802			4.504			5.405			1.802				
	Total																										
1999	Shallow	2.799			4.899			2.799			0.700			1.802			4.504			5.405			1.802				
	Medium	2.799			4.899			2.799			0.700			1.802			4.504			5.405			1.802				
	Deep	2.799			4.899			2.799			0.700			1.802			4.504			5.405			1.802				
	Total																										
2000	Shallow	2.799			4.899			2.799			0.700		5	1.802	0.145	0.01	4.504	0.362	0.14	5.405	0.435	1.71	1.802	0.145			
	Medium	2.799			4.899			2.799			0.700		60	1.802	1.739	0.10	4.504	4.348	1.68	5.405	5.218	20.52	1.802	1.739			
	Deep	2.799			4.899			2.799			0.700		135	1.802	3.913	0.23	4.504	9.784	3.79	5.405	11.740	46.16	1.802	3.913			
	Total												200		5.798	0.34		14.494	5.61		17.393	68.39		5.798			
2001	Shallow	2.799			4.899			2.799			0.700		5	1.802	0.145	0.01	4.504	0.362	0.14	5.405	0.435	1.71	1.802	0.145			
	Medium	2.799			4.899			2.799			0.700		60	1.802	1.739	0.10	4.504	4.348	1.68	5.405	5.218	20.52	1.802	1.739			
	Deep	2.799			4.899			2.799			0.700		135	1.802	3.913	0.23	4.504	9.784	3.79	5.405	11.740	46.16	1.802	3.913			
	Total												200		5.798	0.34		14.494	5.61		17.393	68.39		5.798			
2002	Shallow	2.799			4.899			2.799			0.700		5	1.802	0.145	0.01	4.504	0.362	0.14	5.405	0.435	1.71	1.802	0.145			
	Medium	2.799			4.899			2.799			0.700		60	1.802	1.739	0.10	4.504	4.348	1.68	5.405	5.218	20.52	1.802	1.739			
	Deep	2.799			4.899			2.799			0.700		135	1.802	3.913	0.23	4.504	9.784	3.79	5.405	11.740	46.16	1.802	3.913			
	Total												200		5.798	0.34		14.494	5.61		17.393	68.39		5.798			
2003	Shallow	2.799			4.899			2.799			0.700		5	1.802	0.145	0.01	4.504	0.362	0.14	5.405	0.435	1.71	1.802	0.145			
	Medium	2.799			4.899			2.799			0.700		60	1.802	1.739	0.10	4.504	4.348	1.68	5.405	5.218	20.52	1.802	1.739			
	Deep	2.799			4.899			2.799			0.700		135	1.802	3.913	0.23	4.504	9.784	3.79	5.405	11.740	46.16	1.802	3.913			
	Total												200		5.798	0.34		14.494	5.61		17.393	68.39		5.798			
2004	Shallow	2.799			4.899			2.799			0.700		5	1.802	0.145	0.01	4.504	0.362	0.14	5.405	0.435	1.71	1.802	0.145			
	Medium	2.799			4.899			2.799			0.700		60	1.802	1.739	0.10	4.504	4.348	1.68	5.405	5.218	20.52	1.802	1.739			
	Deep	2.799			4.899			2.799			0.700		135	1.802	3.913	0.23	4.504	9.784	3.79	5.405	11.740	46.16	1.802	3.913			
	Total												200		5.798	0.34		14.494	5.61		17.393	68.39		5.798			
2005	Shallow	2.799			4.899			2.799			0.700		5	1.802	0.145	0.01	4.504	0.362	0.14	5.405	0.435	1.71	1.802	0.145			
	Medium	2.799			4.899			2.799			0.700		60	1.802	1.739	0.10	4.504	4.348	1.68	5.405	5.218	20.52	1.802	1.739			
	Deep	2.799			4.899			2.799			0.700		135	1.802	3.913	0.23	4.504	9.784	3.79	5.405	11.740	46.16	1.802	3.913			
	Total												200		5.798	0.34		14.494	5.61		17.393	68.39		5.798			
2006	Shallow	2.799			4.899			2.799			0.700		5	1.802	0.145	0.01	4.504	0.362	0.14	5.405	0.435	1.71	1.802	0.145			
	Medium	2.799			4.899			2.799			0.700		60	1.802	1.739	0.10	4.504	4.348	1.68	5.405	5.218	20.52	1.802	1.739			
	Deep	2.799			4.899			2.799			0.700		135	1.802	3.913	0.23	4.504	9.784	3.79	5.405	11.740	46.16	1.802	3.913			
	Total												200		5.798	0.34		14.494	5.61		17.393	68.39		5.798			
2007	Shallow	2.799			4.899			2.799			0.700		5	1.802	0.145	0.01	4.504	0.362	0.14	5.405	0.435	1.71	1.802	0.145			
	Medium	2.799			4.899			2.799			0.700		60	1.802	1.739	0.10	4.504	4.348	1.68	5.405	5.218	20.52	1.802	1.739			
	Deep	2.799			4.899			2.799			0.700		135	1.802	3.913	0.23	4.504	9.784	3.79	5.405	11.740	46.16	1.802	3.913			
	Total												200		5.798	0.34		14.494	5.61		17.393	68.39		5.798			
2008	Shallow	2.799			4.899			2.799			0.700		5	1.802	0.145	0.01	4.504	0.362	0.14	5.405	0.435	1.71	1.802	0.145			
	Medium	2.799			4.899			2.799			0.700		60	1.802	1.739	0.10	4.504	4.348	1.68	5.405	5.218	20.52	1.802	1.739			
	Deep	2.799			4.899			2.799			0.700		135	1.802	3.913	0.23	4.504	9.784	3.79	5.405	11.740	46.16	1.802	3.913			
	Total												200		5.798	0.34		14.494	5.61		17.393	68.39		5.798			
2009	Shallow	2.799			4.899			2.799			0.700		5	1.802	0.145	0.01	4.504	0.362	0.14	5.405	0.435	1.71	1.802	0.145			
	Medium	2.799			4.899			2.799			0.700		60	1.802	1.739	0.10	4.504	4.348	1.68	5.405	5.218	20.52	1.802	1.739			
	Deep	2.799			4.899			2.799			0.700		135	1.802	3.913	0.23	4.504	9.784	3.79	5.405	11.740	46.16	1.802	3.913			
	Total												200		5.798	0.34		14.494	5.61		17.393	68.39		5.798			
2010	Shallow	2.799			4.899			2.799			0.700		5	1.802	0.145	0.01	4.504	0.362	0.14	5.405	0.435	1.71	1.802	0.145			
	Medium	2.799			4.899			2.799			0.700		60	1.802	1.739	0.10	4.504	4.348	1.68	5.405	5.218	20.52	1.802	1.739			
	Deep	2.799			4.899			2.799			0.700		135	1.802	3.913	0.23	4.504	9.784	3.79	5.405	11.740	46.16	1.802	3.913			
	Total												200		5.798	0.34		14.494	5.61		17.393	68.39		5.798			

**Table 4.6A.1
Non Arctic Spill Occurrence Chukchi Sea HC P/L**

17705
Spill Index bbl
2.57
30.79
69.29
102.65
2.57
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102.65
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102.65
2.57
30.79
69.29
102.65

**Table 4.6A.2
Non Arctic Spill Occurrence Chukchi Sea HC P/L Summary**

Year	Production [MMbbbl]	Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0																		
1999	0																		
2000	0	5.798		0.336	14.494		5.609	20.292		5.945	17.393		68.389	5.798		102.647	43.482		176.982
2001	0	5.798		0.336	14.494		5.609	20.292		5.945	17.393		68.389	5.798		102.647	43.482		176.982
2002	0	5.798		0.336	14.494		5.609	20.292		5.945	17.393		68.389	5.798		102.647	43.482		176.982
2003	223	5.798	0.026	0.336	14.494	0.065	5.609	20.292	0.091	5.945	17.393	0.078	68.389	5.798	0.026	102.647	43.482	0.195	176.982
2004	297	5.798	0.020	0.336	14.494	0.049	5.609	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
2005	297	5.798	0.020	0.336	14.494	0.049	5.609	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
2006	297	5.798	0.020	0.336	14.494	0.049	5.609	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
2007	297	5.798	0.020	0.336	14.494	0.049	5.609	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
2008	297	5.798	0.020	0.336	14.494	0.049	5.609	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
2009	262	5.798	0.022	0.336	14.494	0.055	5.609	20.292	0.077	5.945	17.393	0.066	68.389	5.798	0.022	102.647	43.482	0.166	176.982
2010	227	5.798	0.026	0.336	14.494	0.064	5.609	20.292	0.089	5.945	17.393	0.077	68.389	5.798	0.026	102.647	43.482	0.192	176.982

**Table 4.6A.3
Non Arctic Spill Occurrence Chukchi Sea HC Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep			1.504			0.251		
	Total								
1999	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep			1.504			0.251		
	Total								
2000	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	2		1.504			0.251		
	Total	2							
2001	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	8	50	1.504	7.518	1.19	0.251	1.253	7.68
	Total	8	50		7.518	1.19		1.253	7.68
2002	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	130	1.504	19.547	3.09	0.251	3.258	19.97
	Total	12	130		19.547	3.09		3.258	19.97
2003	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	270	1.504	40.597	6.41	0.251	6.766	41.48
	Total	12	270		40.597	6.41		6.766	41.48
2004	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	410	1.504	61.647	9.74	0.251	10.274	62.98
	Total	12	410		61.647	9.74		10.274	62.98
2005	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	482	1.504	72.473	11.45	0.251	12.079	74.04
	Total	12	482		72.473	11.45		12.079	74.04
2006	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	482	1.504	72.473	11.45	0.251	12.079	74.04
	Total	12	482		72.473	11.45		12.079	74.04
2007	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	482	1.504	72.473	11.45	0.251	12.079	74.04
	Total	12	482		72.473	11.45		12.079	74.04
2008	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	482	1.504	72.473	11.45	0.251	12.079	74.04
	Total	12	482		72.473	11.45		12.079	74.04
2009	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	482	1.504	72.473	11.45	0.251	12.079	74.04
	Total	12	482		72.473	11.45		12.079	74.04
2010	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	482	1.504	72.473	11.45	0.251	12.079	74.04
	Total	12	482		72.473	11.45		12.079	74.04

**Table 4.6A.4
Non Artic Spill Occurrence Chukchi Sea HC Platforms Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
1998	0									
1999	0									
2000	0									
2001	0	7.518		1.188	1.253		7.681	8.771		8.869
2002	0	19.547		3.088	3.258		19.970	22.804		23.058
2003	223	40.597	0.182	6.414	6.766	0.030	41.476	47.363	0.212	47.891
2004	297	61.647	0.208	9.740	10.274	0.035	62.983	71.921	0.242	72.723
2005	297	72.473	0.244	11.451	12.079	0.041	74.043	84.552	0.285	85.494
2006	297	72.473	0.244	11.451	12.079	0.041	74.043	84.552	0.285	85.494
2007	297	72.473	0.244	11.451	12.079	0.041	74.043	84.552	0.285	85.494
2008	297	72.473	0.244	11.451	12.079	0.041	74.043	84.552	0.285	85.494
2009	262	72.473	0.277	11.451	12.079	0.046	74.043	84.552	0.323	85.494
2010	227	72.473	0.319	11.451	12.079	0.053	74.043	84.552	0.372	85.494

**Table 4.6A.5
Non Arctic Spill Occurrence Chukchi Sea HC Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
1999	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2000	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2001	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	50	0.500	0.250	0.13	3.500	1.750	7.88	1.500	0.750	15.00	1.000	0.500	100.00
	Total	50		0.250	0.13		1.750	7.88		0.750	15.00		0.500	100.00
2002	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	130	0.500	0.650	0.33	3.500	4.550	20.48	1.500	1.950	39.00	1.000	1.300	260.00
	Total	130		0.650	0.33		4.550	20.48		1.950	39.00		1.300	260.00
2003	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	270	0.500	1.350	0.68	3.500	9.450	42.53	1.500	4.050	81.00	1.000	2.700	540.00
	Total	270		1.350	0.68		9.450	42.53		4.050	81.00		2.700	540.00
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	410	0.500	2.050	1.03	3.500	14.350	64.58	1.500	6.150	123.00	1.000	4.100	820.00
	Total	410		2.050	1.03		14.350	64.58		6.150	123.00		4.100	820.00
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2009	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2010	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00

Table 4.6A.6

Non Artic Spill Occurrence Chukchi Sea HC Production Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0												
1999	0												
2000	0												
2001	0	0.250		0.125	0.750		7.875	1.250		115.000	2.250		123.000
2002	0	0.650		0.325	1.950		20.475	3.250		299.000	5.850		319.800
2003	223	1.350	0.006	0.675	4.050	0.018	42.525	6.750	0.030	621.000	12.150	0.054	664.200
2004	297	2.050	0.007	1.025	6.150	0.021	64.575	10.250	0.035	943.000	18.450	0.062	1008.600
2005	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2006	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2007	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2008	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2009	262	2.410	0.009	1.205	7.230	0.028	75.915	12.050	0.046	1108.600	21.690	0.083	1185.720
2010	227	2.410	0.011	1.205	7.230	0.032	75.915	12.050	0.053	1108.600	21.690	0.096	1185.720

**Table 4.6A.7
Non Arctic Spill Occurrence Chukchi Sea HC Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	3	3.160	0.095	0.05	22.110	0.663	2.98	9.500	0.285	5.70	5.500	0.165	33.00
	Total	3		0.095	0.05		0.663	2.98		0.285	5.70		0.165	33.00
1999	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2000	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2001	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2002	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2003	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2004	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2005	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2006	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2007	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2008	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2010	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.6A.8

Non Arctic Spill Occurrence Chukchi Sea HC Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0	0.095		0.047	0.285		2.985	0.450		38.700	0.830		41.732
1999	0	0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2000	0	0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2001	0												
2002	0												
2003	223												
2004	297												
2005	297												
2006	297												
2007	297												
2008	297												
2009	262												
2010	227												

**Table 4.6A.9
Non Arctic Spill Occurrence Chukchi Sea HC Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep	1	1.300	0.013	0.01	9.080	0.091	0.41	3.900	0.039	0.78	3.900	0.039	7.80
	Total	1		0.013	0.01		0.091	0.41		0.039	0.78		0.039	7.80
1999	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep	1	1.300	0.013	0.01	9.080	0.091	0.41	3.900	0.039	0.78	3.900	0.039	7.80
	Total	1		0.013	0.01		0.091	0.41		0.039	0.78		0.039	7.80
2000	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2001	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2002	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2003	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2009	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.6A.10

Non Arctic Spill Occurrence Chukchi Sea HC Development Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0	0.013		0.007	0.039		0.409	0.078		8.580	0.130		8.995
1999	0	0.013		0.007	0.039		0.409	0.078		8.580	0.130		8.995
2000	0												
2001	0												
2002	0												
2003	223												
2004	297												
2005	297												
2006	297												
2007	297												
2008	297												
2009	262												
2010	227												

**Table 4.6A.11
Non Arctic Spill Occurrence Chukchi Sea HC Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]
1998	Pipeline	0												
	Platforms													
	Production Wells													
	Exploration Wells		0.095	0.047	0.285	2.985	0.450	38.700	0.830	41.732				
	Development Wells		0.013	0.007	0.039	0.409	0.078	8.580	0.130	8.995				
Total	0.108	0.054	0.324	3.393	0.528	47.280	0.960	50.727						
1999	Pipeline	0												
	Platforms													
	Production Wells													
	Exploration Wells		0.063	0.032	0.190	1.990	0.300	25.800	0.553	27.822				
	Development Wells		0.013	0.007	0.039	0.409	0.078	8.580	0.130	8.995				
Total	0.076	0.038	0.229	2.399	0.378	34.380	0.683	36.817						
2000	Pipeline	0	20.292	5.945	17.393	68.389	5.798	102.647	43.482	176.982				
	Platforms													
	Production Wells													
	Exploration Wells		0.063	0.032	0.190	1.990	0.300	25.800	0.553	27.822				
	Development Wells													
Total	20.355	5.977	17.583	70.379	6.098	128.447	44.035	204.803						
2001	Pipeline	0	20.292	5.945	17.393	68.389	5.798	102.647	43.482	176.982				
	Platforms		7.518	1.188	1.253	7.681			8.771	8.869				
	Production Wells		0.250	0.125	0.750	7.875	1.250	115.000	2.250	123.000				
	Exploration Wells													
	Development Wells													
Total	28.060	7.258	19.396	83.945	7.048	217.647	54.503	308.850						
2002	Pipeline	0	20.292	5.945	17.393	68.389	5.798	102.647	43.482	176.982				
	Platforms		19.547	3.088	3.258	19.970			22.804	23.058				
	Production Wells		0.650	0.325	1.950	20.475	3.250	299.000	5.850	319.800				
	Exploration Wells													
	Development Wells													
Total	40.488	9.359	22.601	108.834	9.048	401.647	72.137	519.840						
2003	Pipeline	223.0	20.292	0.091	5.945	17.393	0.078	68.389	5.798	0.026	102.647	43.482	0.195	176.982
	Platforms		40.597	0.182	6.414	6.766	0.030	41.476				47.363	0.212	47.891
	Production Wells		1.350	0.006	0.675	4.050	0.018	42.525	6.750	0.030	621.000	12.150	0.054	664.200
	Exploration Wells													
	Development Wells													
Total	62.238	0.279	13.035	28.209	0.126	152.390	12.548	0.056	723.647	102.995	0.462	889.072		
2004	Pipeline	297.0	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
	Platforms		61.647	0.208	9.740	10.274	0.035	62.983				71.921	0.242	72.723
	Production Wells		2.050	0.007	1.025	6.150	0.021	64.575	10.250	0.035	943.000	18.450	0.062	1008.600
	Exploration Wells													
	Development Wells													
Total	83.989	0.283	16.711	33.817	0.114	195.947	16.048	0.054	1045.647	133.854	0.451	1258.304		
2005	Pipeline	297.0	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
	Platforms		72.473	0.244	11.451	12.079	0.041	74.043				84.552	0.285	85.494
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
	Exploration Wells													
	Development Wells													
Total	95.174	0.320	18.601	36.702	0.124	218.347	17.848	0.060	1211.247	149.724	0.504	1448.195		
2006	Pipeline	297.0	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
	Platforms		72.473	0.244	11.451	12.079	0.041	74.043				84.552	0.285	85.494
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
	Exploration Wells													
	Development Wells													
Total	95.174	0.320	18.601	36.702	0.124	218.347	17.848	0.060	1211.247	149.724	0.504	1448.195		
2007	Pipeline	297.0	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
	Platforms		72.473	0.244	11.451	12.079	0.041	74.043				84.552	0.285	85.494
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
	Exploration Wells													
	Development Wells													
Total	95.174	0.320	18.601	36.702	0.124	218.347	17.848	0.060	1211.247	149.724	0.504	1448.195		

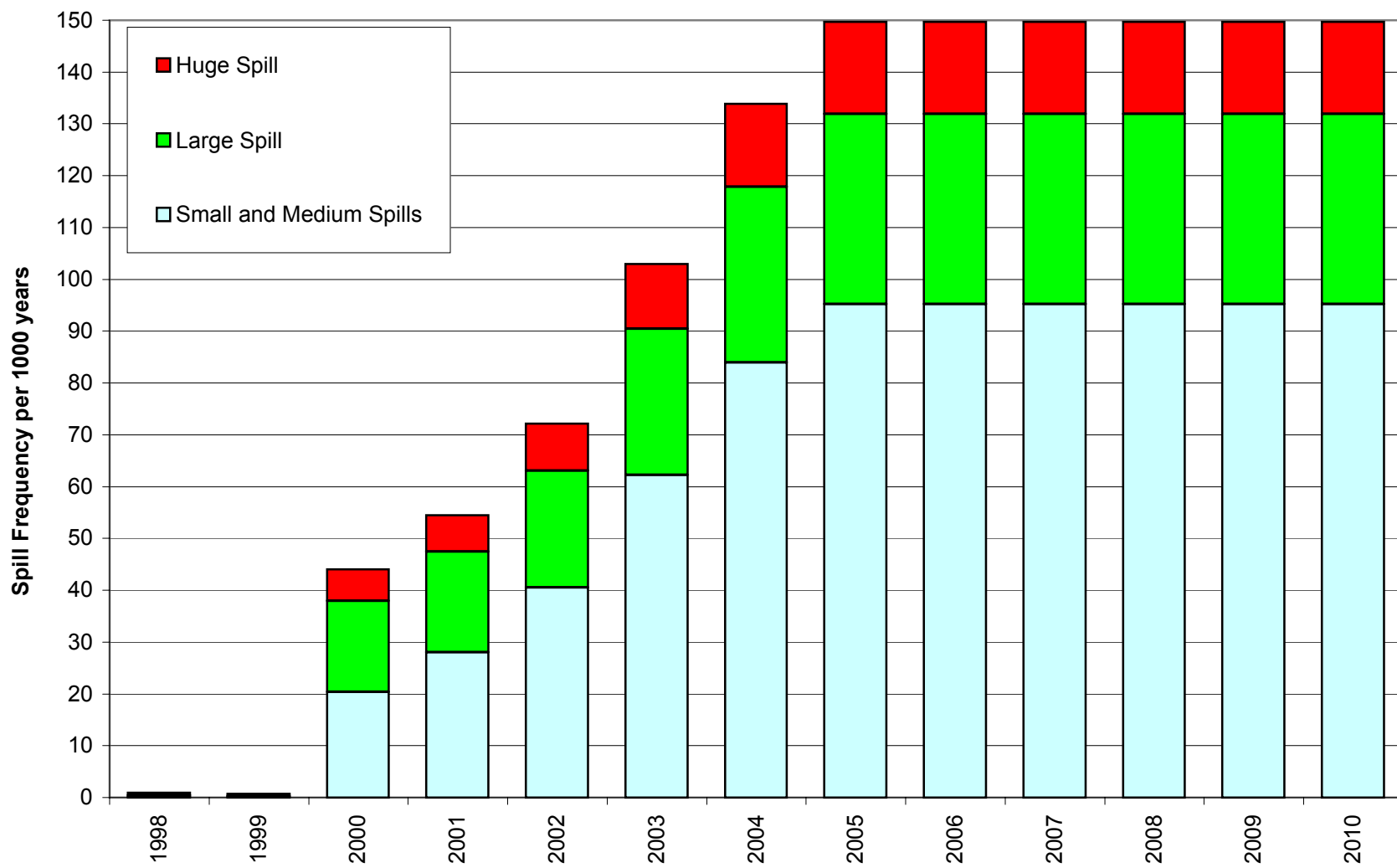
**Table 4.6A.11
Non Arctic Spill Occurrence Chukchi Sea HC Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills			
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	
2008	Pipeline	297.0	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982	
	Platforms		72.473	0.244	11.451	12.079	0.041	74.043				84.552	0.285	85.494	
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720	
	Exploration Wells														
	Development Wells														
	Total		95.174	0.320	18.601	36.702	0.124	218.347	17.848	0.060	1211.247	149.724	0.504	1448.195	
2009	Pipeline	262.0	20.292	0.077	5.945	17.393	0.066	68.389	5.798	0.022	102.647	43.482	0.166	176.982	
	Platforms		72.473	0.277	11.451	12.079	0.046	74.043				84.552	0.323	85.494	
	Production Wells		2.410	0.009	1.205	7.230	0.028	75.915	12.050	0.046	1108.600	21.690	0.083	1185.720	
	Exploration Wells														
	Development Wells														
	Total		95.174	0.363	18.601	36.702	0.140	218.347	17.848	0.068	1211.247	149.724	0.571	1448.195	
2010	Pipeline	227.0	20.292	0.089	5.945	17.393	0.077	68.389	5.798	0.026	102.647	43.482	0.192	176.982	
	Platforms		72.473	0.319	11.451	12.079	0.053	74.043				84.552	0.372	85.494	
	Production Wells		2.410	0.011	1.205	7.230	0.032	75.915	12.050	0.053	1108.600	21.690	0.096	1185.720	
	Exploration Wells														
	Development Wells														
	Total		95.174	0.419	18.601	36.702	0.162	218.347	17.848	0.079	1211.247	149.724	0.660	1448.195	

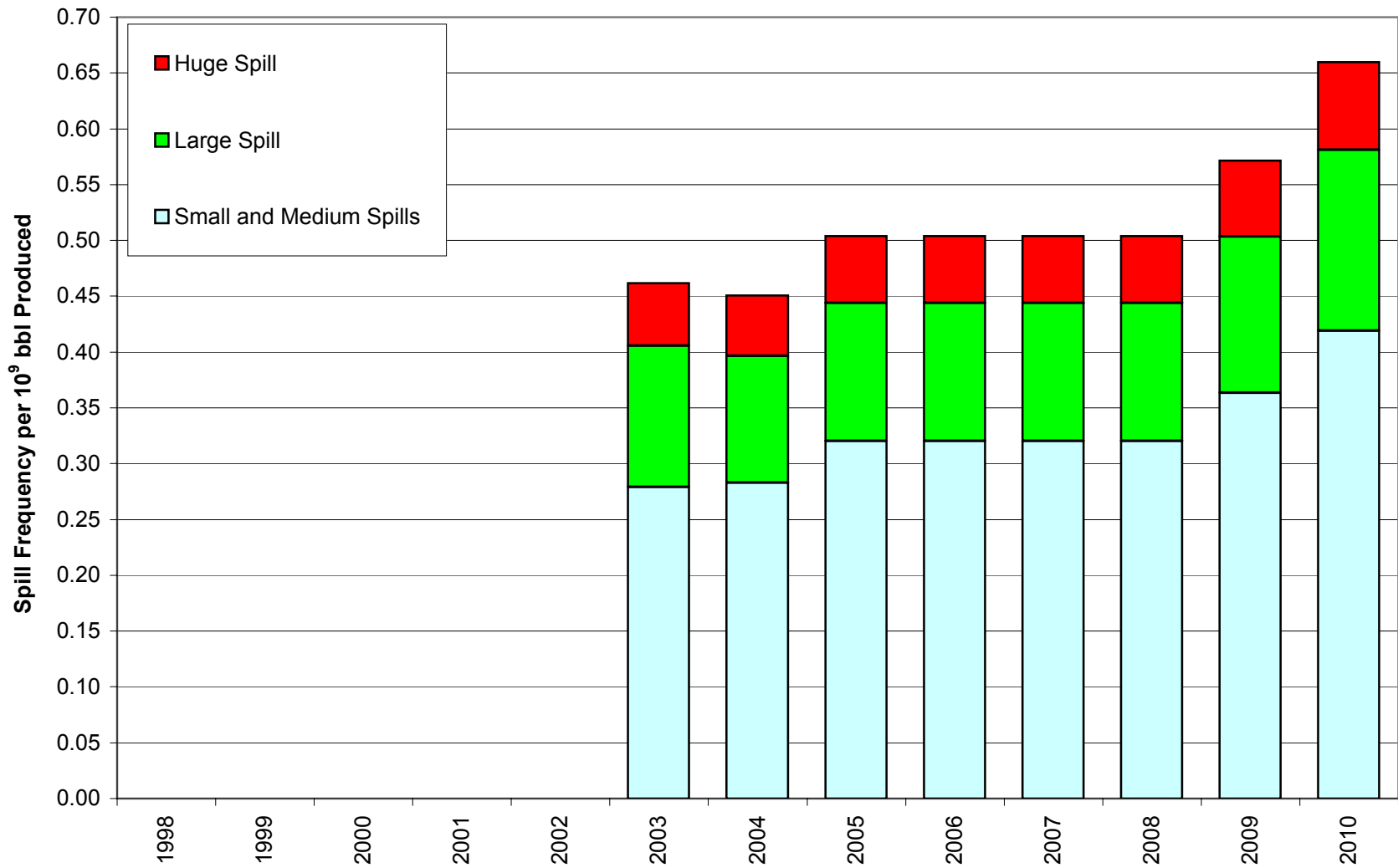
**Table 4.6A.12
Non Arctic Spill Occurrence Chukchi Sea HC Annual Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
1998	0	0.11		0.054	0.32		3.393	0.528		47.28	0.960		50.727
1999	0	0.08		0.038	0.23		2.399	0.378		34.38	0.683		36.817
2000	0	20.35		5.977	17.58		70.379	6.098		128.45	44.035		204.803
2001	0	28.06		7.258	19.40		83.945	7.048		217.65	54.503		308.850
2002	0	40.49		9.359	22.60		108.834	9.048		401.65	72.137		519.840
2003	223	62.24	0.279	13.035	28.21	0.126	152.390	12.548	0.056	723.65	102.995	0.462	889.072
2004	297	83.99	0.283	16.711	33.82	0.114	195.947	16.048	0.054	1045.65	133.854	0.451	1258.304
2005	297	95.17	0.320	18.601	36.70	0.124	218.347	17.848	0.060	1211.25	149.724	0.504	1448.195
2006	297	95.17	0.320	18.601	36.70	0.124	218.347	17.848	0.060	1211.25	149.724	0.504	1448.195
2007	297	95.17	0.320	18.601	36.70	0.124	218.347	17.848	0.060	1211.25	149.724	0.504	1448.195
2008	297	95.17	0.320	18.601	36.70	0.124	218.347	17.848	0.060	1211.25	149.724	0.504	1448.195
2009	262	95.17	0.363	18.601	36.70	0.140	218.347	17.848	0.068	1211.25	149.724	0.571	1448.195
2010	227	95.17	0.419	18.601	36.70	0.162	218.347	17.848	0.079	1211.25	149.724	0.660	1448.195

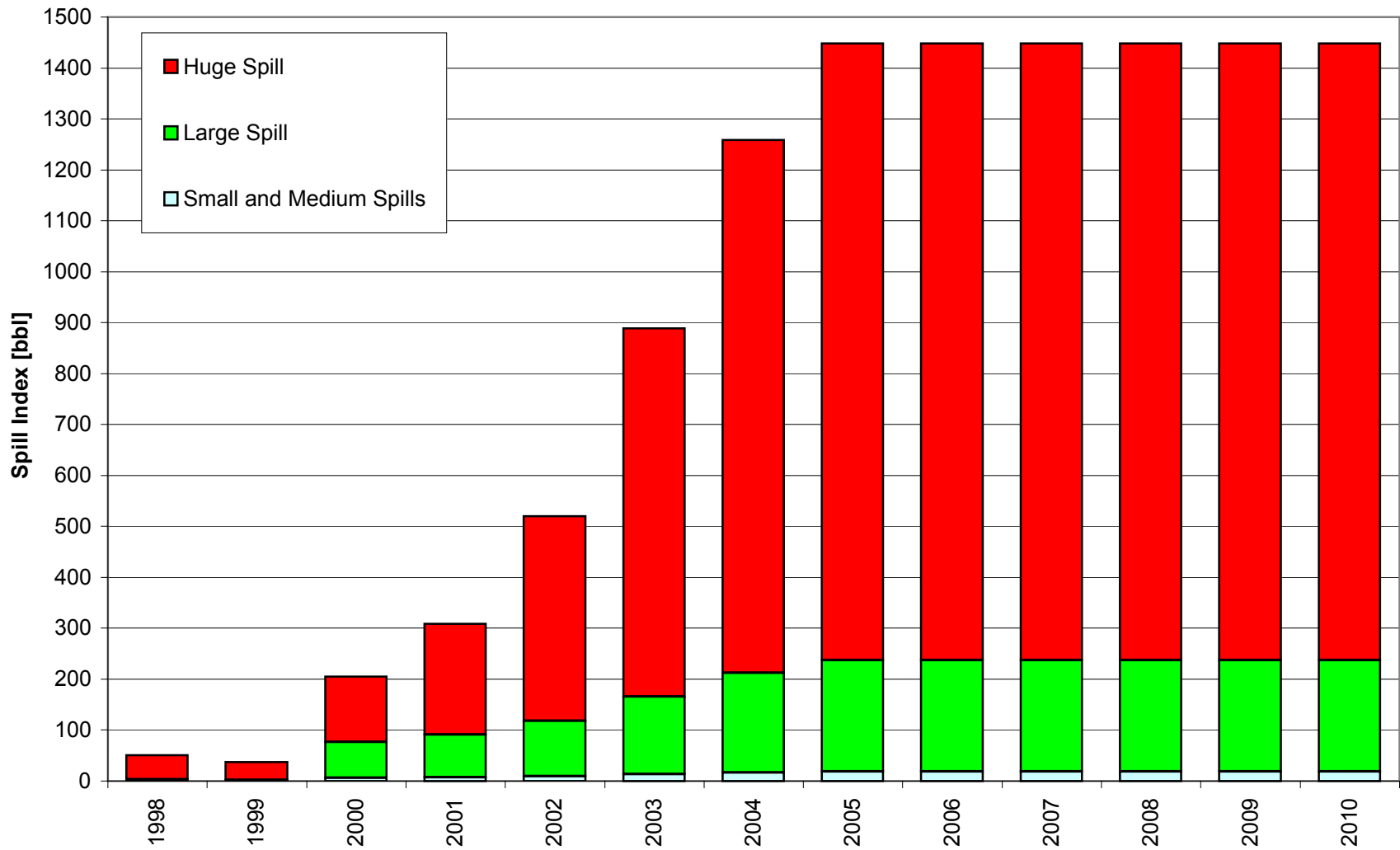
Chukchi Sea HC Spill Frequency - Non Arctic



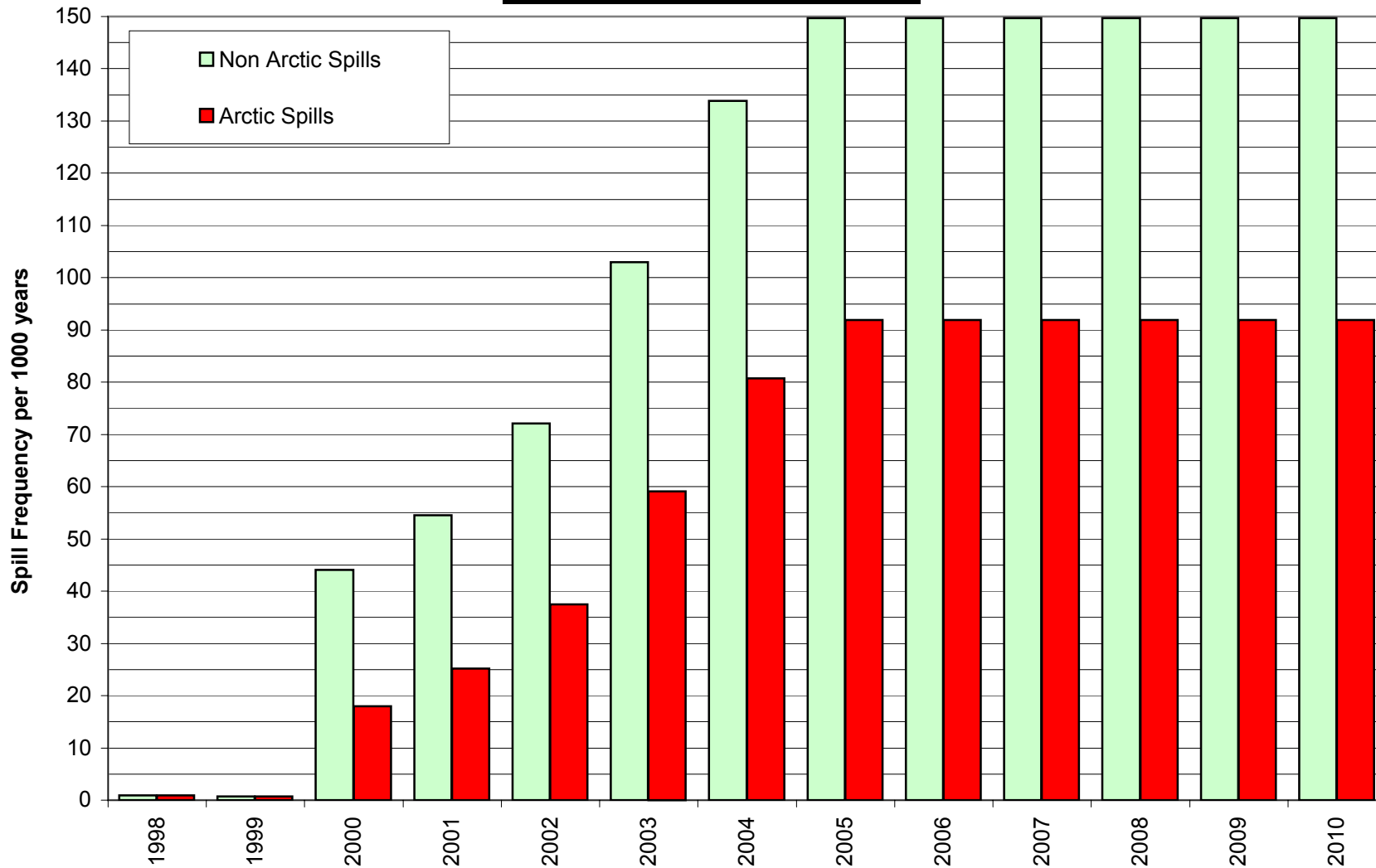
Chukchi Sea HC Spill Frequency per 10⁹ bbl Produced - Non Arctic



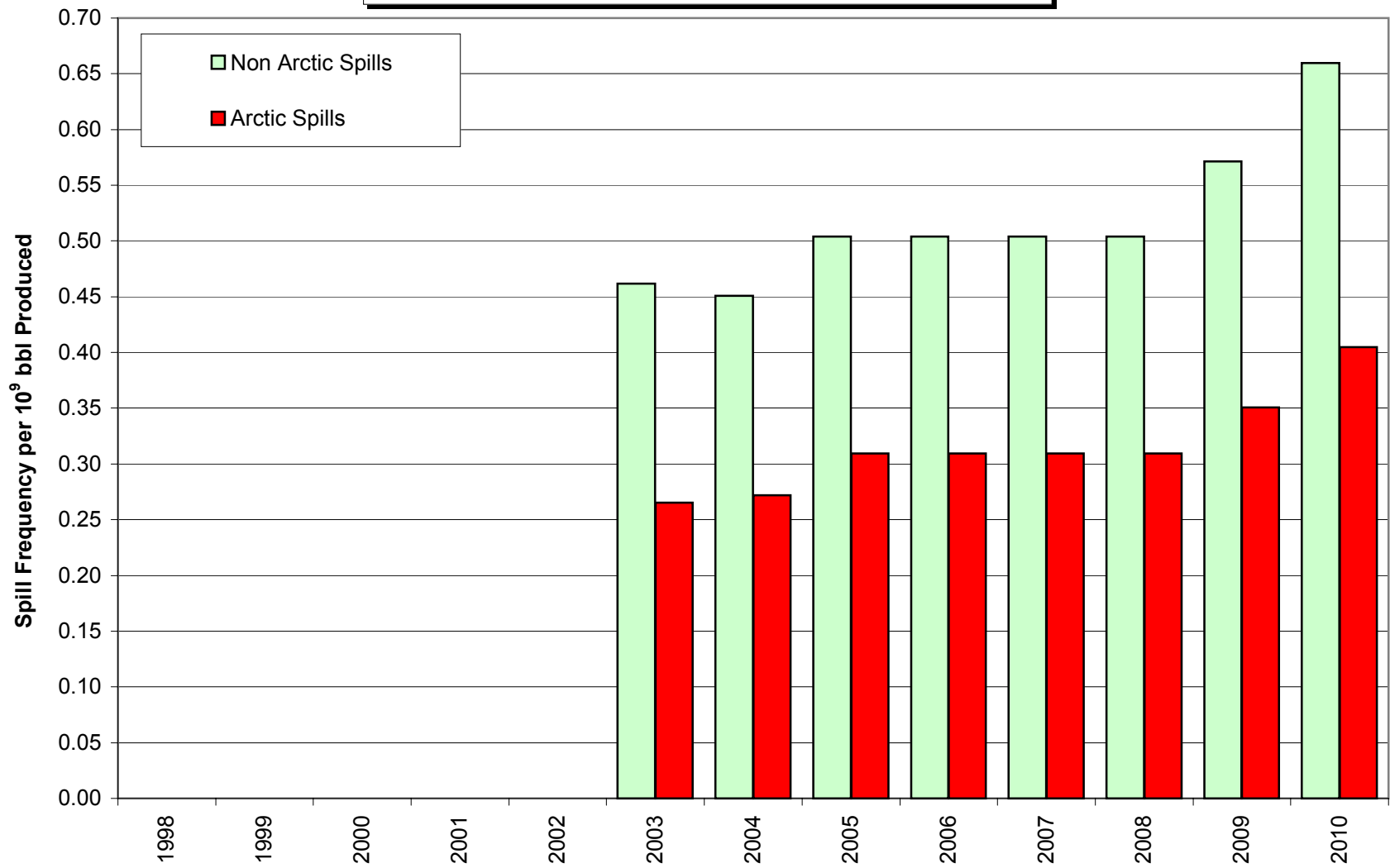
Chukchi Sea HC Spill Index - Non Arctic



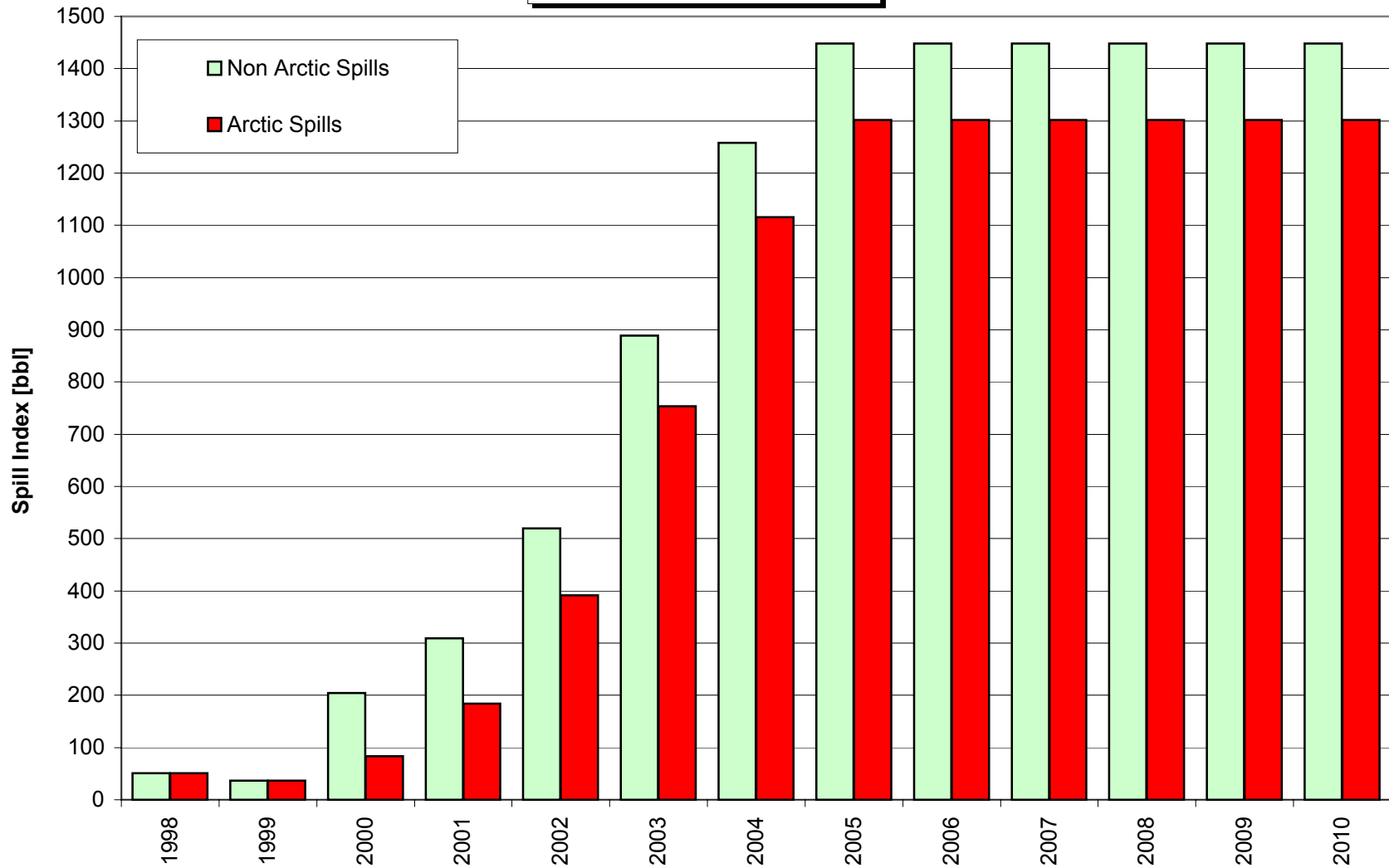
Chukchi Sea HC Spill Frequency



Chukchi Sea HC Spill Frequency per 10⁹ bbl Produced



Chukchi Sea HC Spill Index



**Table 5.1
Summary of Spill Indicators for All Scenarios**

SPILL INDICATORS	Spill Size bbl x 1000	Beaufort Sea					Chukchi Sea		
		Year 2016	Year 2019	Year 2024	Year 2024	Year 2024	Year 2010	Year 2010	Year 2010
		Sale 1	Sale 2	Sale 3	Sale All	Sale All Non Arctic	Base Case	High Case	High C Non Arctic
Spill Frequency per 10 ³ years	SM	8.41	8.51	8.21	25.14	43.11	30.95	56.74	95.17
	L	3.38	3.32	3.15	9.85	17.83	12.43	21.33	36.70
	H	2.09	2.07	1.99	6.16	8.31	7.11	13.81	17.85
	All	13.89	13.90	13.35	41.14	69.25	50.49	91.89	149.72
Spill Frequency per 10 ⁹ bbl produced	SM	0.18	0.20	0.21	0.34	0.58	0.34	0.25	0.42
	L	0.07	0.08	0.08	0.13	0.24	0.14	0.09	0.16
	H	0.04	0.05	0.05	0.08	0.11	0.08	0.06	0.08
	All	0.29	0.33	0.35	0.55	0.93	0.55	0.40	0.66
Maximum Spill Frequency per 10 ⁹ bbl produced (year varies)	All	2.02	2.47	2.05	2.05	3.39	0.55	0.40	0.66
Spill Index [bbl]	SM	2	2	2	5	9	7	11	19
	L	23	23	22	67	102	79	151	218
	H	165	165	162	491	529	523	1140	1211
	All	190	189	185	564	640	609	1302	1448

**Table 5.2
Composition of Spill Indicators**

SPILL INDICATORS	Beaufort Sea				Chukchi Sea			
	Sale All - Year 2024				High Case - Year 2010			
	P/L	Platforms	Wells	TOTAL	P/L	Platforms	Wells	TOTAL
Spill Frequency per 10 ³ years	10.15	21.72	9.27	41.14	17.43	52.77	21.69	91.89
	25%	53%	23%	100%	19%	57%	24%	100%
Spill Frequency per 10 ⁹ bbl produced	0.14	0.29	0.12	0.55	0.08	0.23	0.10	0.40
	25%	53%	23%	100%	19%	57%	24%	100%
Spill Index [bbl]	32	25	507	564	55	61	1186	1302
	6%	4%	90%	100%	4%	5%	91%	100%

**Table 5.3
Composition of Spill Indicators**

SPILL INDICATORS	ITEM	Beaufort Sea				Chukchi Sea			
		Sale All - Year 2024				High Case - Year 2010			
		P/L	Platforms	Wells	TOTAL	P/L	Platforms	Wells	TOTAL
Spill Frequency per 10 ³ years	Monte Carlo	15.55	25.11	9.27	49.93	21.18	67.03	21.69	109.91
	Expected Value	10.15	21.72	9.27	41.14	17.43	52.77	21.69	91.89
	Difference	53%	16%	0%	21%	22%	27%	0%	20%
Spill Frequency per 10 ⁹ bbl produced	Monte Carlo	0.21	0.34	0.12	0.67	0.09	0.3	0.1	0.48
	Expected Value	0.14	0.29	0.12	0.55	0.08	0.23	0.10	0.41
	Difference	55%	17%	0%	23%	17%	29%	0%	17%
Spill Index [bbl]	Monte Carlo	56	29	507	592	73	76	1186	1335
	Expected Value	32	25	507	564	55	61	1186	1302
	Difference	76%	15%	0%	5%	32%	25%	0%	3%

Figure 5.1
Baught Sea Sale All - 2024 year - Spill Indicators

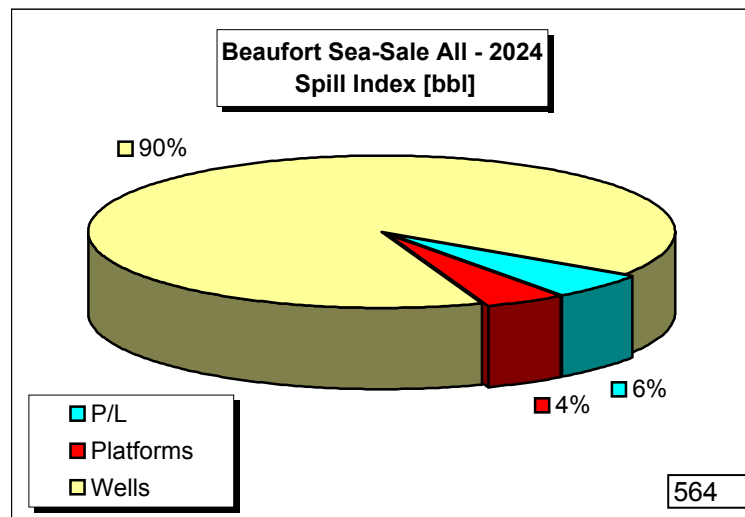
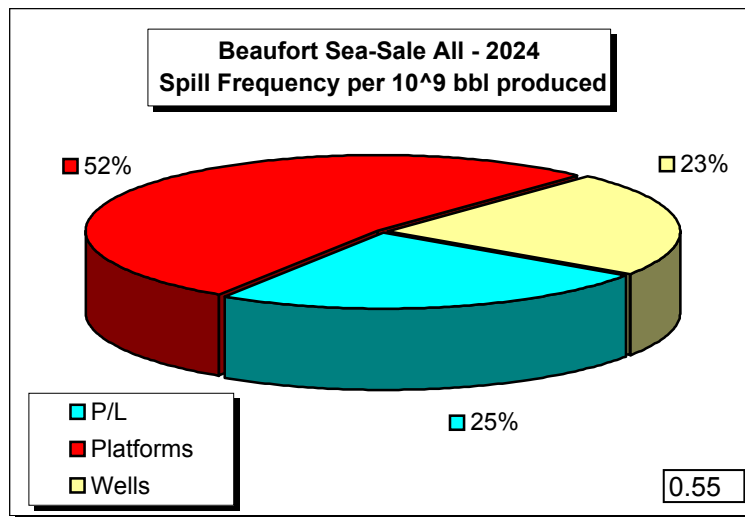
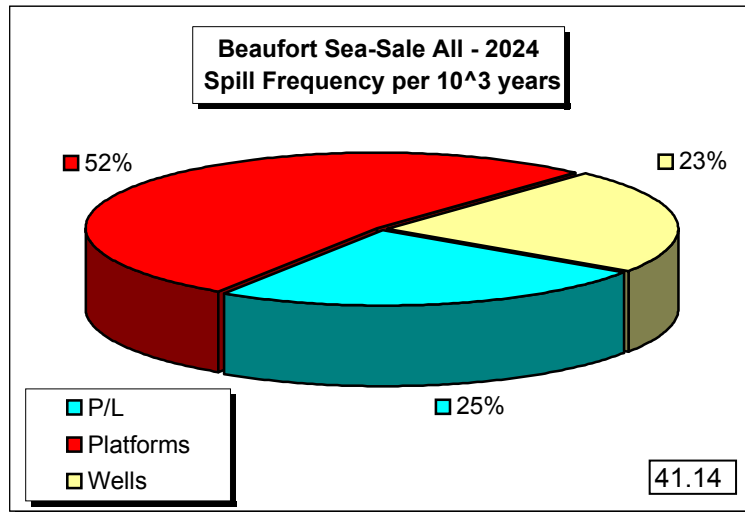


Figure 5.2
 Beaufort Sea Sale All - 2024 year - Spill Indicators

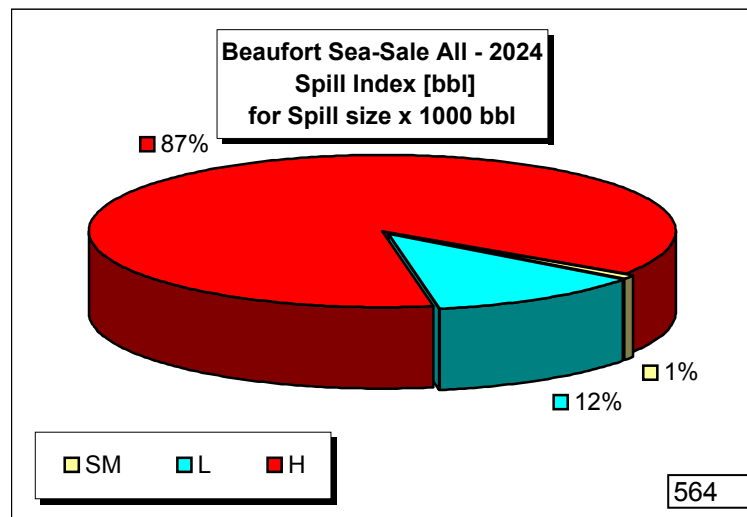
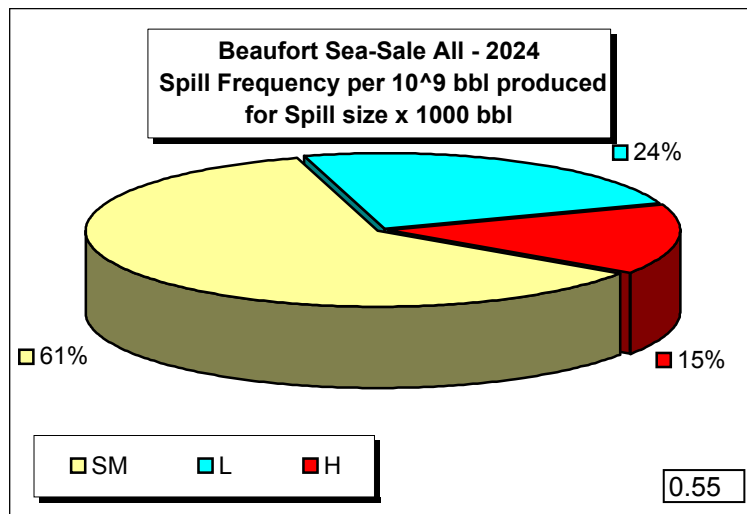
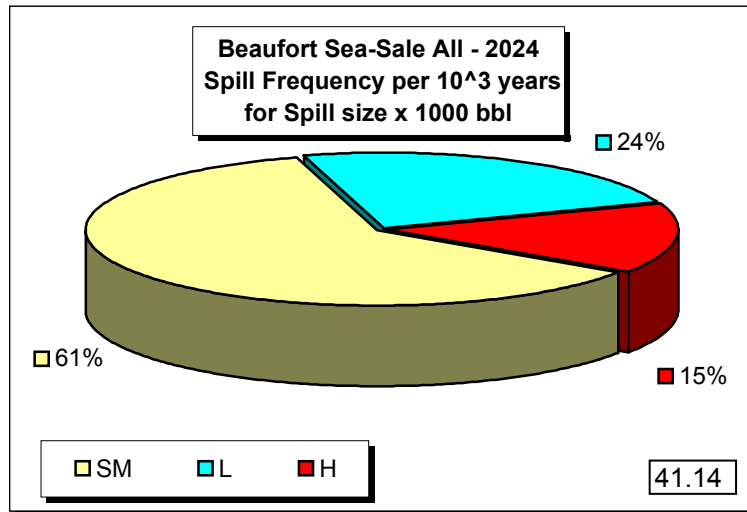


Figure 5.3
Chukchi Sea High Case - 2010 year - Spill Indicators

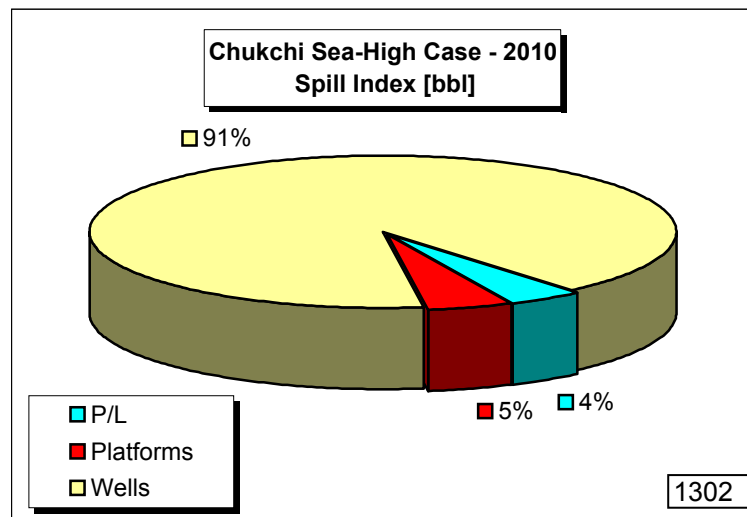
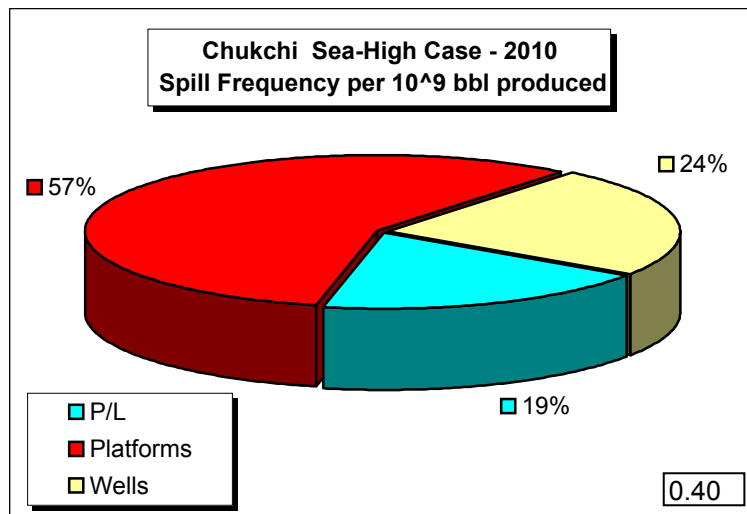
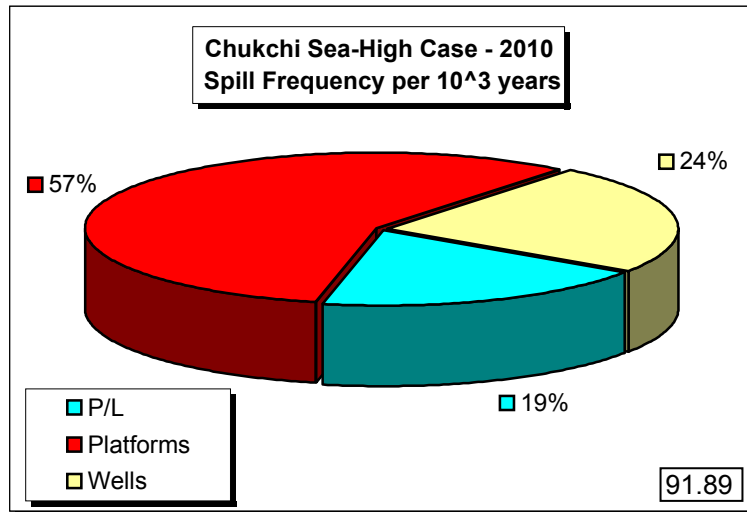
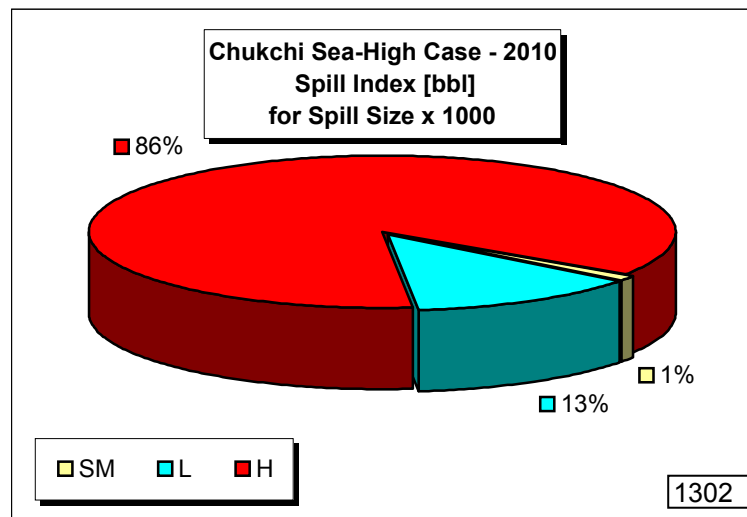
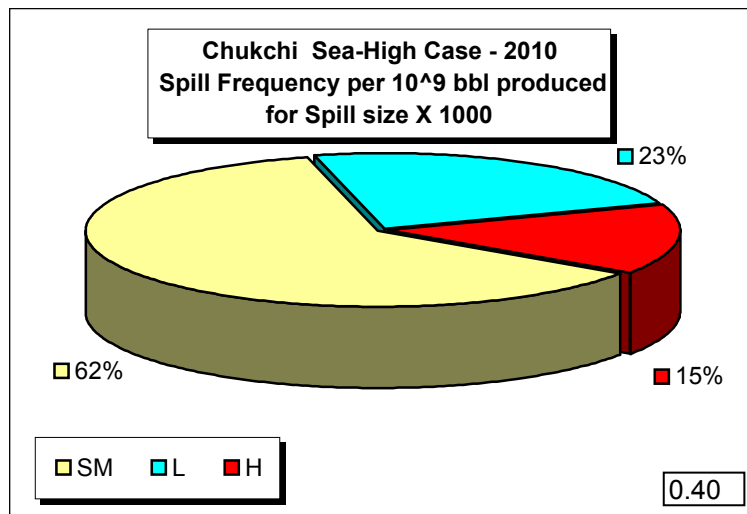
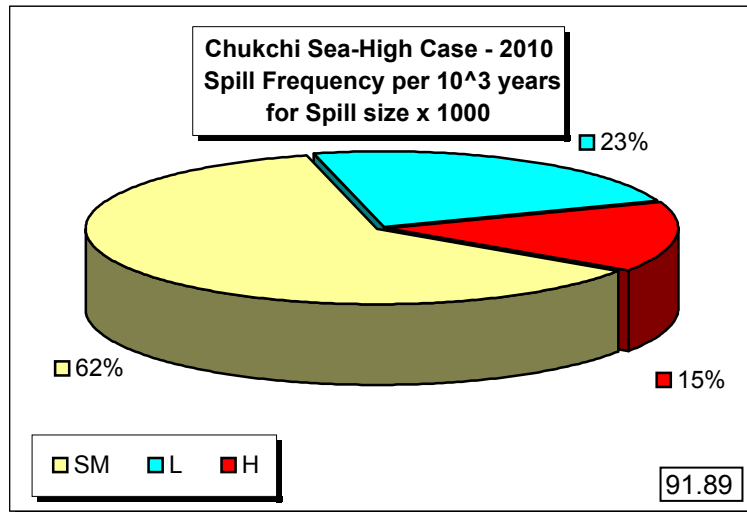


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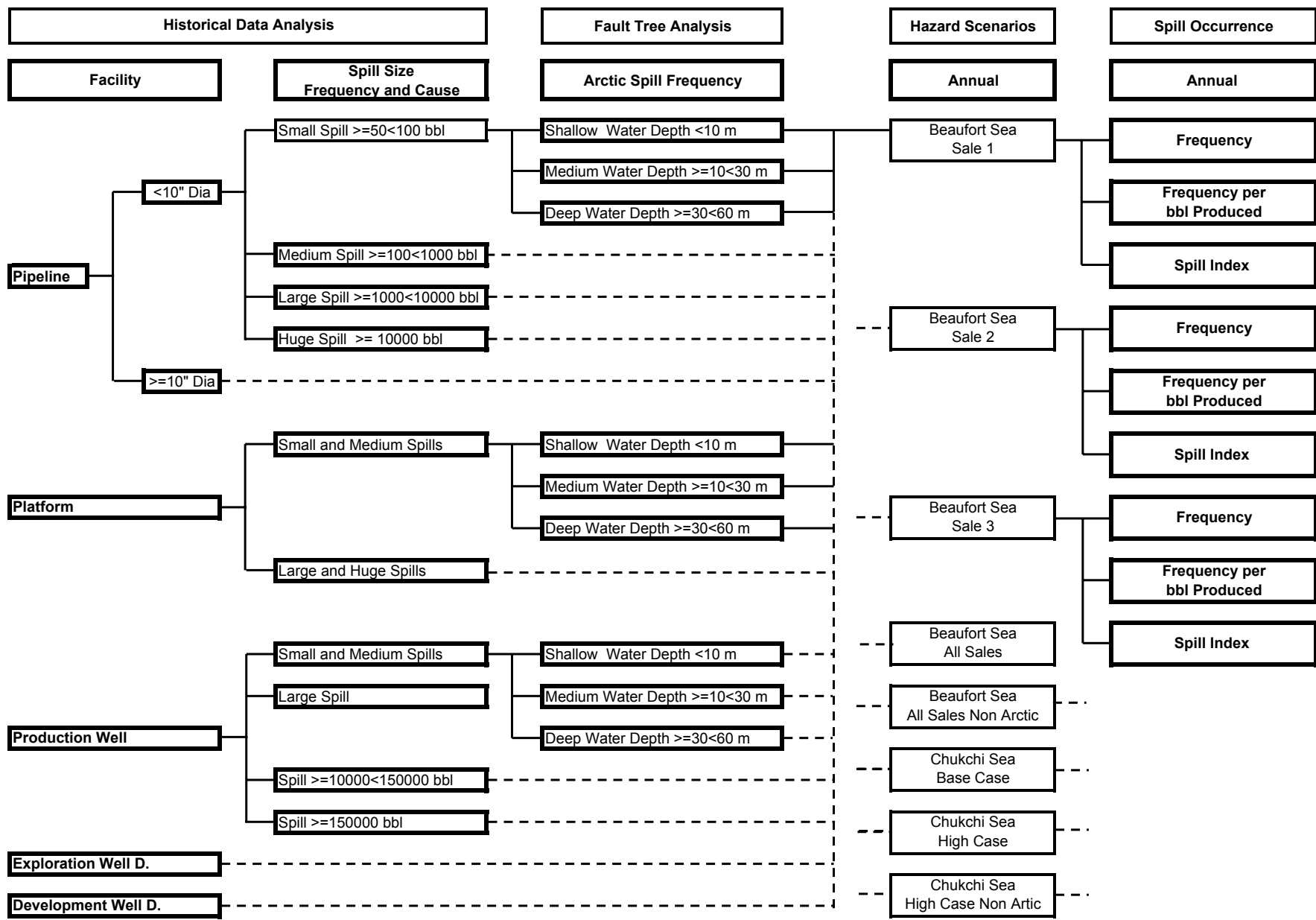
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Figure T.0 Flow Chart



**Table 1.1
Analysis of Historical Spills - P/L**

CAUSE CLASSIFICATION	NUMBER OF SPILLS	SPILL SIZE BBL										NUMBER OF SPILLS					
		1	2	3	4	5	6	7	8	9	10	S	M	L	H	SM	LH
CORROSION	4											1	2	1		3	1
External	1	80										1				1	
Internal	3	100	5000	414								2	2	1		2	1
THIRD PARTY IMPACT	16											2	5	6	3	7	9
Anchor Impact	10	19833	65	50	300	900	323	15576	2000	800	1211	2	4	2	2	6	4
Jackup Rig or Spud Barge	1	3200												1			1
Trawl/Fishing Net	5	4000	100	14423	4569	4533						1	3	1	1	4	
OPERATION IMPACT	4											3		1		3	1
Rig Anchoring	1	50										1				1	
Work Boat Anchoring	3	50	5100	50								2		1		2	1
MECHANICAL	2												2			2	
Connection Failure	1	135											1			1	
Material Failure	1	210											1			1	
NATURAL HAZARD	4											1	1	2		2	2
Mud Slide	3	250	80	8212								1	1	1		2	1
Storm/ Hurricane	1	3500												1			1
ARCTIC																	
Ice Gouging																	
Strudel Scour																	
Upheaval Buckling																	
Thaw Settlement																	
Other																	
UNKNOWN	1	119											1			1	
TOTALS	31											7	11	10	3	18	13

**Table 1.2
Distribution and Frequency of Historical Spills - P/L**

CAUSE CLASSIFICATION	Small and Medium Spills				Large and Huge Spills				
	HIST. DISTRIBUTION %	NUMBER OF SPILLS	EXPOSURE [km-years]	FREQUENCY spill per 10 ⁴ km-year	HIST. DISTRIBUTION %	NUMBER OF SPILLS	EXPOSURE [km-years]	FREQUENCY spill per 10 ⁴ km-year	
CORROSION	16.67	3	253903	0.1182	7.69	1	253903	0.0394	
External	5.56	1		0.0394					
Internal	11.11	2		0.0788	7.69	1			0.0394
THIRD PARTY IMPACT	38.89	7		0.2757	69.23	9			0.3545
Anchor Impact	33.33	6		0.2363	30.77	4			0.1575
Jackup Rig or Spud Barge					7.69	1			0.0394
Trawl/Fishing Net	5.56	1		0.0394	30.77	4			0.1575
OPERATION IMPACT	16.67	3		0.1182	7.69	1			0.0394
Rig Anchoring	5.56	1		0.0394					
Work Boat Anchoring	11.11	2		0.0788	7.69	1			0.0394
MECHANICAL	11.11	2		0.0788					
Connection Failure	5.56	1		0.0394					
Material Failure	5.56	1		0.0394					
NATURAL HAZARD	11.11	2		0.0788	15.38	2			0.0788
Mud Slide	11.11	2		0.0788	7.69	1			0.0394
Storm/ Hurricane					7.69	1			0.0394
ARCTIC									
Ice Gouging									
Strudel Scour									
Upheaval Buckling									
Thaw Settlement									
Other									
UNKNOWN	5.56	1		0.0394					
TOTALS	100.00	18		0.7089	100.00	13		0.5120	

**Table 1.2A
Historical Spills Data Pipeline**

GOM OCS Pipeline Spills, Categorized 1972-99		Spill Statistics			Exposure**	Frequency
		Number of Spills	Average Volume bbl	Median Volume bbl	km-years	spill per 10 ⁴ km-years
By Pipe Diameter						
	<10"	16	2141	173	142,892	1.1197
	>=10"	15	4070	1211	111,011	1.3512
By Pipeline Minimum Depth						
	Bad Depth Data*	14				
	<10m	6	2310	1211	161,966	0.3704
	>=10m	11	3165	1040	94,641	1.1623
By Segment Length						
	<0.5km	0	0	0	2,359	0.0000
	>=0.5<2km	2	2335	2335	25,484	0.7848
	>=2<5km	7	820	100	35,279	1.9842
	>=5km	22	3859	850	192,270	1.1442
By Spill Size						
	Small	6	58	50	253,903	0.2363
	Medium	12	317	230	253,903	0.4726
	Large	10	4133	4267	253,903	0.3939
	Huge	3	16611	15576	253,903	0.1182
By Diameter, By Spill Size						
<10"	Small	4	58	50	142,892	0.2799
	Medium	7	266	135	142,892	0.4899
	Large	4	4436	4551	142,892	0.2799
	Huge	1	14423	14423	142,892	0.0700
>=10"	Small	2	58	58	111,011	0.1802
	Medium	5	387	312	111,011	0.4504
	Large	6	3932	3600	111,011	0.5405
	Huge	2	17705	17705	111,011	0.1802

*14 of the 31 records have both MIN_WATER_DEPTH and MAX_WATER_DEPTH set to "0".

**Exposure comes from an analysis of PPL_MASTERS database as published on Feb 15, 2001.

**Table 1.3
Analysis of Historical Data - Spills - Platforms**

CAUSE CLASSIFICATION	NUMBER OF SPILLS	SPILL SIZE BBL													NUMBER OF SPILLS						
		1	2	3	4	5	6	7	8	9	10	11	12	13	S	M	L	H	SM	LH	
PROCESS FACILITY RLS.	13	130	50	120	104	60	1456	125	50	50	55	400	280	75	6	6	1		12	1	
STORAGE TANK RLS.	3	9935	7000	435													1	2		1	2
STRUCTURAL FAILURE	1	58													1				1		
HURRICANE/STORM	2	75	66												2				2		
COLLISION	2	600	108													2			2		
ARCTIC																					
Ice Force																					
Facility Low Temperature																					
Other																					
TOTALS	21														9	9	3		18	3	

**Table 1.4
Distribution and Frequency of Historical Spills - Platforms**

CAUSE CLASSIFICATION	Small and Medium Spills				Large and Huge Spills			
	HIST. DISTRIBUTION %	NUMBER OF SPILLS	EXPOSURE [well-years]	FREQUENCY spill per 10 ⁴ well-year	HIST. DISTRIBUTION %	NUMBER OF SPILLS	EXPOSURE [well-years]	FREQUENCY spill per 10 ⁴ well-year
PROCESS FACILITY RLS.	66.67	12	119714	1.0024	33.33	1	119714	0.0835
STORAGE TANK RLS.	5.56	1		0.0835	66.67	2		0.1671
STRUCTURAL FAILURE	5.56	1		0.0835				
HURRICANE/STORM	11.11	2		0.1671				
COLLISION	11.11	2		0.1671				
ARCTIC								
Ice Force								
Facility Low Temperature								
Other								
TOTALS	100.00	18			1.5036	100.00		3

**Table 1.5
Frequency of Historical Spills - Wells**

EVENT	FREQUENCY UNIT	Small and Medium Spills	Large Spills	Small, Medium, and Large Spills	Spill ≥ 10000 < 150000 bbl	Spill ≥ 150000 bbl
		HISTORICAL FREQUENCY				
PRODUCTION WELL	spill per 10^5 well-year	0.50	3.50	4.00	1.50	1.00
EXPLORATION WELL DRILLING	spill per 10^5 wells	3.16	22.11	25.27	9.50	5.50
DEVELOPMENT WELL DRILLING	spill per 10^5 wells	1.30	9.08	10.38	3.90	3.90

**Table 1.5A
Historical Spills Data - Wells**

Event	Historical Frequency	Experience	Reference
Development Drilling Blowouts			
Development drilling blowout with oil spill > 10,000 bbl	7.8 x 10 ⁻⁵ /wells drilled	worldwide, 1970 - present	SL Ross 1998
Exploration drilling blowout with oil spill > 10,000 bbl	1.5 x 10 ⁻⁴ /wells drilled	worldwide, 1970 - present	SL Ross 1998
Development drilling blowout with oil spill > 150,000 bbl	3.9 x 10 ⁻⁵ /wells drilled	worldwide, 1970 - present	SL Ross 1998
Exploration drilling blowout with oil spill > 150,000 bbl	5.5 x 10 ⁻⁵ /wells drilled	worldwide, 1970 - present	SL Ross 1998
Production/Workover Blowouts			
Blowout during production and workovers involving some oil discharge >1 bbl	6.5 x 10 ⁻⁵ /well-years	U.S. OCS, 1964 - 1995	SL Ross 1998 and MMS 1997
Production/workover blowout with oil spill > 10,000 bbl	2.5 x 10 ⁻⁵ /well-year	worldwide, 1970 - present	SL Ross 1998
Production/workover blowout with oil spill > 150,000 bbl	1.0 x 10 ⁻⁵ /well-year	worldwide, 1970 - present	SL Ross 1998

**Table 2.1
Fault Tree Analysis Input Rationalization - P/L**

CAUSE CLASSIFICATION	Spill Size	Shallow	Medium	Deep	Reason	
		Frequency Change %				
CORROSION						
External	All	(50)	(50)	(50)	Low temperature and bio effects. Extra smart pigging.	
Internal	All	(30)	(30)	(30)	Extra smart pigging.	
THIRD PARTY IMPACT						
Anchor Impact	All	(90)	(90)	(90)	Low traffic.	
Jackup Rig or Spud Barge	All	(50)	(50)	(50)	Low facility density.	
Trawl/Fishing Net	All	(90)	(90)	(90)	Low fishing activity.	
OPERATION IMPACT						
Rig Anchoring	All	(20)	(20)	(20)	No marine traffic during ice season (8 months).	
Work Boat Anchoring	All	(20)	(20)	(20)	No work boat traffic during ice season (8 months).	
MECHANICAL						
Connection Failure	All					
Material Failure	All					
NATURAL HAZARD						
Mud Slide	All	(80)	(60)	(40)	Gradient low. Mud slide potential (gradient) increases with water depth.	
Storm/ Hurricane	All	(50)	(50)	(50)	Fewer severe storms.	
		Freq. Increment per 10 ⁵ km-year				
		Median	Median	Median		
		Expected	Expected	Expected		
ARCTIC						
Ice Gouging	S	0.3495	0.1747		Ice gouge failure rate calculated using exponential failure distribution for 2.5-m cover, 0.2-m average gouge depth, 4 gouges per km-yr flux. Spill size Distribution explained in text Section 2.5.2	
		0.0680	0.0340			
	M	0.6178	0.3089			
		0.1210	0.0605			
	L	1.3438	0.6719			
0.2610		0.1305				
H	0.3762	0.1881				
	0.0730	0.0365				
Strudel Scour	S	0.0021				Only in shallow water. Average frequency of 4 scours/mile ² and 100 ft of bridge length with 10% conditional P/L failure probability. The same spill size distribution as above.
		0.0012				
	M	0.0038				
		0.0020				
	L	0.0082				
0.0045						
H	0.0023					
	0.0012					
Upheaval Buckling	S	0.0004	0.0004	0.0004	All water depth. The failure frequency is 20% of that of Strudel Scour.	
		0.0002	0.0002	0.0002		
	M	0.0008	0.0008	0.0008		
		0.0004	0.0004	0.0004		
	L	0.0016	0.0016	0.0016		
0.0009		0.0009	0.0009			
H	0.0005	0.0005	0.0005			
	0.0002	0.0002	0.0002			
Thaw Settlement	S	0.0002	0.0002	0.0002		All water depth. The failure frequency is 10% of that of Strudel Scour.
		0.0001	0.0001	0.0001		
	M	0.0004	0.0004	0.0004		
		0.0002	0.0002	0.0002		
	L	0.0008	0.0008	0.0008		
0.0004		0.0004	0.0004			
H	0.0002	0.0002	0.0002			
	0.0001	0.0001	0.0001			
Other	S	0.0881	0.0438	0.0002	To be assessed as 25% of above.	
		0.0174	0.0086	0.0001		
	M	0.1557	0.0775	0.0003		
		0.0309	0.0153	0.0002		
	L	0.3386	0.1686	0.0006		
0.0667		0.0330	0.0003			
H	0.0948	0.0472	0.0002			
	0.0187	0.0092	0.0001			

Table 2.1A
Monte Carlo Input - Pipeline

CAUSE CLASSIFICATION	Spill Size	Shallow			Medium			Deep		
		Frequency Change %								
		Low	Expected	High	Low	Expected	High	Low	Expected	High
CORROSION										
External	All	(25)	(50)	(75)	(25)	(50)	(75)	(25)	(50)	(75)
Internal	All	(15)	(30)	(45)	(15)	(30)	(45)	(15)	(30)	(45)
THIRD PARTY IMPACT										
Anchor Impact	All	(60)	(90)	(95)	(60)	(90)	(95)	(60)	(90)	(95)
Jackup Rig or Spud Barge	All	(25)	(50)	(75)	(25)	(50)	(75)	(25)	(50)	(75)
Trawl/Fishing Net	All	(60)	(90)	(95)	(60)	(90)	(95)	(60)	(90)	(95)
OPERATION IMPACT										
Rig Anchoring	All	(10)	(20)	(30)	(10)	(20)	(30)	(10)	(20)	(30)
Work Boat Anchoring	All	(10)	(20)	(30)	(10)	(20)	(30)	(10)	(20)	(30)
MECHANICAL										
Connection Failure	All									
Material Failure	All									
NATURAL HAZARD										
Mud Slide	All	(50)	(80)	(90)	(30)	(60)	(90)	(20)	(40)	(60)
Storm/ Hurricane	All	(25)	(50)	(75)	(25)	(50)	(75)	(25)	(50)	(75)
Frequency Increment per 10⁵km-year										
ARCTIC										
Ice Gouging	S	0.0060	0.0680	0.8290	0.0030	0.0340	0.4145			
	M	0.0090	0.1210	1.4670	0.0045	0.0605	0.7335			
	L	0.0210	0.2610	3.1900	0.0105	0.1305	1.5950			
	H	0.0060	0.0730	0.8930	0.0030	0.0365	0.4465			
Strudel Scour	S	0.0004	0.0012	0.0044						
	M	0.0006	0.0020	0.0078						
	L	0.0014	0.0045	0.0170						
	H	0.0004	0.0012	0.0048						
Upheaval Buckling	S	0.00007	0.00023	0.00088	0.00007	0.00023	0.00088	0.00007	0.00023	0.00088
	M	0.00013	0.00041	0.00156	0.00013	0.00041	0.00156	0.00013	0.00041	0.00156
	L	0.00028	0.00089	0.00340	0.00028	0.00089	0.00340	0.00028	0.00089	0.00340
	H	0.00008	0.00025	0.00095	0.00008	0.00025	0.00095	0.00008	0.00025	0.00095
Thaw Settlement	S	0.00004	0.00012	0.00044	0.00004	0.00012	0.00044	0.00004	0.00012	0.00044
	M	0.00006	0.00020	0.00078	0.00006	0.00020	0.00078	0.00006	0.00020	0.00078
	L	0.00014	0.00045	0.00170	0.00014	0.00045	0.00170	0.00014	0.00045	0.00170
	H	0.00004	0.00012	0.00048	0.00004	0.00012	0.00048	0.00004	0.00012	0.00048
Other	S	0.00162	0.01738	0.20869	0.00078	0.00859	0.10396	0.00003	0.00009	0.00033
	M	0.00246	0.03092	0.36929	0.00117	0.01528	0.18396	0.00005	0.00015	0.00059
	L	0.00571	0.06670	0.80303	0.00273	0.03296	0.40003	0.00011	0.00033	0.00128
	H	0.00163	0.01865	0.22480	0.00078	0.00922	0.11198	0.00003	0.00009	0.00036

Table 2.2
FTA Input Rationalization Platforms

CAUSE CLASSIFICATION	Spill Size	Frequency Change %			Reason
		Shallow	Medium	Deep	
PROCESS FACILITY RLS.	All	(50)	(50)	(50)	State of the art now, High QC, High Inspection and Maintenance Requirements
STORAGE TANK RLS.	All	(30)	(30)	(30)	State of the art now, High QC, High Inspection and Maintenance Requirements
STRUCTURAL FAILURE	All	(30)	(30)	(30)	High safety factor, Monitoring Programs
HURRICANE/STORM	All	(80)	(80)	(80)	Less severe storms.
COLLISION	All	(90)	(90)	(90)	Very low traffic density.
		Freq. Increment per 10 ⁴ well-year			
		Median	Median	Median	
		Expected	Expected	Expected	
ARCTIC					
Ice Force	SM	0.1447	0.2170	0.3256	Assumed 1/10000 years ice force causes spill. 85% of the spills are SM.
		0.0340	0.0510	0.0765	
	LH	0.0255	0.0383	0.0575	
		0.0060	0.0090	0.0135	
Facility Low Temperature	SM	0.1000	0.1000	0.1000	Assumed 10% of Historical Process Facilities release frequency and corresponding spill size distribution.
		0.1000	0.1000	0.1000	
	LH	0.0080	0.0080	0.0080	
		0.0080	0.0080	0.0080	
Other	SM	0.0244	0.0316	0.0424	10% of above.
		0.0134	0.0151	0.0177	
	LH	0.0033	0.0046	0.0065	
		0.0014	0.0017	0.0022	

**Table 2.2A
Monte Carlo Input - Platforms**

CAUSE CLASSIFICATION	Spill Size	Shallow			Medium			Deep		
		Frequency Change %								
		Low	Expected	High	Low	Expected	High	Low	Expected	High
PROCESS FACILITY RLS.	AII	(30)	(50)	(80)	(30)	(50)	(80)	(30)	(50)	(80)
STORAGE TANK RLS.	AII	(20)	(30)	(40)	(20)	(30)	(40)	(20)	(30)	(40)
STRUCTURAL FAILURE	AII	(20)	(30)	(40)	(20)	(30)	(40)	(20)	(30)	(40)
HURRICANE/STORM	AII	(25)	(50)	(75)	(25)	(50)	(75)	(25)	(50)	(75)
COLLISION	AII	(60)	(90)	(95)	(60)	(90)	(95)	(60)	(90)	(95)
Frequency Increment per 10⁴ well-year										
ARCTIC										
Ice Force	SM	0.003	0.034	0.340	0.005	0.051	0.510	0.008	0.077	0.765
	LH	0.001	0.006	0.060	0.001	0.009	0.090	0.001	0.014	0.135
Facility Low Temperature	SM	0.050	0.100	0.150	0.050	0.100	0.150	0.050	0.100	0.150
	LH	0.004	0.008	0.012	0.004	0.008	0.012	0.004	0.008	0.012
Other	SM	0.005	0.013	0.049	0.006	0.015	0.066	0.006	0.018	0.092
	LH	0.000	0.001	0.007	0.000	0.002	0.010	0.001	0.002	0.015

**Table 2.3
Arctic Spill Distribution and Frequency - P/L - Small Spills**

CAUSE CLASSIFICATION	HIST. DISTRIBUTION %	SMALL SPILL																			
		P/L Dia <10"									P/L Dia >=10"										
		FREQUENCY spill per 10 ⁵ km-year	Shallow			Medium			Deep			FREQUENCY spill per 10 ⁵ km-year	Shallow			Medium			Deep		
			Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %		Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
CORROSION	16.67	0.467	(0.171)	0.295	15.71	(0.171)	0.295	17.42	(0.171)	0.295	19.18	0.300	(0.110)	0.190	13.91	(0.110)	0.190	16.25	(0.110)	0.190	19.18
External	5.56	0.156	(0.078)	0.078	4.14	(0.078)	0.078	4.58	(0.078)	0.078	5.05	0.100	(0.050)	0.050	3.66	(0.050)	0.050	4.28	(0.050)	0.050	5.05
Internal	11.11	0.311	(0.093)	0.218	11.58	(0.093)	0.218	12.83	(0.093)	0.218	14.13	0.200	(0.060)	0.140	10.25	(0.060)	0.140	11.98	(0.060)	0.140	14.13
THIRD PARTY IMPACT	38.89	1.089	(0.871)	0.218	11.58	(0.871)	0.218	12.83	(0.871)	0.218	14.13	0.701	(0.561)	0.140	10.25	(0.561)	0.140	11.98	(0.561)	0.140	14.13
Anchor Impact	33.33	0.933	(0.746)	0.187	9.93	(0.746)	0.187	11.00	(0.746)	0.187	12.11	0.601	(0.480)	0.120	8.79	(0.480)	0.120	10.26	(0.480)	0.120	12.11
Jackup Rig or Spud Barge																					
Trawl/Fishing Net	5.56	0.156	(0.124)	0.031	1.65	(0.124)	0.031	1.83	(0.124)	0.031	2.02	0.100	(0.080)	0.020	1.46	(0.080)	0.020	1.71	(0.080)	0.020	2.02
OPERATION IMPACT	16.67	0.467	(0.093)	0.373	19.85	(0.093)	0.373	22.00	(0.093)	0.373	24.23	0.300	(0.060)	0.240	17.57	(0.060)	0.240	20.53	(0.060)	0.240	24.22
Rig Anchoring	5.56	0.156	(0.031)	0.124	6.62	(0.031)	0.124	7.33	(0.031)	0.124	8.08	0.100	(0.020)	0.080	5.86	(0.020)	0.080	6.84	(0.020)	0.080	8.07
Work Boat Anchoring	11.11	0.311	(0.062)	0.249	13.23	(0.062)	0.249	14.67	(0.062)	0.249	16.15	0.200	(0.040)	0.160	11.71	(0.040)	0.160	13.69	(0.040)	0.160	16.15
MECHANICAL	11.11	0.311		0.311	16.54		0.311	18.33		0.311	20.19	0.200		0.200	14.64		0.200	17.11		0.200	20.19
Connection Failure	5.56	0.156		0.156	8.27		0.156	9.17		0.156	10.10	0.100		0.100	7.32		0.100	8.55		0.100	10.09
Material Failure	5.56	0.156		0.156	8.27		0.156	9.17		0.156	10.10	0.100		0.100	7.32		0.100	8.55		0.100	10.09
NATURAL HAZARD	11.11	0.311	(0.224)	0.087	4.62	(0.187)	0.124	7.33	(0.124)	0.187	12.11	0.200	(0.144)	0.056	4.09	(0.120)	0.080	6.84	(0.080)	0.120	12.11
Mud Slide	11.11	0.311	(0.224)	0.087	4.62	(0.187)	0.124	7.33	(0.124)	0.187	12.11	0.200	(0.144)	0.056	4.09	(0.120)	0.080	6.84	(0.080)	0.120	12.11
Storm/ Hurricane																					
ARCTIC			0.440	0.440	23.42	0.219	0.219	12.92	0.001	0.001	0.05		0.440	0.440	32.21	0.219	0.219	18.74	0.001	0.001	0.08
Ice Gouging			0.3495	0.3495	18.59	0.1747	0.1747	10.30					0.3495	0.3495	25.56	0.1747	0.1747	14.93			
Strudel Scour			0.0021	0.0021	0.11								0.0021	0.0021	0.16						
Upheaval Buckling			0.0004	0.0004	0.02	0.0004	0.0004	0.03	0.0004	0.0004	0.03	0.0004	0.0004	0.03	0.0004	0.0004	0.04	0.0004	0.0004	0.04	0.04
Thaw Settlement			0.0002	0.0002	0.01	0.0002	0.0002	0.01	0.0002	0.0002	0.01	0.0002	0.0002	0.02	0.0002	0.0002	0.02	0.0002	0.0002	0.02	0.02
Other			0.0881	0.0881	4.68	0.0438	0.0438	2.58	0.0002	0.0002	0.01		0.0881	0.0881	6.44	0.0438	0.0438	3.75	0.0002	0.0002	0.02
UNKNOWN	5.56	0.156		0.156	8.27		0.156	9.17		0.156	10.10	0.100		0.100	7.32		0.100	8.55		0.100	10.09
TOTALS	100.00	2.799	(0.919)	1.880	100.00	(1.103)	1.697	100.00	(1.259)	1.540	100.00	1.802	(0.435)	1.367	100.00	(0.632)	1.170	100.00	(0.810)	0.992	100.00

**Table 2.4
Arctic Spill Distribution and Frequency - P/L - Medium Spills**

CAUSE CLASSIFICATION	HIST. DISTRIBUTION %	MEDIUM SPILL																			
		P/L Dia <10"									P/L Dia >=10"										
		FREQUENCY spill per 10 ⁶ km-year	Shallow			Medium			Deep			FREQUENCY spill per 10 ⁶ km-year	Shallow			Medium			Deep		
			Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %		Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
CORROSION	16.67	0.816	(0.299)	0.517	15.68	(0.299)	0.517	17.39	(0.299)	0.517	19.18	0.751	(0.275)	0.475	15.36	(0.275)	0.475	17.20	(0.275)	0.475	19.18
External	5.56	0.272	(0.136)	0.136	4.13	(0.136)	0.136	4.58	(0.136)	0.136	5.05	0.250	(0.125)	0.125	4.04	(0.125)	0.125	4.53	(0.125)	0.125	5.05
Internal	11.11	0.544	(0.163)	0.381	11.55	(0.163)	0.381	12.82	(0.163)	0.381	14.13	0.500	(0.150)	0.350	11.32	(0.150)	0.350	12.67	(0.150)	0.350	14.13
THIRD PARTY IMPACT	38.89	1.905	(1.524)	0.381	11.55	(1.524)	0.381	12.82	(1.524)	0.381	14.13	1.752	(1.401)	0.350	11.32	(1.401)	0.350	12.67	(1.401)	0.350	14.13
Anchor Impact	33.33	1.633	(1.306)	0.327	9.90	(1.306)	0.327	10.98	(1.306)	0.327	12.11	1.501	(1.201)	0.300	9.70	(1.201)	0.300	10.86	(1.201)	0.300	12.11
Jackup Rig or Spud Barge																					
Trawl/Fishing Net	5.56	0.272	(0.218)	0.054	1.65	(0.218)	0.054	1.83	(0.218)	0.054	2.02	0.250	(0.200)	0.050	1.62	(0.200)	0.050	1.81	(0.200)	0.050	2.02
OPERATION IMPACT	16.67	0.816	(0.163)	0.653	19.80	(0.163)	0.653	21.97	(0.163)	0.653	24.23	0.751	(0.150)	0.601	19.40	(0.150)	0.601	21.72	(0.150)	0.601	24.23
Rig Anchoring	5.56	0.272	(0.054)	0.218	6.60	(0.054)	0.218	7.32	(0.054)	0.218	8.08	0.250	(0.050)	0.200	6.47	(0.050)	0.200	7.24	(0.050)	0.200	8.08
Work Boat Anchoring	11.11	0.544	(0.109)	0.435	13.20	(0.109)	0.435	14.65	(0.109)	0.435	16.15	0.500	(0.100)	0.400	12.93	(0.100)	0.400	14.48	(0.100)	0.400	16.15
MECHANICAL	11.11	0.544		0.544	16.50		0.544	18.31		0.544	20.19	0.500		0.500	16.17		0.500	18.10		0.500	20.19
Connection Failure	5.56	0.272		0.272	8.25		0.272	9.15		0.272	10.10	0.250		0.250	8.08		0.250	9.05		0.250	10.10
Material Failure	5.56	0.272		0.272	8.25		0.272	9.15		0.272	10.10	0.250		0.250	8.08		0.250	9.05		0.250	10.10
NATURAL HAZARD	11.11	0.544	(0.392)	0.152	4.61	(0.327)	0.218	7.32	(0.218)	0.327	12.11	0.500	(0.361)	0.140	4.52	(0.300)	0.200	7.24	(0.200)	0.300	12.11
Mud Slide	11.11	0.544	(0.392)	0.152	4.61	(0.327)	0.218	7.32	(0.218)	0.327	12.11	0.500	(0.361)	0.140	4.52	(0.300)	0.200	7.24	(0.200)	0.300	12.11
Storm/ Hurricane																					
ARCTIC			0.778	0.778	23.60	0.388	0.388	13.04	0.001	0.001	0.05		0.778	0.778	25.15	0.388	0.388	14.02	0.001	0.001	0.06
Ice Gouging			0.6178	0.6178	18.73	0.3089	0.3089	10.39					0.6178	0.6178	19.96	0.3089	0.3089	11.17			
Strudel Scour			0.0038	0.0038	0.11								0.0038	0.0038	0.12						
Upheaval Buckling			0.0008	0.0008	0.02	0.0008	0.0008	0.03	0.0008	0.0008	0.03		0.0008	0.0008	0.02	0.0008	0.0008	0.03	0.0008	0.0008	0.03
Thaw Settlement			0.0004	0.0004	0.01	0.0004	0.0004	0.01	0.0004	0.0004	0.01		0.0004	0.0004	0.01	0.0004	0.0004	0.01	0.0004	0.0004	0.02
Other			0.1557	0.1557	4.72	0.0775	0.0775	2.61	0.0003	0.0003	0.01		0.1557	0.1557	5.03	0.0775	0.0775	2.80	0.0003	0.0003	0.01
UNKNOWN	5.56	0.272		0.272	8.25		0.272	9.15		0.272	10.10	0.250		0.250	8.08		0.250	9.05		0.250	10.10
TOTALS	100.00	4.899	(1.600)	3.298	100.00	(1.926)	2.973	100.00	(2.203)	2.696	100.00	4.504	(1.409)	3.095	100.00	(1.739)	2.765	100.00	(2.025)	2.479	100.00

**Table 2.5
Arctic Spill Distribution and Frequency - P/L - Large Spills**

CAUSE CLASSIFICATION	HIST. DISTRIBUTION %	LARGE SPILL																			
		P/L Dia <10"									P/L Dia >=10"										
		FREQUENCY spill per 10 ⁵ km-year	Shallow			Medium			Deep			FREQUENCY spill per 10 ⁵ km-year	Shallow			Medium			Deep		
			Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %		Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
CORROSION	7.69	0.215	(0.065)	0.151	5.72	(0.065)	0.151	8.32	(0.065)	0.151	14.85	0.416	(0.125)	0.291	8.28	(0.125)	0.291	10.72	(0.125)	0.291	14.87
External																					
Internal	7.69	0.215	(0.065)	0.151	5.72	(0.065)	0.151	8.32	(0.065)	0.151	14.85	0.416	(0.125)	0.291	8.28	(0.125)	0.291	10.72	(0.125)	0.291	14.87
THIRD PARTY IMPACT	69.23	1.938	(1.486)	0.452	17.15	(1.486)	0.452	24.96	(1.486)	0.452	44.54	3.742	(2.869)	0.873	24.85	(2.869)	0.873	32.17	(2.869)	0.873	44.61
Anchor Impact	30.77	0.861	(0.689)	0.172	6.53	(0.689)	0.172	9.51	(0.689)	0.172	16.97	1.663	(1.330)	0.333	9.47	(1.330)	0.333	12.26	(1.330)	0.333	16.99
Jackup Rig or Spud Barge	7.69	0.215	(0.108)	0.108	4.08	(0.108)	0.108	5.94	(0.108)	0.108	10.61	0.416	(0.208)	0.208	5.92	(0.208)	0.208	7.66	(0.208)	0.208	10.62
Trawl/Fishing Net	30.77	0.861	(0.689)	0.172	6.53	(0.689)	0.172	9.51	(0.689)	0.172	16.97	1.663	(1.330)	0.333	9.47	(1.330)	0.333	12.26	(1.330)	0.333	16.99
OPERATION IMPACT	7.69	0.215	(0.043)	0.172	6.53	(0.043)	0.172	9.51	(0.043)	0.172	16.97	0.416	(0.083)	0.333	9.47	(0.083)	0.333	12.26	(0.083)	0.333	16.99
Rig Anchoring																					
Work Boat Anchoring	7.69	0.215	(0.043)	0.172	6.53	(0.043)	0.172	9.51	(0.043)	0.172	16.97	0.416	(0.083)	0.333	9.47	(0.083)	0.333	12.26	(0.083)	0.333	16.99
MECHANICAL																					
Connection Failure																					
Material Failure																					
NATURAL HAZARD	15.38	0.431	(0.263)	0.168	6.37	(0.237)	0.194	10.70	(0.194)	0.237	23.33	0.832	(0.507)	0.324	9.22	(0.457)	0.374	13.79	(0.374)	0.457	23.37
Mud Slide	7.69	0.215	(0.155)	0.060	2.28	(0.129)	0.086	4.75	(0.086)	0.129	12.73	0.416	(0.300)	0.116	3.31	(0.249)	0.166	6.13	(0.166)	0.249	12.75
Storm/ Hurricane	7.69	0.215	(0.108)	0.108	4.08	(0.108)	0.108	5.94	(0.108)	0.108	10.61	0.416	(0.208)	0.208	5.92	(0.208)	0.208	7.66	(0.208)	0.208	10.62
ARCTIC			1.693	1.693	64.23	0.843	0.843	46.52	0.003	0.003	0.30		1.693	1.693	48.18	0.843	0.843	31.06	0.003	0.003	0.16
Ice Gouging			1.3438	1.3438	50.98	0.6719	0.6719	37.08					1.3438	1.3438	38.24	0.6719	0.6719	24.76			
Strudel Scour			0.0082	0.0082	0.31								0.0082	0.0082	0.23						
Upheaval Buckling			0.0016	0.0016	0.06	0.0016	0.0016	0.09	0.0016	0.0016	0.16		0.0016	0.0016	0.05	0.0016	0.0016	0.06	0.0016	0.0016	0.08
Thaw Settlement			0.0008	0.0008	0.03	0.0008	0.0008	0.05	0.0008	0.0008	0.08		0.0008	0.0008	0.02	0.0008	0.0008	0.03	0.0008	0.0008	0.04
Other			0.3386	0.3386	12.84	0.1686	0.1686	9.30	0.0006	0.0006	0.06		0.3386	0.3386	9.64	0.1686	0.1686	6.21	0.0006	0.0006	0.03
UNKNOWN																					
TOTALS	100.00	2.799	(0.163)	2.636	100.00	(0.987)	1.812	100.00	(1.784)	1.015	100.00	5.405	(1.891)	3.514	100.00	(2.691)	2.714	100.00	(3.448)	1.957	100.00

Table 2.6
Arctic Spill Distribution and Frequency - P/L - Huge Spills

CAUSE CLASSIFICATION	HIST. DISTRIBUTION %	HUGE SPILL																			
		P/L Dia <10"									P/L Dia >=10"										
		FREQUENCY spill per 10 ⁵ km-year	Shallow			Medium			Deep			FREQUENCY spill per 10 ⁵ km-year	Shallow			Medium			Deep		
			Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %		Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
CORROSION	7.69	0.054	(0.016)	0.038	5.31	(0.016)	0.038	7.88	(0.016)	0.038	14.84	0.139	(0.042)	0.097	8.97	(0.042)	0.097	11.29	(0.042)	0.097	14.87
External																					
Internal	7.69	0.054	(0.016)	0.038	5.31	(0.016)	0.038	7.88	(0.016)	0.038	14.84	0.139	(0.042)	0.097	8.97	(0.042)	0.097	11.29	(0.042)	0.097	14.87
THIRD PARTY IMPACT	69.23	0.484	(0.371)	0.113	15.93	(0.371)	0.113	23.64	(0.371)	0.113	44.53	1.247	(0.956)	0.291	26.92	(0.956)	0.291	33.86	(0.956)	0.291	44.62
Anchor Impact	30.77	0.215	(0.172)	0.043	6.07	(0.172)	0.043	9.00	(0.172)	0.043	16.96	0.554	(0.443)	0.111	10.26	(0.443)	0.111	12.90	(0.443)	0.111	17.00
Jackup Rig or Spud Barge	7.69	0.054	(0.027)	0.027	3.79	(0.027)	0.027	5.63	(0.027)	0.027	10.60	0.139	(0.069)	0.069	6.41	(0.069)	0.069	8.06	(0.069)	0.069	10.62
Trawl/Fishing Net	30.77	0.215	(0.172)	0.043	6.07	(0.172)	0.043	9.00	(0.172)	0.043	16.96	0.554	(0.443)	0.111	10.26	(0.443)	0.111	12.90	(0.443)	0.111	17.00
OPERATION IMPACT	7.69	0.054	(0.011)	0.043	6.07	(0.011)	0.043	9.00	(0.011)	0.043	16.96	0.139	(0.028)	0.111	10.26	(0.028)	0.111	12.90	(0.028)	0.111	17.00
Rig Anchoring																					
Work Boat Anchoring	7.69	0.054	(0.011)	0.043	6.07	(0.011)	0.043	9.00	(0.011)	0.043	16.96	0.139	(0.028)	0.111	10.26	(0.028)	0.111	12.90	(0.028)	0.111	17.00
MECHANICAL																					
Connection Failure																					
Material Failure																					
NATURAL HAZARD	15.38	0.108	(0.066)	0.042	5.91	(0.059)	0.048	10.13	(0.048)	0.059	23.32	0.277	(0.169)	0.108	9.99	(0.152)	0.125	14.51	(0.125)	0.152	23.37
Mud Slide	7.69	0.054	(0.039)	0.015	2.12	(0.032)	0.022	4.50	(0.022)	0.032	12.72	0.139	(0.100)	0.039	3.58	(0.083)	0.055	6.45	(0.055)	0.083	12.75
Storm/ Hurricane	7.69	0.054	(0.027)	0.027	3.79	(0.027)	0.027	5.63	(0.027)	0.027	10.60	0.139	(0.069)	0.069	6.41	(0.069)	0.069	8.06	(0.069)	0.069	10.62
ARCTIC			0.474	0.474	66.78	0.236	0.236	49.35	0.001	0.001	0.34		0.474	0.474	43.85	0.236	0.236	27.45	0.001	0.001	0.13
Ice Gouging			0.3762	0.3762	53.01	0.1881	0.1881	39.33					0.3762	0.3762	34.80	0.1881	0.1881	21.88			
Strudel Scour			0.0023	0.0023	0.32								0.0023	0.0023	0.21						
Upheaval Buckling			0.0005	0.0005	0.06	0.0005	0.0005	0.10	0.0005	0.0005	0.18		0.0005	0.0005	0.04	0.0005	0.0005	0.05	0.0005	0.0005	0.07
Thaw Settlement			0.0002	0.0002	0.03	0.0002	0.0002	0.05	0.0002	0.0002	0.09		0.0002	0.0002	0.02	0.0002	0.0002	0.03	0.0002	0.0002	0.04
Other			0.0948	0.0948	13.36	0.0472	0.0472	9.87	0.0002	0.0002	0.07		0.0948	0.0948	8.77	0.0472	0.0472	5.49	0.0002	0.0002	0.03
UNKNOWN																					
TOTALS	100.00	0.700	0.010	0.710	100.00	(0.222)	0.478	100.00	(0.446)	0.254	100.00	1.802	(0.721)	1.081	100.00	(0.942)	0.860	100.00	(1.149)	0.652	100.00

**Table 2.7
Arctic Spill Distribution and Frequency - Platforms - Small and Medium Spills**

CAUSE CLASSIFICATION	HIST. DISTRIBUTION %	SMALL AND MEDIUM SPILLS									
		FREQUENCY spill per 10 ⁴ well-year	Shallow			Medium			Deep		
			Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
PROCESS FACILITY RLS.	66.67	1.002	(0.541)	0.461	47.85	(0.541)	0.4615	44.20	(0.541)	0.4615	39.67
STORAGE TANK RLS.	5.56	0.084	(0.025)	0.058	6.06	(0.025)	0.0585	5.60	(0.025)	0.0585	5.03
STRUCTURAL FAILURE	5.56	0.084	(0.025)	0.058	6.06	(0.025)	0.0585	5.60	(0.025)	0.0585	5.03
HURRICANE/STORM	11.11	0.167	(0.084)	0.084	8.66	(0.084)	0.0835	8.00	(0.084)	0.0835	7.18
COLLISION	11.11	0.167	(0.134)	0.033	3.46	(0.134)	0.0334	3.20	(0.134)	0.0334	2.87
ARCTIC			0.269	0.269	27.90	0.349	0.3486	33.39	0.468	0.4680	40.23
Ice Force			0.145	0.145	15.00	0.217	0.2170	20.79	0.326	0.3256	27.98
Facility Low Temperature			0.100	0.100	10.37	0.100	0.1000	9.58	0.100	0.1000	8.60
Other			0.024	0.024	2.53	0.032	0.0316	3.03	0.042	0.0424	3.65
TOTALS	100.00	1.504	(0.539)	0.964	100.00	(0.460)	1.0440	100.00	(0.340)	1.1634	100.00

**Table 2.8
Arctic Spill Distribution and Frequency - Platforms - Large and Huge Spills**

CAUSE CLASSIFICATION	HIST. DISTRIBUTION %	LARGE AND HUGE SPILLS									
		FREQUENCY spill per 10 ⁴ well-year	Shallow			Medium			Deep		
			Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
PROCESS FACILITY RLS.	33.33	0.0835	(0.045)	0.0385	20.00	(0.045)	0.0385	18.64	(0.045)	0.0385	16.91
STORAGE TANK RLS.	66.67	0.1671	(0.050)	0.1169	60.82	(0.050)	0.1169	56.68	(0.050)	0.1169	51.43
STRUCTURAL FAILURE											
HURRICANE/STORM											
COLLISION											
ARCTIC			0.037	0.0369	19.18	0.051	0.0509	24.68	0.072	0.0720	31.66
Ice Force			0.026	0.0255	13.28	0.038	0.0383	18.56	0.057	0.0575	25.27
Facility Low Temperature			0.008	0.0080	4.16	0.008	0.0080	3.88	0.008	0.0080	3.52
Other			0.003	0.0033	1.74	0.005	0.0046	2.24	0.007	0.0065	2.87
TOTALS	100.00	0.2506	(0.058)	0.1923	100.00	(0.044)	0.2063	100.00	(0.023)	0.2274	100.00

**Table 2.9
Arctic Frequency - Wells**

EVENT	FREQUENCY UNIT	Small and Medium Spills						Large Spill						Spill >=10000 <150000 bbl						Spill >=150000 bbl												
		HISTORICAL FREQUENCY	Shallow		Medium		Deep		HISTORICAL FREQUENCY	Shallow		Medium		Deep		HISTORICAL FREQUENCY	Shallow		Medium		Deep		HISTORICAL FREQUENCY	Shallow		Medium		Deep				
			Frequency Change	New Frequency	Frequency Change	New Frequency	Frequency Change	New Frequency		Frequency Change	New Frequency	Frequency Change	New Frequency	Frequency Change	New Frequency		Frequency Change	New Frequency	Frequency Change	New Frequency	Frequency Change	New Frequency		Frequency Change	New Frequency	Frequency Change	New Frequency	Frequency Change	New Frequency			
PRODUCTION WELL	spill per 10 ⁵ well-year	0.500		0.500		0.500		0.500		3.500		3.500		3.500		3.500		1.500		1.500		1.500		1.500		1.000		1.000		1.000		1.000
EXPLORATION WELL DRILLING	spill per 10 ⁵ wells	3.160		3.160		3.160		3.160		22.110		22.110		22.110		22.110		9.500		9.500		9.500		9.500		5.500		5.500		5.500		5.500
DEVELOPMENT WELL DRILLING	spill per 10 ⁵ wells	1.300		1.300		1.300		1.300		9.080		9.080		9.080		9.080		3.900		3.900		3.900		3.900		3.900		3.900		3.900		3.900

**Table 2.10
Average Spill Distribution**

PIPELINE SPILLS																	
Spill Size	Small				Medium				Large				Huge				
Spill Expectation	Low	Most Likely	High	Expected	Low	Expected	High	Expected	Low	Most Likely	High	Expected	Low	Most Likely	High	Expected	
P/L Dia <10" Spill	1	58	99	52	100	226	999	485	1000	4436	9999	5279	10000	14423	20000	14880	
P/L Dia > 10" Spill	1	58	99	52	100	387	999	516	1000	3932	9999	5176	10000	17705	20000	15552	
PLATFORM SPILLS																	
Spill Size	Small and Medium Spills				Large and Huge Spills												
Spill Expectation	Low	Most Likely	High	Expected	Low	Most Likely	High	Expected									
Platform Spill	1	158	999	431	1000	6130	10000	5631									
WELL BLOWOUT SPILLS																	
Spill Size	Small and Medium Spills				Large and Huge Spills				≥10000 < 150000 bbl				≥150000 bbl				
Spill Expectation	Low	Most Likely	High	Expected	Low	Most Likely	High	Expected	Low	Most Likely	High	Expected	Low	Most Likely	High	Expected	
Well Blowout Spill	1	500	999	500	1000	4500	9999	5292	10000	20000	150000	68349	150000	200000	250000	200000	

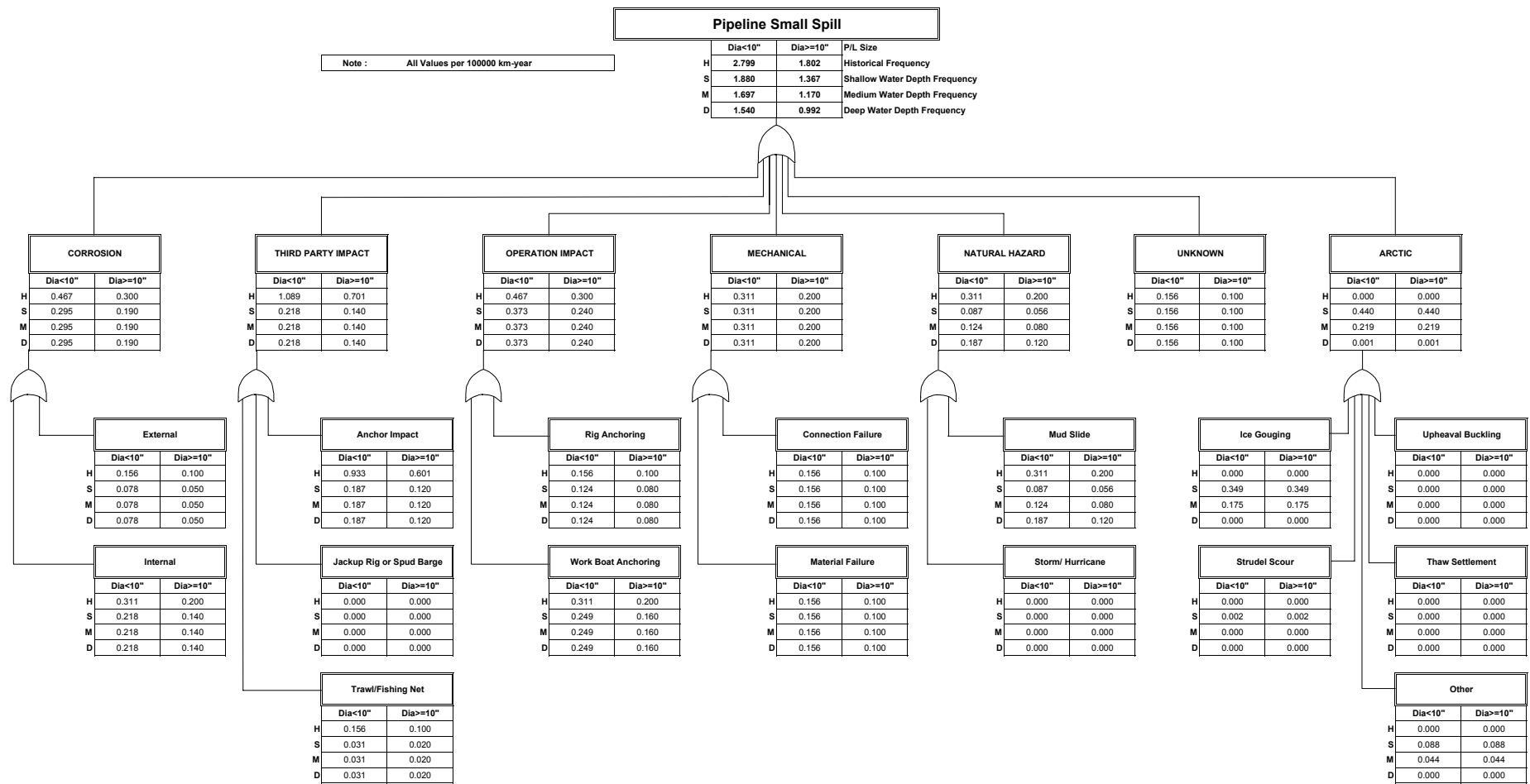


Figure 2.1 Fault Tree - Pipeline - Small Spill

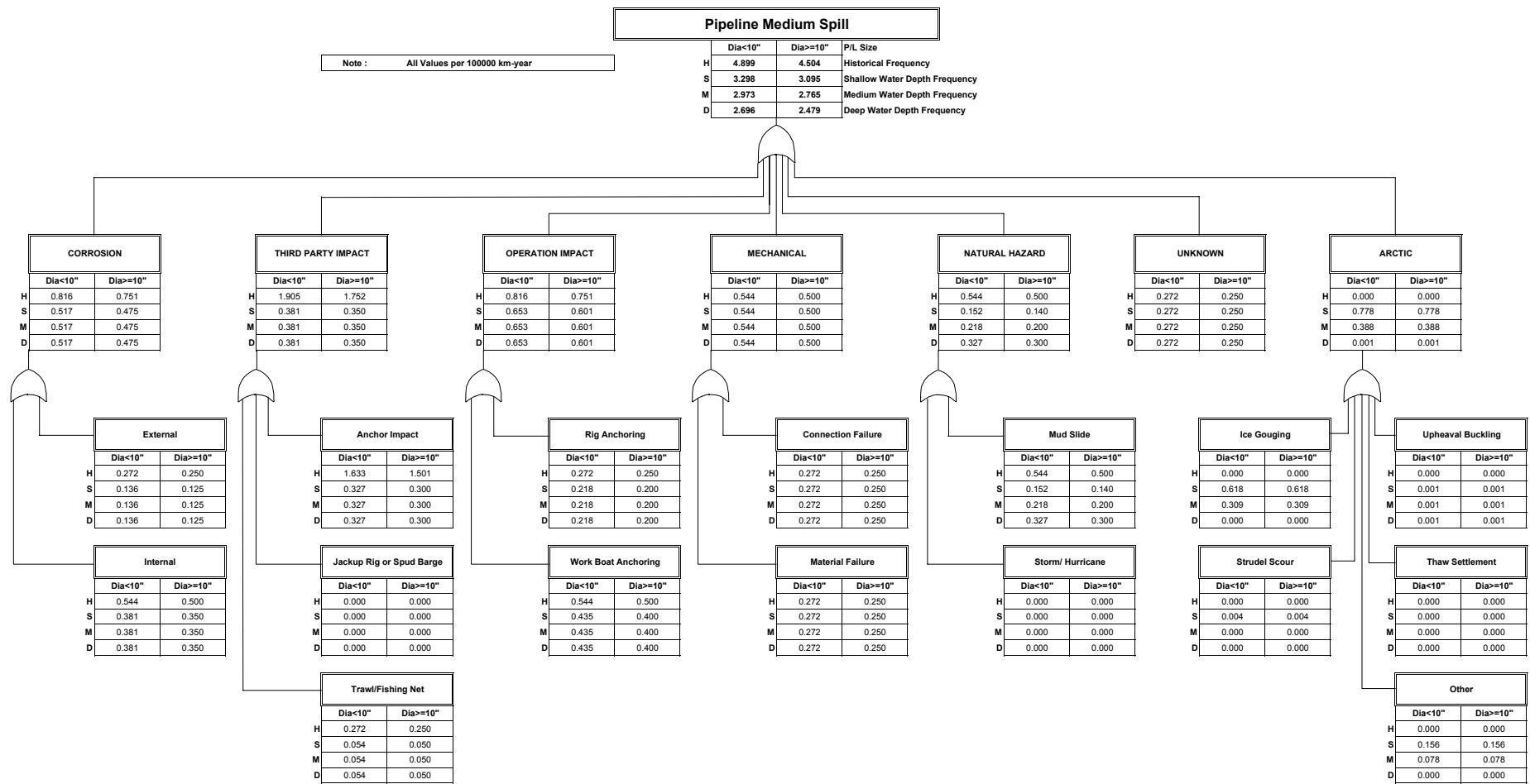


Figure 2.2 Fault Tree - Pipeline - Medium Spill

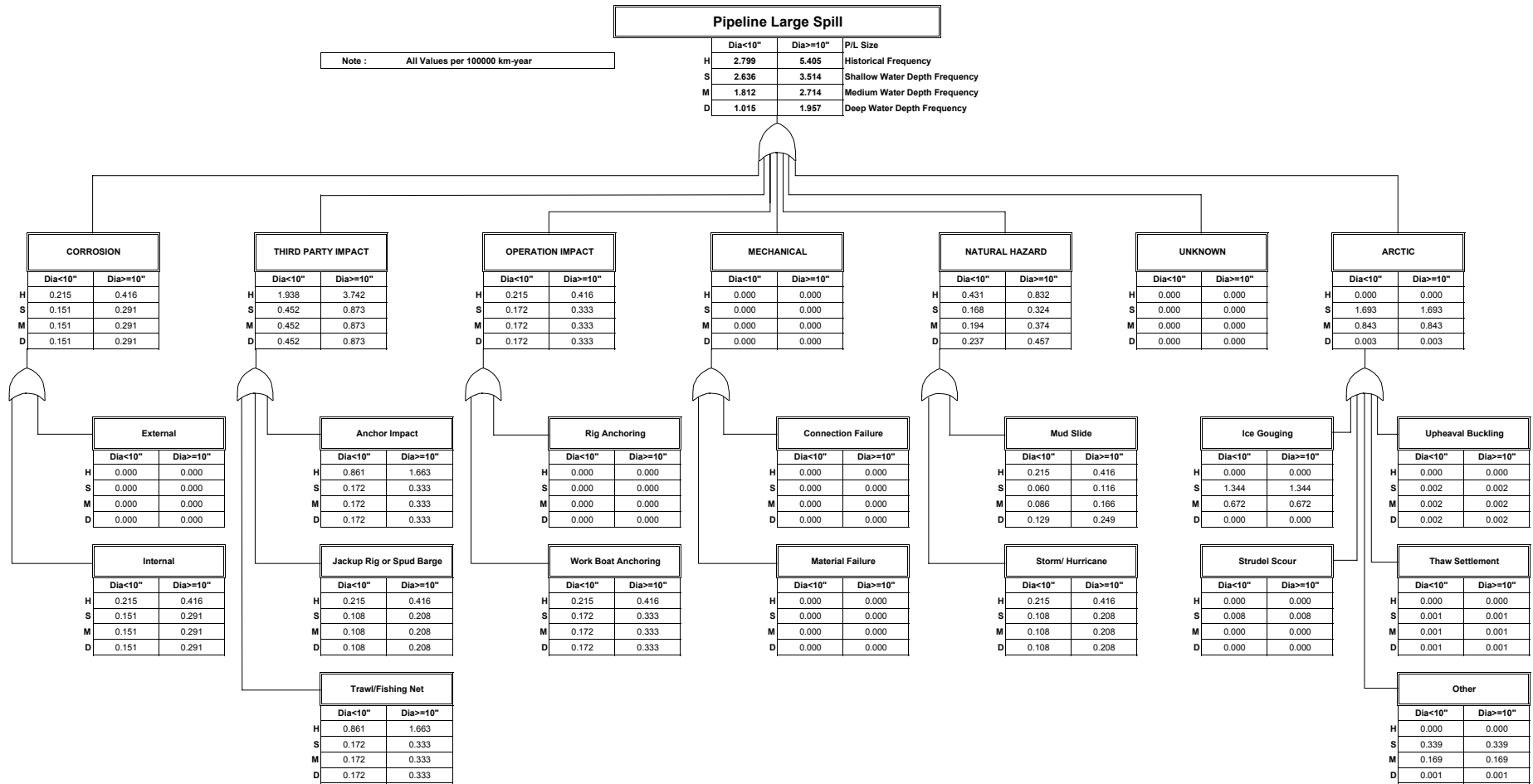


Figure 2.3 Fault Tree - Pipeline - Large Spill

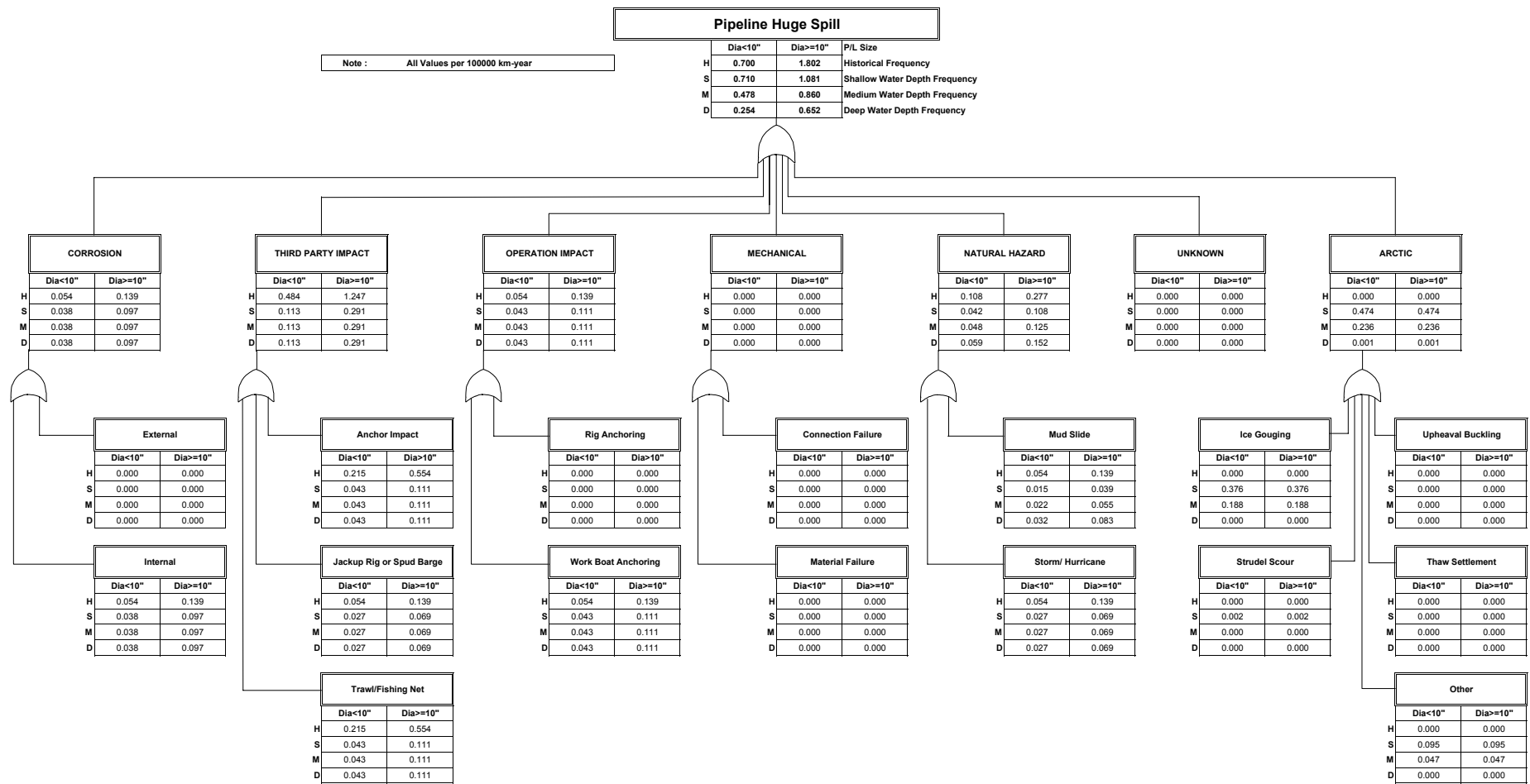


Figure 2.4 Fault Tree - Pipeline - Huge Spill

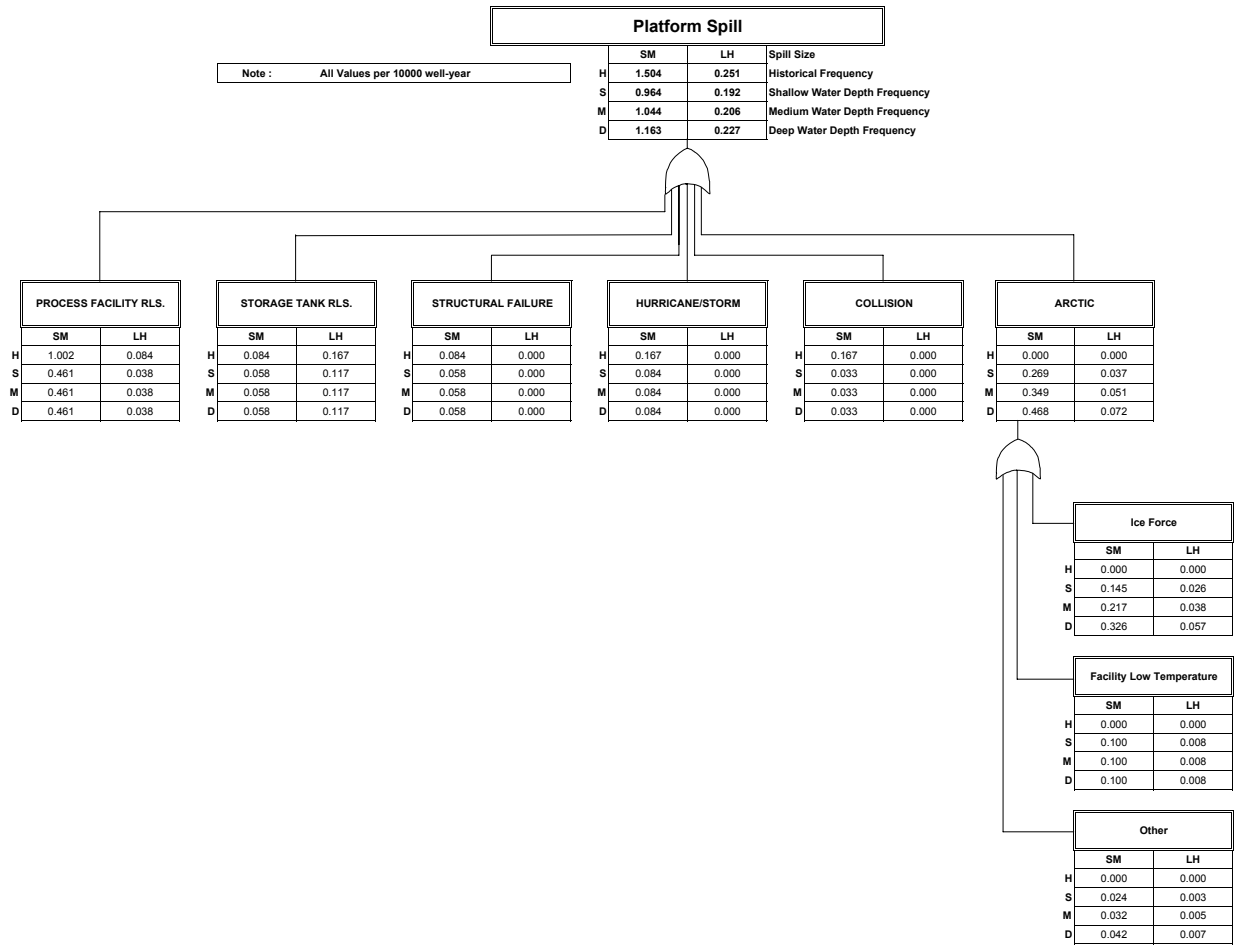


Figure 2.5 Fault Tree - Platform Spill

**Table 3.1
Beaufort Sea Sale 1 2004-2038**

Year	Water Depth	Exploration Wells	Delineation Wells	Expl./Del. Rigs	Production Platforms		Production Wells		Service Wells		Production Rigs	In-use Pipeline Length [miles]						Production MMbbl
					Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		Sum<10"		Sum >=10"		Sum All		
												Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2004	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2005	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2006	Shallow	1	2	2														
	Medium																	
	Deep																	
	Total	1	2	2														
2007	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2008	Shallow		2	1														
	Medium	1																
	Deep																	
	Total	1	2	1														
2009	Shallow				1	1	3	3	3	3	1							
	Medium	1		1														
	Deep																	
	Total	1		1	1	1	3	3	3	3	1							
2010	Shallow				1	10	13	4	7	1			10	10	10	10		10.9
	Medium		2	1														
	Deep																	
	Total		2	1	1	10	13	4	7	1			10	10	10	10		10.9
2011	Shallow				1	2	13	26	7	14	2			10		10		19.9
	Medium																	
	Deep																	
	Total				1	2	13	26	7	14	2			10		10		19.9
2012	Shallow				2	10	36	4	18	1			10	20	10	20		30.8
	Medium																	
	Deep																	
	Total				2	10	36	4	18	1			10	20	10	20		30.8
2013	Shallow				2	10	46	4	22	1				20		20		39.8
	Medium																	
	Deep																	
	Total				2	10	46	4	22	1				20		20		39.8
2014	Shallow				2		46		22					20		20		36.3
	Medium				1	1	3	3	3	3	1							
	Deep																	
	Total				1	3	3	49	3	25	1			20		20		36.3
2015	Shallow				2		46		22				10	30	10	30		33.4
	Medium				1	10	13	4	7	1			10	10	10	10		10.9
	Deep																	
	Total				3	10	59	4	29	1			20	40	20	40		44.3
2016	Shallow				2		46		22					30		30		27.6
	Medium				1	10	23	4	11	1			10		10		19.9	
	Deep																	
	Total				3	10	69	4	33	1			40		40		47.5	
2017	Shallow				2		46		22					30		30		22.7
	Medium				1		23		11				10		10		19.9	
	Deep																	
	Total				3		69		33				40		40		42.6	
2018	Shallow				2		46		22					30		30		18.8
	Medium				1		23		11				10		10		19.9	
	Deep																	
	Total				3		69		33				40		40		38.7	
2019	Shallow				2		46		22					30		30		15.5
	Medium				1		23		11				10		10		16.4	
	Deep																	
	Total				3		69		33				40		40		31.9	
2020	Shallow				2		46		22					30		30		12.8
	Medium				1		23		11				10		10		13.5	
	Deep																	
	Total				3		69		33				40		40		26.3	
2021	Shallow				2		46		22					30		30		10.5
	Medium				1		23		11				10		10		11.2	
	Deep																	
	Total				3		69		33				40		40		21.7	
2022	Shallow				2		46		22					30		30		8.7
	Medium				1		23		11				10		10		9.2	
	Deep																	
	Total				3		69		33				40		40		17.9	

**Table 3.1
Beaufort Sea Sale 1 2004-2038**

Year	Water Depth	Exploration Wells	Delineation Wells	Expl./Del. Rigs	Production Platforms		Production Wells		Service Wells		Production Rigs	In-use Pipeline Length [miles]						Production MMbbl
					Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		Sum<10"		Sum >=10"		Sum All		
												Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2023	Shallow					2	46	22							30	30	7.3	
	Medium					1	23	11							10	10	7.6	
	Deep																	
	Total					3	69	33							40	40	14.9	
2024	Shallow					2	46	22							30	30	6.1	
	Medium					1	23	11							10	10	6.3	
	Deep																	
	Total					3	69	33							40	40	12.4	
2025	Shallow					-1	1	-23	23	-11	11				-10	20	3.0	
	Medium					1	1	23	11	11					10	10	5.2	
	Deep																	
	Total					-1	2	-23	46	-11	22				-10	30	8.2	
2026	Shallow						1	23	11	11					20	20	2.6	
	Medium					1	1	23	11	11					10	10	4.3	
	Deep																	
	Total					2	2	46	22	22					30	30	6.9	
2027	Shallow					-1	1	-23	23	-11	11				-10	10	3.5	
	Medium					1	1	23	11	11					10	10	3.5	
	Deep																	
	Total					-1	1	-23	23	-11	11				-10	20	3.5	
2028	Shallow														10	10		
	Medium					1	1	23	11	11					10	10	3.0	
	Deep																	
	Total					1	1	23	11	11					20	20	3.0	
2029	Shallow														10	10		
	Medium					1	1	23	11	11					10	10	2.6	
	Deep																	
	Total					1	1	23	11	11					20	20	2.6	
2030	Shallow														-10	-10		
	Medium					-1	1	-23	23	-11	11				-10	-10		
	Deep																	
	Total					-1	1	-23	23	-11	11				-20	-20		
2031	Shallow																	
	Medium																	
	Deep																	
	Total																	
2032	Shallow																	
	Medium																	
	Deep																	
	Total																	
2033	Shallow																	
	Medium																	
	Deep																	
	Total																	
2034	Shallow																	
	Medium																	
	Deep																	
	Total																	
2035	Shallow																	
	Medium																	
	Deep																	
	Total																	
2036	Shallow																	
	Medium																	
	Deep																	
	Total																	
2037	Shallow																	
	Medium																	
	Deep																	
	Total																	
2038	Shallow																	
	Medium																	
	Deep																	
	Total																	

**Table 3.2
Beaufort Sea Sale 2 2004-2038**

Year	Water Depth	Exploration Wells	Delineation Wells	Expl./Del. Rigs	Production Platforms		Production Wells		Service Wells		Production Rigs	In-use Pipeline Length [miles]						Production MMbbl
					Incr. Cum.		Incr. Cum.		Incr. Cum.			Sum<10"		Sum >=10"		Sum All		
					Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2004	Shallow																	
	Medium																	
	Deep																	
	Total																	
2005	Shallow																	
	Medium																	
	Deep																	
	Total																	
2006	Shallow																	
	Medium																	
	Deep																	
	Total																	
2007	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2008	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2009	Shallow		2	1														
	Medium																	
	Deep																	
	Total		2	1														
2010	Shallow																	
	Medium	1		1														
	Deep																	
	Total	1		1														
2011	Shallow																	
	Medium																	
	Deep																	
	Total																	
2012	Shallow				1	1	3	3	3	3	1							
	Medium	1		1														
	Deep	1		1														
	Total	2		2	1	1	3	3	3	3	1							
2013	Shallow					1	10	13	4	7	1			15	15	15	15	10.9
	Medium		2	1														
	Deep	1		1														
	Total	1	2	2		1	10	13	4	7	1			15	15	15	15	10.9
2014	Shallow					1	10	23	4	11	1				15	15	15	19.9
	Medium		2	1														
	Deep																	
	Total		2	1		1	10	23	4	11	1			15	15	15	19.9	
2015	Shallow					1	23	23	11	11					15	15	15	19.9
	Medium																	
	Deep																	
	Total					1	23	23	11	11				15	15	15	19.9	
2016	Shallow					1	1	3	3	3	1							
	Medium																	
	Deep																	
	Total					1	2	3	26	3	14	1			15	15	15	19.9
2017	Shallow					1	2	23	11	11				10	25	10	25	16.4
	Medium					1	2	13	16	7	10	2	5	5	10	10	15	18.4
	Deep																	
	Total					1	3	13	39	7	21	2	5	5	20	35	25	40
2018	Shallow					1	2	23	11	11					25	25	25	13.5
	Medium					2	20	36	8	18	2		5	10	10	15	30.7	
	Deep																	
	Total					3	20	59	8	29	2		5	35	35	40	44.2	
2019	Shallow					1	2	23	11	11					25	25	25	11.2
	Medium					2	10	46	4	22	1		5	10	10	15	30.7	
	Deep																	
	Total					3	10	69	4	33	1		5	35	35	40	41.9	
2020	Shallow					1	2	23	11	11					25	25	25	9.2
	Medium					2	10	46	4	22			5	10	10	15	30.7	
	Deep																	
	Total					3	10	69	4	33			5	35	35	40	39.9	
2021	Shallow					1	2	23	11	11					25	25	25	7.6
	Medium					2	10	46	4	22			5	10	10	15	30.7	
	Deep																	
	Total					3	10	69	4	33			5	35	35	40	38.3	
2022	Shallow					1	2	23	11	11					25	25	25	6.3
	Medium					2	10	46	4	22			5	10	10	15	26.4	
	Deep																	
	Total					3	10	69	4	33			5	35	35	40	32.7	

**Table 3.2
Beaufort Sea Sale 2 2004-2038**

Year	Water Depth	Exploration Wells	Delineation Wells	Expl./Del. Rigs	Production Platforms		Production Wells		Service Wells		Production Rigs	In-use Pipeline Length [miles]						Production MMbbl
					Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		Sum <10"		Sum >=10"		Sum All		
												Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2023	Shallow					1	23		11						25	25	5.2	
	Medium					2	46		22			5		10	15	22.7		
	Deep																	
	Total					3	69		33			5		35	40	27.9		
2024	Shallow					1	23		11					25	25	4.3		
	Medium					2	46		22			5		10	15	19.5		
	Deep																	
	Total					3	69		33			5		35	40	23.8		
2025	Shallow					1	23		11					25	25	3.5		
	Medium					2	46		22			5		10	15	16.8		
	Deep																	
	Total					3	69		33			5		35	40	20.3		
2026	Shallow					1	23		11					25	25	2.9		
	Medium					2	46		22			5		10	15	14.4		
	Deep																	
	Total					3	69		33			5		35	40	17.3		
2027	Shallow					1	23		11					25	25	2.4		
	Medium					2	46		22			5		10	15	12.4		
	Deep																	
	Total					3	69		33			5		35	40	14.8		
2028	Shallow					-1	-23		-11				-15	10	-15	10		
	Medium					2	46		22			5		10	15	10.7		
	Deep																	
	Total					-1	2	-23	46	-11	22		5	-15	20	-15	25	10.7
2029	Shallow													10	10			
	Medium					2	46		22			5		10	15	9.2		
	Deep																	
	Total					2	46		22			5		20	25	9.2		
2030	Shallow													10	10			
	Medium					2	46		22			5		10	15	7.9		
	Deep																	
	Total					2	46		22			5		20	25	7.9		
2031	Shallow													10	10			
	Medium					2	46		22			5		10	15	6.8		
	Deep																	
	Total					2	46		22			5		20	25	6.8		
2032	Shallow													10	10			
	Medium					2	46		22			5		10	15	5.8		
	Deep																	
	Total					2	46		22			5		20	25	5.8		
2033	Shallow													10	10			
	Medium					2	46		22			5		10	15	5.0		
	Deep																	
	Total					2	46		22			5		20	25	5.0		
2034	Shallow													10	10			
	Medium					2	46		22			5		10	15	4.3		
	Deep																	
	Total					2	46		22			5		20	25	4.3		
2035	Shallow													10	10			
	Medium					2	46		22			5		10	15	3.7		
	Deep																	
	Total					2	46		22			5		20	25	3.7		
2036	Shallow												-10		-10			
	Medium					-2	-46		-22			-5		-10	-15			
	Deep																	
	Total					-2	-46		-22			-5		-20	-25			
2037	Shallow																	
	Medium																	
	Deep																	
	Total																	
2038	Shallow																	
	Medium																	
	Deep																	
	Total																	

**Table 3.3
Beaufort Sea Sale 3 2004-2038**

Year	Water Depth	Exploration Wells	Delineation Wells	Expl./Del. Rigs	Production Platforms		Production Wells		Service Wells		Production Rigs	In-use Pipeline Length [miles]						Production MMbbl
					Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		Sum <10"		Sum >=10"		Sum All		
												Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2004	Shallow																	
	Medium																	
	Deep																	
	Total																	
2005	Shallow																	
	Medium																	
	Deep																	
	Total																	
2006	Shallow																	
	Medium																	
	Deep																	
	Total																	
2007	Shallow																	
	Medium																	
	Deep																	
	Total																	
2008	Shallow																	
	Medium																	
	Deep																	
	Total																	
2009	Shallow																	
	Medium																	
	Deep																	
	Total																	
2010	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2011	Shallow																	
	Medium																	
	Deep																	
	Total																	
2012	Shallow																	
	Medium	1		1														
	Deep																	
	Total	1		1														
2013	Shallow																	
	Medium	1	1	1														
	Deep																	
	Total	1	1	1														
2014	Shallow																	
	Medium		2	1														
	Deep																	
	Total		2	1														
2015	Shallow																	
	Medium		2	1														
	Deep	1		1														
	Total	1	2	2														
2016	Shallow																	
	Medium																	
	Deep																	
	Total																	
2017	Shallow																	
	Medium																	
	Deep	1		1														
	Total	1		1														
2018	Shallow																	
	Medium				1	1	4	4	4	4	1							
	Deep	1		1														
	Total	1		1	1	1	4	4	4	4	1							
2019	Shallow													15	15	15	15	
	Medium				1	2	14	18	8	12	2	5	5	15	15	20	20	30.8
	Deep																	
	Total				1	2	14	18	8	12	2	5	5	30	30	35	35	30.8
2020	Shallow													15		15		
	Medium					2	20	38	8	20	2		5	15		20		38.6
	Deep																	
	Total					2	20	38	8	20	2		5		30		35	38.6
2021	Shallow													15		15		
	Medium					2	20	58	9	29	2		5	15		20		38.6
	Deep																	
	Total					2	20	58	9	29	2		5		30		35	38.6
2022	Shallow													15		15		
	Medium					2	10	68	5	34	1		5	15		20		38.6
	Deep																	
	Total					2	10	68	5	34	1		5		30		35	38.6

**Table 3.3
Beaufort Sea Sale 3 2004-2038**

2023	Shallow												15	15	
	Medium				2	68	34						15	20	38.6
	Deep														
	Total				2	68	34						30	35	38.6
2024	Shallow												15	15	
	Medium				2	68	34						15	20	38.6
	Deep														
	Total				2	68	34						30	35	38.6
2025	Shallow												15	15	
	Medium				2	68	34						15	20	34.0
	Deep														
	Total				2	68	34						30	35	34.0
2026	Shallow												15	15	
	Medium				2	68	34						15	20	29.9
	Deep														
	Total				2	68	34						30	35	29.9
2027	Shallow												15	15	
	Medium				2	68	34						15	20	26.3
	Deep														
	Total				2	68	34						30	35	26.3
2028	Shallow												15	15	
	Medium				2	68	34						15	20	23.2
	Deep														
	Total				2	68	34						30	35	23.2
2029	Shallow												15	15	
	Medium				2	68	34						15	20	20.4
	Deep														
	Total				2	68	34						30	35	20.4
2030	Shallow												15	15	
	Medium				2	68	34						15	20	17.9
	Deep														
	Total				2	68	34						30	35	17.9
2031	Shallow												15	15	
	Medium				2	68	34						15	20	15.8
	Deep														
	Total				2	68	34						30	35	15.8
2032	Shallow												15	15	
	Medium				2	68	34						15	20	13.9
	Deep														
	Total				2	68	34						30	35	13.9
2033	Shallow												15	15	
	Medium				2	68	34						15	20	12.2
	Deep														
	Total				2	68	34						30	35	12.2
2034	Shallow												15	15	
	Medium				2	68	34						15	20	10.8
	Deep														
	Total				2	68	34						30	35	10.8
2035	Shallow												15	15	
	Medium				2	68	34						15	20	9.5
	Deep														
	Total				2	68	34						30	35	9.5
2036	Shallow												15	15	
	Medium				2	68	34						15	20	8.3
	Deep														
	Total				2	68	34						30	35	8.3
2037	Shallow												15	15	
	Medium				2	68	34						15	20	7.3
	Deep														
	Total				2	68	34						30	35	7.3
2038	Shallow												15	15	
	Medium				2	68	34						15	20	6.5
	Deep														
	Total				2	68	34						30	35	6.5

**Table 3.4
Beaufort Sea All Sales 2004-2038**

Year	Water Depth	Exploration Wells	Delineation Wells	Expl./Del. Rigs	Production Platforms		Production Wells		Service Wells		Production Rigs	In-use Pipeline Length [miles]						Production MMbbl
					Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		Sum<10"		Sum >=10"		Sum All		
												Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2004	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2005	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2006	Shallow	1	2	2														
	Medium																	
	Deep																	
	Total	1	2	2														
2007	Shallow	2		2														
	Medium																	
	Deep																	
	Total	2		2														
2008	Shallow	1	2	2														
	Medium	1																
	Deep																	
	Total	2	2	2														
2009	Shallow		2	1	1	1	3	3	3	3	1							
	Medium	1		1														
	Deep																	
	Total	1	2	2	1	1	3	3	3	3	1							
2010	Shallow	1		1		1	10	13	4	7	1		10	10	10	10		10.9
	Medium	1	2	2														
	Deep																	
	Total	2	2	3		1	10	13	4	7	1		10	10	10	10		10.9
2011	Shallow				1	2	13	26	7	14	2			10	10			19.9
	Medium																	
	Deep																	
	Total				1	2	13	26	7	14	2			10	10	10		19.9
2012	Shallow				1	3	13	39	7	21	2		10	20	10	20		30.8
	Medium	2		2														
	Deep	1		1														
	Total	3		3	1	3	13	39	7	21	2		10	20	10	20		30.8
2013	Shallow					3	20	59	8	29	2		15	35	15	35		50.7
	Medium	1	3	2														
	Deep	1		1														
	Total	2	3	3		3	20	59	8	29	2		15	35	15	35		50.7
2014	Shallow					3	10	69	4	33	1			35		35		56.2
	Medium		4	2	1	1	3	3	3	3	1							
	Deep																	
	Total		4	2	1	4	13	72	7	36	2			35		35		56.2
2015	Shallow					3		69		33			10	45	10	45		53.3
	Medium		2	1		1	10	13	4	7	1		10	10	10	10		10.9
	Deep	1		1														
	Total	1	2	2		4	10	82	4	40	1		20	55	20	55		64.2
2016	Shallow					3		69		33				45		45		47.5
	Medium				1	2	13	26	7	14	2			10		10		19.9
	Deep																	
	Total				1	5	13	95	7	47	2			55		55		67.4
2017	Shallow					3		69		33			10	55	10	55		39.1
	Medium				1	3	13	39	7	21	2	5	5	10	20	15	25	38.3
	Deep	1		1														
	Total	1		1	1	6	13	108	7	54	2	5	5	20	75	25	80	77.4
2018	Shallow					3		69		33				55		55		32.3
	Medium				1	4	24	63	12	33	3		5	20		25		50.6
	Deep	1		1														
	Total	1		1	1	7	24	132	12	66	3		5		75		80	82.9
2019	Shallow					3		69		33			15	70	15	70		26.7
	Medium				1	5	24	87	12	45	3	5	10	15	35	20	45	77.9
	Deep																	
	Total				1	8	24	156	12	78	3	5	10	30	105	35	115	104.6
2020	Shallow					3		69		33				70		70		22.0
	Medium					5	20	107	8	53	2		10	35		45		82.8
	Deep																	
	Total					8	20	176	8	86	2		10	105		115		104.8
2021	Shallow					3		69		33				70		70		18.1
	Medium					5	20	127	9	62	2		10	35		45		80.5
	Deep																	
	Total					8	20	196	9	95	2		10	105		115		98.6
2022	Shallow					3		69		33				70		70		15.0
	Medium					5	10	137	5	67	1		10	35		45		74.2
	Deep																	
	Total					8	10	206	5	100	1		10	105		115		89.2

**Table 3.4
Beaufort Sea All Sales 2004-2038**

Year	Water Depth	Exploration Wells	Delineation Wells	Expl./Del. Rigs	Production Platforms		Production Wells		Service Wells		Production Rigs	In-use Pipeline Length [miles]						Production MMbbl	
					Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		Sum <10"		Sum >=10"		Sum All			
												Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		
2023	Shallow					3		69		33					70		70	12.5	
	Medium					5		137		67		10		35		45	68.9		
	Deep																		
	Total					8		206		100		10		105		115	81.4		
2024	Shallow					3		69		33				70		70	10.4		
	Medium					5		137		67		10		35		45	64.4		
	Deep																		
	Total					8		206		100		10		105		115	74.8		
2025	Shallow					-1	2	-23	46	-11	22			-10	60	-10	60	6.5	
	Medium					5		137		67		10		35		45	56.0		
	Deep																		
	Total					-1	7	-23	183	-11	89		10	-10	95	-10	105	62.5	
2026	Shallow						2		46		22			60		60	5.5		
	Medium					5		137		67		10		35		45	48.6		
	Deep																		
	Total					7		183		89		10		95		105	54.1		
2027	Shallow					-1	1	-23	23	-11	11			-10	50	-10	50	2.4	
	Medium					5		137		67		10		35		45	42.2		
	Deep																		
	Total					-1	6	-23	160	-11	78		10	-10	85	-10	95	44.6	
2028	Shallow					-1		-23		-11				-15	35	-15	35		
	Medium					5		137		67		10		35		45	36.9		
	Deep																		
	Total					-1	5	-23	137	-11	67		10	-15	70	-15	80	36.9	
2029	Shallow													35		35			
	Medium					5		137		67		10		35		45	32.2		
	Deep																		
	Total					5		137		67		10		70		80	32.2		
2030	Shallow													-10	25	-10	25		
	Medium					-1	4	-23	114	-11	56		10	-10	25	-10	35	25.8	
	Deep																		
	Total					-1	4	-23	114	-11	56		10	-20	50	-20	60	25.8	
2031	Shallow													25		25			
	Medium					4		114		56		10		25		35	22.6		
	Deep																		
	Total					4		114		56		10		50		60	22.6		
2032	Shallow													25		25			
	Medium					4		114		56		10		25		35	19.7		
	Deep																		
	Total					4		114		56		10		50		60	19.7		
2033	Shallow													25		25			
	Medium					4		114		56		10		25		35	17.2		
	Deep																		
	Total					4		114		56		10		50		60	17.2		
2034	Shallow													25		25			
	Medium					4		114		56		10		25		35	15.1		
	Deep																		
	Total					4		114		56		10		50		60	15.1		
2035	Shallow													25		25			
	Medium					4		114		56		10		25		35	13.2		
	Deep																		
	Total					4		114		56		10		50		60	13.2		
2036	Shallow													-10	15	-10	15		
	Medium					-2	2	-46	68	-22	34		-5	5	-10	15	-15	20	8.3
	Deep																		
	Total					-2	2	-46	68	-22	34		-5	5	-20	30	-25	35	8.3
2037	Shallow													15		15			
	Medium					2		68		34		5		15		20	7.3		
	Deep																		
	Total					2		68		34		5		30		35	7.3		
2038	Shallow													15		15			
	Medium					2		68		34		5		15		20	6.5		
	Deep																		
	Total					2		68		34		5		30		35	6.5		

**Table T.3.5
Chukchi Sea Base Case 1998-2010**

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Prod./Serv. Wells		Pipeline Length [miles]						Production MMbbl	
				Incr.	Cum.	Incr.	Cum.	Sum<10"		Sum >=10"		Sum All			
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		
1998	Shallow														
	Medium														
	Deep	2	2												
	Total	2	2												0
1999	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep									135	135	135	135		
	Total									200	200	200	200		0
2000	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep			2	2	8	8			135	135	135	135		
	Total			2	2	8	8			200	200	200	200		0
2001	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep			2	4	40	48			135	135	135	135		
	Total			2	4	40	48			200	200	200	200		0
2002	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep			2	6	60	108			135	135	135	135		
	Total			2	6	60	108			200	200	200	200		101
2003	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	80	188			135	135	135	135		
	Total				6	80	188			200	200	200	200		135
2004	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	26	214			135	135	135	135		
	Total				6	26	214			200	200	200	200		135
2005	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	214	214			135	135	135	135		
	Total				6	214	214			200	200	200	200		135
2006	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	214	214			135	135	135	135		
	Total				6	214	214			200	200	200	200		135
2007	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	214	214			135	135	135	135		
	Total				6	214	214			200	200	200	200		135
2008	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	214	214			135	135	135	135		
	Total				6	214	214			200	200	200	200		119
2009	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	214	214			135	135	135	135		
	Total				6	214	214			200	200	200	200		103
2010	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	214	214			135	135	135	135		
	Total				6	214	214			200	200	200	200		92

**Table T.3.6
Chukchi Sea High Case 1998-2010**

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Prod./Serv. Wells		Pipeline Length [miles]						Production MMbbl	
				Incr.	Cum.	Incr.	Cum.	Sum<10"		Sum >=10"		Sum All			
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		
1998	Shallow														
	Medium														
	Deep	3	1												
	Total	3	1												0
1999	Shallow														
	Medium														
	Deep	2	1												
	Total	2	1												0
2000	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep	2		2	2					135	135	135	135		
	Total	2		2	2					200	200	200	200		0
2001	Shallow										5		5		
	Medium										60		60		
	Deep			6	8	50	50					135		135	
	Total			6	8	50	50					200		200	0
2002	Shallow										5		5		
	Medium										60		60		
	Deep			4	12	80	130					135		135	
	Total			4	12	80	130					200		200	0
2003	Shallow										5		5		
	Medium										60		60		
	Deep				12	140	270					135		135	
	Total				12	140	270					200		200	223
2004	Shallow										5		5		
	Medium										60		60		
	Deep				12	140	410					135		135	
	Total				12	140	410					200		200	297
2005	Shallow										5		5		
	Medium										60		60		
	Deep				12	72	482					135		135	
	Total				12	72	482					200		200	297
2006	Shallow										5		5		
	Medium										60		60		
	Deep				12		482					135		135	
	Total				12		482					200		200	297
2007	Shallow										5		5		
	Medium										60		60		
	Deep				12		482					135		135	
	Total				12		482					200		200	297
2008	Shallow										5		5		
	Medium										60		60		
	Deep				12		482					135		135	
	Total				12		482					200		200	297
2009	Shallow										5		5		
	Medium										60		60		
	Deep				12		482					135		135	
	Total				12		482					200		200	262
2010	Shallow										5		5		
	Medium										60		60		
	Deep				12		482					135		135	
	Total				12		482					200		200	227

Table 4.1.1
Arctic Spill Occurrence Beaufort Sea Sale 1 P/L Spills

17706	Spill Index bbl
3.08	
3.08	
3.08	
3.08	
6.16	
6.16	
6.16	
6.16	
6.16	
9.24	
2.45	
11.69	
9.24	
2.45	
11.69	
9.24	
2.45	
11.69	
9.24	
2.45	
11.69	
9.24	
2.45	
11.69	
9.24	
2.45	
11.69	

**Table 4.1.2
Arctic Spill Occurrence Beaufort Sea Sale 1 P/L Summary**

Year	Production [Mmbbl]			Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills				
	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]		
2004																							
2005																							
2006																							
2007																							
2008																							
2009																							
2010	10.9	0.220	0.020	0.013	0.498	0.046	0.193	0.066	0.205	0.565	0.052	2.223	0.174	0.016	3.079	1.457	0.134	5.508					
2011	19.9	0.220	0.011	0.013	0.498	0.025	0.193	0.036	0.205	0.565	0.028	2.223	0.174	0.009	3.079	1.457	0.073	5.508					
2012	30.8	0.440	0.014	0.026	0.996	0.032	0.385	0.047	0.411	1.131	0.037	4.446	0.348	0.011	6.159	2.915	0.095	11.016					
2013	39.8	0.440	0.011	0.026	0.996	0.025	0.385	0.036	0.411	1.131	0.028	4.446	0.348	0.009	6.159	2.915	0.073	11.016					
2014	36.3	0.440	0.012	0.026	0.996	0.027	0.385	0.040	0.411	1.131	0.031	4.446	0.348	0.010	6.159	2.915	0.080	11.016					
2015	44.3	0.848	0.019	0.049	1.939	0.044	0.750	0.063	0.800	2.133	0.048	8.386	0.660	0.015	11.687	5.580	0.126	20.873					
2016	47.5	0.848	0.018	0.049	1.939	0.041	0.750	0.059	0.800	2.133	0.045	8.386	0.660	0.014	11.687	5.580	0.117	20.873					
2017	42.6	0.848	0.020	0.049	1.939	0.046	0.750	0.065	0.800	2.133	0.050	8.386	0.660	0.015	11.687	5.580	0.131	20.873					
2018	38.7	0.848	0.022	0.049	1.939	0.050	0.750	0.072	0.800	2.133	0.055	8.386	0.660	0.017	11.687	5.580	0.144	20.873					
2019	31.9	0.848	0.027	0.049	1.939	0.061	0.750	0.087	0.800	2.133	0.067	8.386	0.660	0.021	11.687	5.580	0.175	20.873					
2020	26.3	0.848	0.032	0.049	1.939	0.074	0.750	0.106	0.800	2.133	0.081	8.386	0.660	0.025	11.687	5.580	0.212	20.873					
2021	21.7	0.848	0.039	0.049	1.939	0.089	0.750	0.128	0.800	2.133	0.098	8.386	0.660	0.030	11.687	5.580	0.257	20.873					
2022	17.9	0.848	0.047	0.049	1.939	0.108	0.750	0.156	0.800	2.133	0.119	8.386	0.660	0.037	11.687	5.580	0.312	20.873					
2023	14.9	0.848	0.057	0.049	1.939	0.130	0.750	0.187	0.800	2.133	0.143	8.386	0.660	0.044	11.687	5.580	0.374	20.873					
2024	12.4	0.848	0.068	0.049	1.939	0.156	0.750	0.225	0.800	2.133	0.172	8.386	0.660	0.053	11.687	5.580	0.450	20.873					
2025	8.2	0.628	0.077	0.036	1.441	0.176	0.558	0.252	0.594	1.567	0.191	6.163	0.486	0.059	8.608	4.123	0.503	15.365					
2026	6.9	0.628	0.091	0.036	1.441	0.209	0.558	0.300	0.594	1.567	0.227	6.163	0.486	0.070	8.608	4.123	0.597	15.365					
2027	3.5	0.408	0.117	0.024	0.943	0.269	0.365	0.386	0.389	1.002	0.286	3.940	0.312	0.089	5.528	2.665	0.762	9.857					
2028	3.0	0.408	0.136	0.024	0.943	0.314	0.365	0.450	0.389	1.002	0.334	3.940	0.312	0.104	5.528	2.665	0.888	9.857					
2029	2.6	0.408	0.157	0.024	0.943	0.363	0.365	0.520	0.389	1.002	0.385	3.940	0.312	0.120	5.528	2.665	1.025	9.857					
2030																							
2031																							
2032																							
2033																							
2034																							
2035																							
2036																							
2037																							
2038																							

**Table 4.1.3
Arctic Spill Occurrence Beaufort Sea Sale 1 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2005	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2006	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2007	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2008	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2009	Shallow	1	3	0.964	0.289	0.05	0.192	0.058	0.35
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total	1	3		0.289	0.05		0.058	0.35
2010	Shallow	1	13	0.964	1.254	0.20	0.192	0.250	1.53
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total	1	13		1.254	0.20		0.250	1.53
2011	Shallow	2	26	0.964	2.508	0.40	0.192	0.500	3.06
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total	2	26		2.508	0.40		0.500	3.06
2012	Shallow	2	36	0.964	3.472	0.55	0.192	0.692	4.24
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total	2	36		3.472	0.55		0.692	4.24
2013	Shallow	2	46	0.964	4.436	0.70	0.192	0.884	5.42
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total	2	46		4.436	0.70		0.884	5.42
2014	Shallow	2	46	0.964	4.436	0.70	0.192	0.884	5.42
	Medium	1	3	1.044	0.313	0.05	0.206	0.062	0.38
	Deep			1.163			0.227		
	Total	3	49		4.750	0.75		0.946	5.80
2015	Shallow	2	46	0.964	4.436	0.70	0.192	0.884	5.42
	Medium	1	13	1.044	1.357	0.21	0.206	0.268	1.64
	Deep			1.163			0.227		
	Total	3	59		5.794	0.92		1.153	7.07
2016	Shallow	2	46	0.964	4.436	0.70	0.192	0.884	5.42
	Medium	1	23	1.044	2.401	0.38	0.206	0.475	2.91
	Deep			1.163			0.227		
	Total	3	69		6.838	1.08		1.359	8.33
2017	Shallow	2	46	0.964	4.436	0.70	0.192	0.884	5.42
	Medium	1	23	1.044	2.401	0.38	0.206	0.475	2.91
	Deep			1.163			0.227		
	Total	3	69		6.838	1.08		1.359	8.33

**Table 4.1.3
Arctic Spill Occurrence Beaufort Sea Sale 1 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow	2	46	0.964	4.436	0.70	0.192	0.884	5.42
	Medium	1	23	1.044	2.401	0.38	0.206	0.475	2.91
	Deep			1.163			0.227		
	Total	3	69		6.838	1.08		1.359	8.33
2019	Shallow	2	46	0.964	4.436	0.70	0.192	0.884	5.42
	Medium	1	23	1.044	2.401	0.38	0.206	0.475	2.91
	Deep			1.163			0.227		
	Total	3	69		6.838	1.08		1.359	8.33
2020	Shallow	2	46	0.964	4.436	0.70	0.192	0.884	5.42
	Medium	1	23	1.044	2.401	0.38	0.206	0.475	2.91
	Deep			1.163			0.227		
	Total	3	69		6.838	1.08		1.359	8.33
2021	Shallow	2	46	0.964	4.436	0.70	0.192	0.884	5.42
	Medium	1	23	1.044	2.401	0.38	0.206	0.475	2.91
	Deep			1.163			0.227		
	Total	3	69		6.838	1.08		1.359	8.33
2022	Shallow	2	46	0.964	4.436	0.70	0.192	0.884	5.42
	Medium	1	23	1.044	2.401	0.38	0.206	0.475	2.91
	Deep			1.163			0.227		
	Total	3	69		6.838	1.08		1.359	8.33
2023	Shallow	2	46	0.964	4.436	0.70	0.192	0.884	5.42
	Medium	1	23	1.044	2.401	0.38	0.206	0.475	2.91
	Deep			1.163			0.227		
	Total	3	69		6.838	1.08		1.359	8.33
2024	Shallow	2	46	0.964	4.436	0.70	0.192	0.884	5.42
	Medium	1	23	1.044	2.401	0.38	0.206	0.475	2.91
	Deep			1.163			0.227		
	Total	3	69		6.838	1.08		1.359	8.33
2025	Shallow	1	23	0.964	2.218	0.35	0.192	0.442	2.71
	Medium	1	23	1.044	2.401	0.38	0.206	0.475	2.91
	Deep			1.163			0.227		
	Total	2	46		4.619	0.73		0.917	5.62
2026	Shallow	1	23	0.964	2.218	0.35	0.192	0.442	2.71
	Medium	1	23	1.044	2.401	0.38	0.206	0.475	2.91
	Deep			1.163			0.227		
	Total	2	46		4.619	0.73		0.917	5.62
2027	Shallow			0.964			0.192		
	Medium	1	23	1.044	2.401	0.38	0.206	0.475	2.91
	Deep			1.163			0.227		
	Total	1	23		2.401	0.38		0.475	2.91
2028	Shallow			0.964			0.192		
	Medium	1	23	1.044	2.401	0.38	0.206	0.475	2.91
	Deep			1.163			0.227		
	Total	1	23		2.401	0.38		0.475	2.91
2029	Shallow			0.964			0.192		
	Medium	1	23	1.044	2.401	0.38	0.206	0.475	2.91
	Deep			1.163			0.227		
	Total	1	23		2.401	0.38		0.475	2.91
2030	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2031	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								

**Table 4.1.3
Arctic Spill Occurrence Beaufort Sea Sale 1 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2033	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2034	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2035	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2036	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2037	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2038	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								

**Table 4.1.4
Arctic Spill Occurrence Beaufort Sea Sale 1 Platforms Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004										
2005										
2006										
2007										
2008										
2009		0.289		0.046	0.058		0.354	0.347		0.399
2010	10.9	1.254	0.115	0.198	0.250	0.023	1.532	1.504	0.138	1.730
2011	19.9	2.508	0.126	0.396	0.500	0.025	3.065	3.007	0.151	3.461
2012	30.8	3.472	0.113	0.549	0.692	0.022	4.243	4.164	0.135	4.792
2013	39.8	4.436	0.111	0.701	0.884	0.022	5.422	5.321	0.134	6.123
2014	36.3	4.750	0.131	0.750	0.946	0.026	5.801	5.696	0.157	6.552
2015	44.3	5.794	0.131	0.915	1.153	0.026	7.066	6.946	0.157	7.982
2016	47.5	6.838	0.144	1.080	1.359	0.029	8.331	8.197	0.173	9.411
2017	42.6	6.838	0.161	1.080	1.359	0.032	8.331	8.197	0.192	9.411
2018	38.7	6.838	0.177	1.080	1.359	0.035	8.331	8.197	0.212	9.411
2019	31.9	6.838	0.214	1.080	1.359	0.043	8.331	8.197	0.257	9.411
2020	26.3	6.838	0.260	1.080	1.359	0.052	8.331	8.197	0.312	9.411
2021	21.7	6.838	0.315	1.080	1.359	0.063	8.331	8.197	0.378	9.411
2022	17.9	6.838	0.382	1.080	1.359	0.076	8.331	8.197	0.458	9.411
2023	14.9	6.838	0.459	1.080	1.359	0.091	8.331	8.197	0.550	9.411
2024	12.4	6.838	0.551	1.080	1.359	0.110	8.331	8.197	0.661	9.411
2025	8.2	4.619	0.563	0.730	0.917	0.112	5.620	5.536	0.675	6.350
2026	6.9	4.619	0.669	0.730	0.917	0.133	5.620	5.536	0.802	6.350
2027	3.5	2.401	0.686	0.379	0.475	0.136	2.909	2.876	0.822	3.288
2028	3.0	2.401	0.800	0.379	0.475	0.158	2.909	2.876	0.959	3.288
2029	2.6	2.401	0.924	0.379	0.475	0.183	2.909	2.876	1.106	3.288
2030										
2031										
2032										
2033										
2034										
2035										
2036										
2037										
2038										

**Table 4.1.5
Arctic Spill Occurrence Beaufort Sea Sale 1 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2009	Shallow	3	0.500	0.015	0.01	3.500	0.105	0.47	1.500	0.045	0.90	1.000	0.030	6.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	3		0.015	0.01		0.105	0.47		0.045	0.90		0.030	6.00
2010	Shallow	13	0.500	0.065	0.03	3.500	0.455	2.05	1.500	0.195	3.90	1.000	0.130	26.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	13		0.065	0.03		0.455	2.05		0.195	3.90		0.130	26.00
2011	Shallow	26	0.500	0.130	0.07	3.500	0.910	4.10	1.500	0.390	7.80	1.000	0.260	52.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	26		0.130	0.07		0.910	4.10		0.390	7.80		0.260	52.00
2012	Shallow	36	0.500	0.180	0.09	3.500	1.260	5.67	1.500	0.540	10.80	1.000	0.360	72.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	36		0.180	0.09		1.260	5.67		0.540	10.80		0.360	72.00
2013	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2014	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	3	0.500	0.015	0.01	3.500	0.105	0.47	1.500	0.045	0.90	1.000	0.030	6.00
	Deep		0.500			3.500			1.500			1.000		
	Total	49		0.245	0.12		1.715	7.72		0.735	14.70		0.490	98.00
2015	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	13	0.500	0.065	0.03	3.500	0.455	2.05	1.500	0.195	3.90	1.000	0.130	26.00
	Deep		0.500			3.500			1.500			1.000		
	Total	59		0.295	0.15		2.065	9.29		0.885	17.70		0.590	118.00
2016	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2017	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00

**Table 4.1.5
Arctic Spill Occurrence Beaufort Sea Sale 1 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2019	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2020	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2021	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2022	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2023	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2024	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2025	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2026	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2027	Shallow		0.500			3.500			1.500			1.000		
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	23		0.115	0.06		0.805	3.62		0.345	6.90		0.230	46.00
2028	Shallow		0.500			3.500			1.500			1.000		
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	23		0.115	0.06		0.805	3.62		0.345	6.90		0.230	46.00
2029	Shallow		0.500			3.500			1.500			1.000		
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	23		0.115	0.06		0.805	3.62		0.345	6.90		0.230	46.00
2030	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2031	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													

**Table 4.1.5
Arctic Spill Occurrence Beaufort Sea Sale 1 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2033	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2034	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2035	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2036	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2037	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2038	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													

Table 4.1.6

Arctic Spill Occurrence Beaufort Sea Sale 1 Production Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009		0.015		0.008	0.045		0.473	0.075		6.900	0.135		7.380
2010	10.9	0.065	0.006	0.033	0.195	0.018	2.048	0.325	0.030	29.900	0.585	0.054	31.980
2011	19.9	0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
2012	30.8	0.180	0.006	0.090	0.540	0.018	5.670	0.900	0.029	82.800	1.620	0.053	88.560
2013	39.8	0.230	0.006	0.115	0.690	0.017	7.245	1.150	0.029	105.800	2.070	0.052	113.160
2014	36.3	0.245	0.007	0.123	0.735	0.020	7.718	1.225	0.034	112.700	2.205	0.061	120.540
2015	44.3	0.295	0.007	0.148	0.885	0.020	9.293	1.475	0.033	135.700	2.655	0.060	145.140
2016	47.5	0.345	0.007	0.173	1.035	0.022	10.868	1.725	0.036	158.700	3.105	0.065	169.740
2017	42.6	0.345	0.008	0.173	1.035	0.024	10.868	1.725	0.040	158.700	3.105	0.073	169.740
2018	38.7	0.345	0.009	0.173	1.035	0.027	10.868	1.725	0.045	158.700	3.105	0.080	169.740
2019	31.9	0.345	0.011	0.173	1.035	0.032	10.868	1.725	0.054	158.700	3.105	0.097	169.740
2020	26.3	0.345	0.013	0.173	1.035	0.039	10.868	1.725	0.066	158.700	3.105	0.118	169.740
2021	21.7	0.345	0.016	0.173	1.035	0.048	10.868	1.725	0.079	158.700	3.105	0.143	169.740
2022	17.9	0.345	0.019	0.173	1.035	0.058	10.868	1.725	0.096	158.700	3.105	0.173	169.740
2023	14.9	0.345	0.023	0.173	1.035	0.069	10.868	1.725	0.116	158.700	3.105	0.208	169.740
2024	12.4	0.345	0.028	0.173	1.035	0.083	10.868	1.725	0.139	158.700	3.105	0.250	169.740
2025	8.2	0.230	0.028	0.115	0.690	0.084	7.245	1.150	0.140	105.800	2.070	0.252	113.160
2026	6.9	0.230	0.033	0.115	0.690	0.100	7.245	1.150	0.167	105.800	2.070	0.300	113.160
2027	3.5	0.115	0.033	0.058	0.345	0.099	3.623	0.575	0.164	52.900	1.035	0.296	56.580
2028	3.0	0.115	0.038	0.058	0.345	0.115	3.623	0.575	0.192	52.900	1.035	0.345	56.580
2029	2.6	0.115	0.044	0.058	0.345	0.133	3.623	0.575	0.221	52.900	1.035	0.398	56.580
2030													
2031													
2032													
2033													
2034													
2035													
2036													
2037													
2038													

**Table 4.1.7
Occurrence Spill Risks Beaufort Sea Sale 1 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2005	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2006	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2007	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2008	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2010	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2011	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2012	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2013	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2014	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2015	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2016	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2017	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

**Table 4.1.7
Occurrence Spill Risks Beaufort Sea Sale 1 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2019	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2020	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2021	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2022	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2023	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2024	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2025	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2026	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2027	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2028	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2029	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2030	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2031	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

**Table 4.1.7
Occurrence Spill Risks Beaufort Sea Sale 1 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2033	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2034	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2035	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2036	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2037	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2038	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.1.8

Arctic Spill Occurrence Beaufort Sea Sale 1 Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2005		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2006		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2007		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2008		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2009		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2010	10.9												
2011	19.9												
2012	30.8												
2013	39.8												
2014	36.3												
2015	44.3												
2016	47.5												
2017	42.6												
2018	38.7												
2019	31.9												
2020	26.3												
2021	21.7												
2022	17.9												
2023	14.9												
2024	12.4												
2025	8.2												
2026	6.9												
2027	3.5												
2028	3.0												
2029	2.6												
2030													
2031													
2032													
2033													
2034													
2035													
2036													
2037													
2038													

**Table 4.1.9
Arctic Spill Occurrence Beaufort Sea Sale 1 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2009	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2011	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2012	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2013	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2014	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2015	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2016	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2017	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.1.9
Arctic Spill Occurrence Beaufort Sea Sale 1 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] = 500		Spill Index bbl	Average Spill [bbl] = 4500		Spill Index bbl	Average Spill [bbl] = 20000		Spill Index bbl	Average Spill [bbl] = 200000		Spill Index bbl
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2019	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2020	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2021	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2022	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2023	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2024	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2025	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2026	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2027	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2028	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2029	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2030	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2031	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.1.9
Arctic Spill Occurrence Beaufort Sea Sale 1 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2033	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2034	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2035	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2036	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2037	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2038	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.1.10

Arctic Spill Occurrence Beaufort Sea Sale 1 Development Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004													
2005													
2006		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2007													
2008		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2009													
2010	10.9	0.026	0.002	0.013	0.078	0.007	0.817	0.156	0.014	17.160	0.260	0.024	17.990
2011	19.9												
2012	30.8												
2013	39.8												
2014	36.3												
2015	44.3												
2016	47.5												
2017	42.6												
2018	38.7												
2019	31.9												
2020	26.3												
2021	21.7												
2022	17.9												
2023	14.9												
2024	12.4												
2025	8.2												
2026	6.9												
2027	3.5												
2028	3.0												
2029	2.6												
2030													
2031													
2032													
2033													
2034													
2035													
2036													
2037													
2038													

**Table 4.1.11
Arctic Spill Occurrence Beaufort Sea Sale 1 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
Total		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911	
2005	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
Total		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911	
2006	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
Total		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901	
2007	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
Total		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911	
2008	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
Total		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901	
2009	Pipeline													
	Platforms		0.289		0.046	0.058		0.354				0.347		0.399
	Production Wells		0.015		0.008	0.045		0.473	0.075		6.900	0.135		7.380
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
Total		0.336		0.069	0.198		1.821	0.225		19.800	0.759		21.690	
2010	Pipeline	10.9	0.718	0.066	0.205	0.565	0.052	2.223	0.174	0.016	3.079	1.457	0.134	5.508
	Platforms		1.254	0.115	0.198	0.250	0.023	1.532				1.504	0.138	1.730
	Production Wells		0.065	0.006	0.033	0.195	0.018	2.048	0.325	0.030	29.900	0.585	0.054	31.980
	Exploration Wells													
	Development Wells		0.026	0.002	0.013	0.078	0.007	0.817	0.156	0.014	17.160	0.260	0.024	17.990
Total		2.063	0.189	0.449	1.088	0.100	6.620	0.655	0.060	50.139	3.806	0.349	57.209	
2011	Pipeline	19.9	0.718	0.036	0.205	0.565	0.028	2.223	0.174	0.009	3.079	1.457	0.073	5.508
	Platforms		2.508	0.126	0.396	0.500	0.025	3.065				3.007	0.151	3.461
	Production Wells		0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
	Exploration Wells													
	Development Wells													
Total		3.356	0.169	0.667	1.455	0.073	9.383	0.824	0.041	62.879	5.635	0.283	72.929	
2012	Pipeline	30.8	1.436	0.047	0.411	1.131	0.037	4.446	0.348	0.011	6.159	2.915	0.095	11.016
	Platforms		3.472	0.113	0.549	0.692	0.022	4.243				4.164	0.135	4.792
	Production Wells		0.180	0.006	0.090	0.540	0.018	5.670	0.900	0.029	82.800	1.620	0.053	88.560
	Exploration Wells													
	Development Wells													
Total		5.088	0.165	1.050	2.363	0.077	14.359	1.248	0.041	88.959	8.699	0.282	104.368	
2013	Pipeline	39.8	1.436	0.036	0.411	1.131	0.028	4.446	0.348	0.009	6.159	2.915	0.073	11.016
	Platforms		4.436	0.111	0.701	0.884	0.022	5.422				5.321	0.134	6.123
	Production Wells		0.230	0.006	0.115	0.690	0.017	7.245	1.150	0.029	105.800	2.070	0.052	113.160
	Exploration Wells													
	Development Wells													
Total		6.102	0.153	1.227	2.705	0.068	17.113	1.498	0.038	111.959	10.306	0.259	130.299	

**Table 4.1.11
Arctic Spill Occurrence Beaufort Sea Sale 1 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2014	Pipeline	36.3	1.436	0.040	0.411	1.131	0.031	4.446	0.348	0.010	6.159	2.915	0.080	11.016
	Platforms		4.750	0.131	0.750	0.946	0.026	5.801				5.696	0.157	6.552
	Production Wells		0.245	0.007	0.123	0.735	0.020	7.718	1.225	0.034	112.700	2.205	0.061	120.540
	Exploration Wells													
	Development Wells													
	Total		6.431	0.177	1.284	2.812	0.077	17.965	1.573	0.043	118.859	10.816	0.298	138.108
2015	Pipeline	44.3	2.787	0.063	0.800	2.133	0.048	8.386	0.660	0.015	11.687	5.580	0.126	20.873
	Platforms		5.794	0.131	0.915	1.153	0.026	7.066				6.946	0.157	7.982
	Production Wells		0.295	0.007	0.148	0.885	0.020	9.293	1.475	0.033	135.700	2.655	0.060	145.140
	Exploration Wells													
	Development Wells													
	Total		8.876	0.200	1.862	4.171	0.094	24.745	2.135	0.048	147.387	15.181	0.343	173.994
2016	Pipeline	47.5	2.787	0.059	0.800	2.133	0.045	8.386	0.660	0.014	11.687	5.580	0.117	20.873
	Platforms		6.838	0.144	1.080	1.359	0.029	8.331				8.197	0.173	9.411
	Production Wells		0.345	0.007	0.173	1.035	0.022	10.868	1.725	0.036	158.700	3.105	0.065	169.740
	Exploration Wells													
	Development Wells													
	Total		9.970	0.210	2.052	4.527	0.095	27.585	2.385	0.050	170.387	16.882	0.355	200.024
2017	Pipeline	42.6	2.787	0.065	0.800	2.133	0.050	8.386	0.660	0.015	11.687	5.580	0.131	20.873
	Platforms		6.838	0.161	1.080	1.359	0.032	8.331				8.197	0.192	9.411
	Production Wells		0.345	0.008	0.173	1.035	0.024	10.868	1.725	0.040	158.700	3.105	0.073	169.740
	Exploration Wells													
	Development Wells													
	Total		9.970	0.234	2.052	4.527	0.106	27.585	2.385	0.056	170.387	16.882	0.396	200.024
2018	Pipeline	38.7	2.787	0.072	0.800	2.133	0.055	8.386	0.660	0.017	11.687	5.580	0.144	20.873
	Platforms		6.838	0.177	1.080	1.359	0.035	8.331				8.197	0.212	9.411
	Production Wells		0.345	0.009	0.173	1.035	0.027	10.868	1.725	0.045	158.700	3.105	0.080	169.740
	Exploration Wells													
	Development Wells													
	Total		9.970	0.258	2.052	4.527	0.117	27.585	2.385	0.062	170.387	16.882	0.436	200.024
2019	Pipeline	31.9	2.787	0.087	0.800	2.133	0.067	8.386	0.660	0.021	11.687	5.580	0.175	20.873
	Platforms		6.838	0.214	1.080	1.359	0.043	8.331				8.197	0.257	9.411
	Production Wells		0.345	0.011	0.173	1.035	0.032	10.868	1.725	0.054	158.700	3.105	0.097	169.740
	Exploration Wells													
	Development Wells													
	Total		9.970	0.313	2.052	4.527	0.142	27.585	2.385	0.075	170.387	16.882	0.529	200.024
2020	Pipeline	26.3	2.787	0.106	0.800	2.133	0.081	8.386	0.660	0.025	11.687	5.580	0.212	20.873
	Platforms		6.838	0.260	1.080	1.359	0.052	8.331				8.197	0.312	9.411
	Production Wells		0.345	0.013	0.173	1.035	0.039	10.868	1.725	0.066	158.700	3.105	0.118	169.740
	Exploration Wells													
	Development Wells													
	Total		9.970	0.379	2.052	4.527	0.172	27.585	2.385	0.091	170.387	16.882	0.642	200.024
2021	Pipeline	21.7	2.787	0.128	0.800	2.133	0.098	8.386	0.660	0.030	11.687	5.580	0.257	20.873
	Platforms		6.838	0.315	1.080	1.359	0.063	8.331				8.197	0.378	9.411
	Production Wells		0.345	0.016	0.173	1.035	0.048	10.868	1.725	0.079	158.700	3.105	0.143	169.740
	Exploration Wells													
	Development Wells													
	Total		9.970	0.459	2.052	4.527	0.209	27.585	2.385	0.110	170.387	16.882	0.778	200.024
2022	Pipeline	17.9	2.787	0.156	0.800	2.133	0.119	8.386	0.660	0.037	11.687	5.580	0.312	20.873
	Platforms		6.838	0.382	1.080	1.359	0.076	8.331				8.197	0.458	9.411
	Production Wells		0.345	0.019	0.173	1.035	0.058	10.868	1.725	0.096	158.700	3.105	0.173	169.740
	Exploration Wells													
	Development Wells													
	Total		9.970	0.557	2.052	4.527	0.253	27.585	2.385	0.133	170.387	16.882	0.943	200.024
2023	Pipeline	14.9	2.787	0.187	0.800	2.133	0.143	8.386	0.660	0.044	11.687	5.580	0.374	20.873
	Platforms		6.838	0.459	1.080	1.359	0.091	8.331				8.197	0.550	9.411
	Production Wells		0.345	0.023	0.173	1.035	0.069	10.868	1.725	0.116	158.700	3.105	0.208	169.740
	Exploration Wells													
	Development Wells													
	Total		9.970	0.669	2.052	4.527	0.304	27.585	2.385	0.160	170.387	16.882	1.133	200.024

**Table 4.1.11
Arctic Spill Occurrence Beaufort Sea Sale 1 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
2024	Pipeline	12.4	2.787	0.225	0.800	2.133	0.172	8.386	0.660	0.053	11.687	5.580	0.450	20.873
	Platforms		6.838	0.551	1.080	1.359	0.110	8.331				8.197	0.661	9.411
	Production Wells		0.345	0.028	0.173	1.035	0.083	10.868	1.725	0.139	158.700	3.105	0.250	169.740
	Exploration Wells													
	Development Wells													
	Total		9.970	0.804	2.052	4.527	0.365	27.585	2.385	0.192	170.387	16.882	1.361	200.024
2025	Pipeline	8.2	2.069	0.252	0.594	1.567	0.191	6.163	0.486	0.059	8.608	4.123	0.503	15.365
	Platforms		4.619	0.563	0.730	0.917	0.112	5.620				5.536	0.675	6.350
	Production Wells		0.230	0.028	0.115	0.690	0.084	7.245	1.150	0.140	105.800	2.070	0.252	113.160
	Exploration Wells													
	Development Wells													
	Total		6.919	0.844	1.439	3.174	0.387	19.028	1.636	0.200	114.408	11.729	1.430	134.875
2026	Pipeline	6.9	2.069	0.300	0.594	1.567	0.227	6.163	0.486	0.070	8.608	4.123	0.597	15.365
	Platforms		4.619	0.669	0.730	0.917	0.133	5.620				5.536	0.802	6.350
	Production Wells		0.230	0.033	0.115	0.690	0.100	7.245	1.150	0.167	105.800	2.070	0.300	113.160
	Exploration Wells													
	Development Wells													
	Total		6.919	1.003	1.439	3.174	0.460	19.028	1.636	0.237	114.408	11.729	1.700	134.875
2027	Pipeline	3.5	1.351	0.386	0.389	1.002	0.286	3.940	0.312	0.089	5.528	2.665	0.762	9.857
	Platforms		2.401	0.686	0.379	0.475	0.136	2.909				2.876	0.822	3.288
	Production Wells		0.115	0.033	0.058	0.345	0.099	3.623	0.575	0.164	52.900	1.035	0.296	56.580
	Exploration Wells													
	Development Wells													
	Total		3.867	1.105	0.825	1.822	0.520	10.472	0.887	0.253	58.428	6.576	1.879	69.725
2028	Pipeline	3.0	1.351	0.450	0.389	1.002	0.334	3.940	0.312	0.104	5.528	2.665	0.888	9.857
	Platforms		2.401	0.800	0.379	0.475	0.158	2.909				2.876	0.959	3.288
	Production Wells		0.115	0.038	0.058	0.345	0.115	3.623	0.575	0.192	52.900	1.035	0.345	56.580
	Exploration Wells													
	Development Wells													
	Total		3.867	1.289	0.825	1.822	0.607	10.472	0.887	0.296	58.428	6.576	2.192	69.725
2029	Pipeline	2.6	1.351	0.520	0.389	1.002	0.385	3.940	0.312	0.120	5.528	2.665	1.025	9.857
	Platforms		2.401	0.924	0.379	0.475	0.183	2.909				2.876	1.106	3.288
	Production Wells		0.115	0.044	0.058	0.345	0.133	3.623	0.575	0.221	52.900	1.035	0.398	56.580
	Exploration Wells													
	Development Wells													
	Total		3.867	1.487	0.825	1.822	0.701	10.472	0.887	0.341	58.428	6.576	2.529	69.725
2030	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2031	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2032	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2033	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													

**Table 4.1.11
Arctic Spill Occurrence Beaufort Sea Sale 1 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
2034	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2035	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2036	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2037	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2038	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													

**Table 4.1.12
Arctic Spill Occurrence Beaufort Sea Sale 1 Annual Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2005		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2006		0.06		0.029	0.17		1.812	0.306		30.06	0.537		31.901
2007		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2008		0.06		0.029	0.17		1.812	0.306		30.06	0.537		31.901
2009		0.34		0.069	0.20		1.821	0.225		19.80	0.759		21.690
2010	10.9	2.06	0.189	0.449	1.09	0.100	6.620	0.655	0.060	50.14	3.806	0.349	57.209
2011	19.9	3.36	0.169	0.667	1.46	0.073	9.383	0.824	0.041	62.88	5.635	0.283	72.929
2012	30.8	5.09	0.165	1.050	2.36	0.077	14.359	1.248	0.041	88.96	8.699	0.282	104.368
2013	39.8	6.10	0.153	1.227	2.71	0.068	17.113	1.498	0.038	111.96	10.306	0.259	130.299
2014	36.3	6.43	0.177	1.284	2.81	0.077	17.965	1.573	0.043	118.86	10.816	0.298	138.108
2015	44.3	8.88	0.200	1.862	4.17	0.094	24.745	2.135	0.048	147.39	15.181	0.343	173.994
2016	47.5	9.97	0.210	2.052	4.53	0.095	27.585	2.385	0.050	170.39	16.882	0.355	200.024
2017	42.6	9.97	0.234	2.052	4.53	0.106	27.585	2.385	0.056	170.39	16.882	0.396	200.024
2018	38.7	9.97	0.258	2.052	4.53	0.117	27.585	2.385	0.062	170.39	16.882	0.436	200.024
2019	31.9	9.97	0.313	2.052	4.53	0.142	27.585	2.385	0.075	170.39	16.882	0.529	200.024
2020	26.3	9.97	0.379	2.052	4.53	0.172	27.585	2.385	0.091	170.39	16.882	0.642	200.024
2021	21.7	9.97	0.459	2.052	4.53	0.209	27.585	2.385	0.110	170.39	16.882	0.778	200.024
2022	17.9	9.97	0.557	2.052	4.53	0.253	27.585	2.385	0.133	170.39	16.882	0.943	200.024
2023	14.9	9.97	0.669	2.052	4.53	0.304	27.585	2.385	0.160	170.39	16.882	1.133	200.024
2024	12.4	9.97	0.804	2.052	4.53	0.365	27.585	2.385	0.192	170.39	16.882	1.361	200.024
2025	8.2	6.92	0.844	1.439	3.17	0.387	19.028	1.636	0.200	114.41	11.729	1.430	134.875
2026	6.9	6.92	1.003	1.439	3.17	0.460	19.028	1.636	0.237	114.41	11.729	1.700	134.875
2027	3.5	3.87	1.105	0.825	1.82	0.520	10.472	0.887	0.253	58.43	6.576	1.879	69.725
2028	3.0	3.87	1.289	0.825	1.82	0.607	10.472	0.887	0.296	58.43	6.576	2.192	69.725
2029	2.6	3.87	1.487	0.825	1.82	0.701	10.472	0.887	0.341	58.43	6.576	2.529	69.725
2030													
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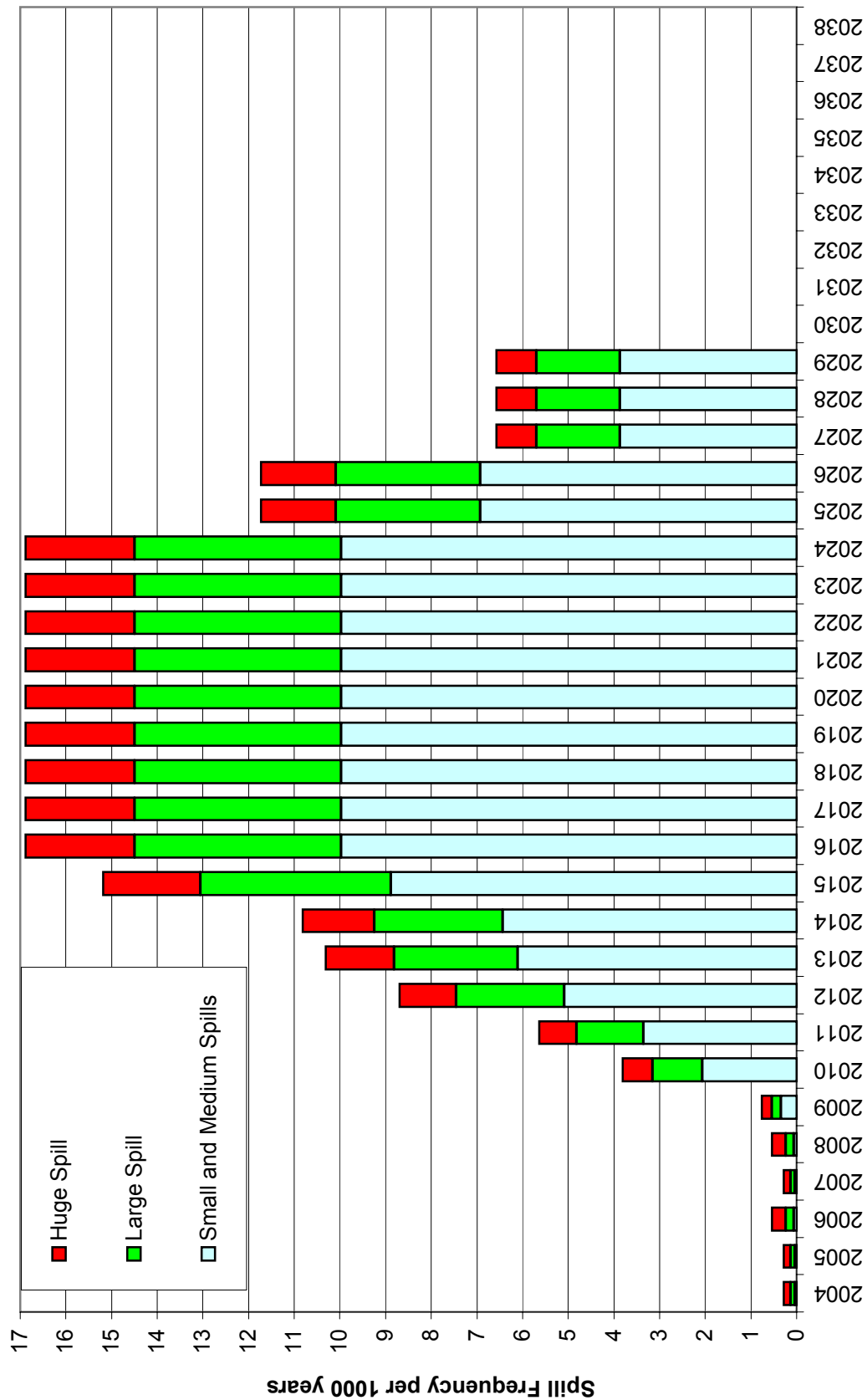
**Table 4.1.13
Arctic Spill Occurrence Beaufort Sea Sale 1 Wells Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2005		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2006		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901
2007		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2008		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901
2009		0.047		0.023	0.140		1.467	0.225		19.800	0.412		21.291
2010	10.9	0.091	0.008	0.046	0.273	0.025	2.865	0.481	0.044	47.060	0.845	0.078	49.970
2011	19.9	0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
2012	30.8	0.180	0.006	0.090	0.540	0.018	5.670	0.900	0.029	82.800	1.620	0.053	88.560
2013	39.8	0.230	0.006	0.115	0.690	0.017	7.245	1.150	0.029	105.800	2.070	0.052	113.160
2014	36.3	0.245	0.007	0.123	0.735	0.020	7.718	1.225	0.034	112.700	2.205	0.061	120.540
2015	44.3	0.295	0.007	0.148	0.885	0.020	9.293	1.475	0.033	135.700	2.655	0.060	145.140
2016	47.5	0.345	0.007	0.173	1.035	0.022	10.868	1.725	0.036	158.700	3.105	0.065	169.740
2017	42.6	0.345	0.008	0.173	1.035	0.024	10.868	1.725	0.040	158.700	3.105	0.073	169.740
2018	38.7	0.345	0.009	0.173	1.035	0.027	10.868	1.725	0.045	158.700	3.105	0.080	169.740
2019	31.9	0.345	0.011	0.173	1.035	0.032	10.868	1.725	0.054	158.700	3.105	0.097	169.740
2020	26.3	0.345	0.013	0.173	1.035	0.039	10.868	1.725	0.066	158.700	3.105	0.118	169.740
2021	21.7	0.345	0.016	0.173	1.035	0.048	10.868	1.725	0.079	158.700	3.105	0.143	169.740
2022	17.9	0.345	0.019	0.173	1.035	0.058	10.868	1.725	0.096	158.700	3.105	0.173	169.740
2023	14.9	0.345	0.023	0.173	1.035	0.069	10.868	1.725	0.116	158.700	3.105	0.208	169.740
2024	12.4	0.345	0.028	0.173	1.035	0.083	10.868	1.725	0.139	158.700	3.105	0.250	169.740
2025	8.2	0.230	0.028	0.115	0.690	0.084	7.245	1.150	0.140	105.800	2.070	0.252	113.160
2026	6.9	0.230	0.033	0.115	0.690	0.100	7.245	1.150	0.167	105.800	2.070	0.300	113.160
2027	3.5	0.115	0.033	0.058	0.345	0.099	3.623	0.575	0.164	52.900	1.035	0.296	56.580
2028	3.0	0.115	0.038	0.058	0.345	0.115	3.623	0.575	0.192	52.900	1.035	0.345	56.580
2029	2.6	0.115	0.044	0.058	0.345	0.133	3.623	0.575	0.221	52.900	1.035	0.398	56.580
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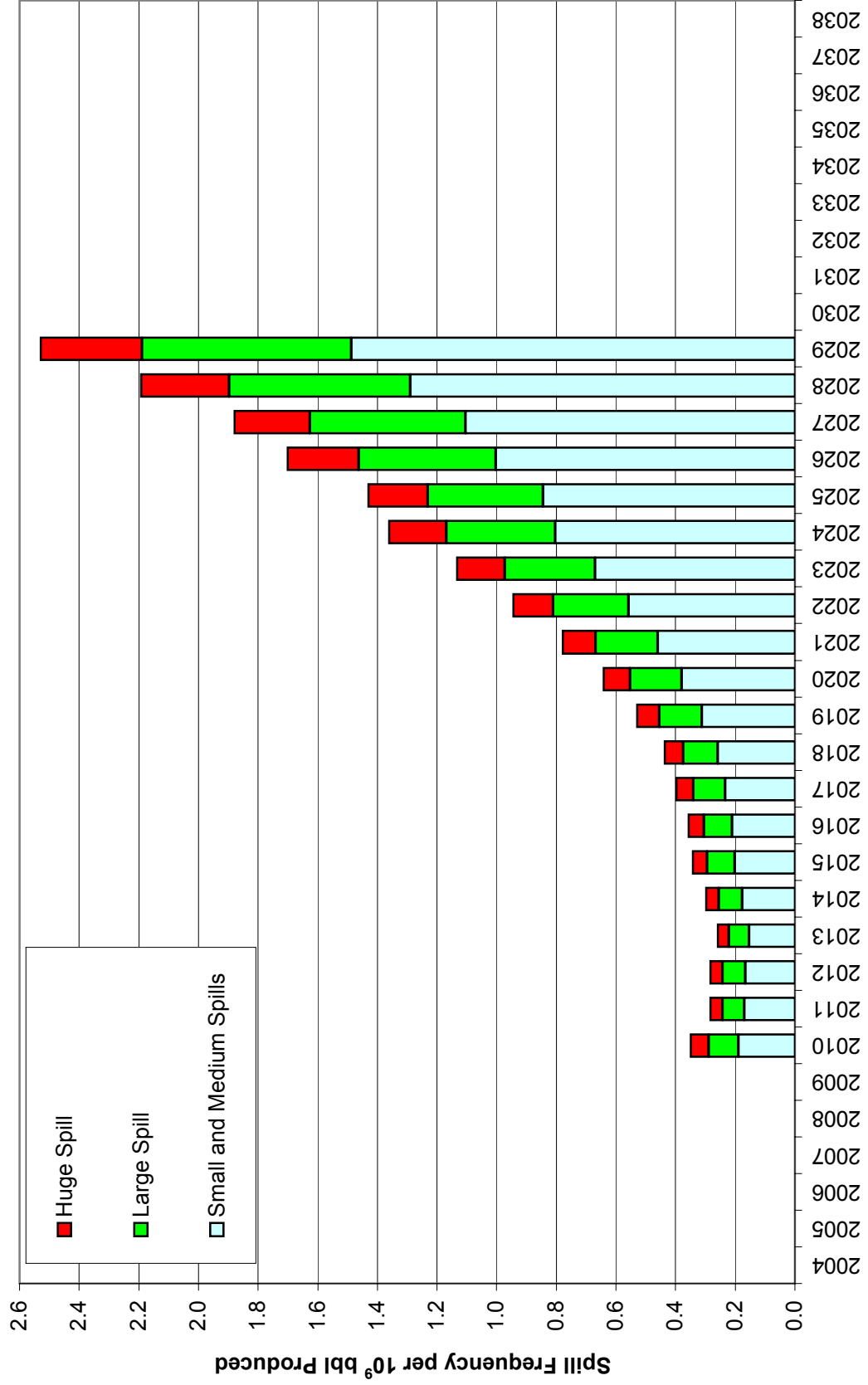
Table 4.1.14
Beufort Sea Sale 1 Year 2016 - Monte Carlo Results

SALE 1	Small and Medium Spills			Large Spill			Huge Spill		
Year 2016	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
Mean =	9.67	0.20	2.02	4.53	0.10	27.58	2.39	0.05	170.39
Std Deviation =	1.03	0.02	0.18	0.54	0.01	2.20	0.15	0.00	2.61
Variance =	1.07	0.00	0.03	0.29	0.00	4.84	0.02	0.00	6.83
Skewness =	-0.04	-0.04	0.01	0.41	0.41	0.37	0.41	0.41	0.41
Kurtosis =	2.87	2.87	2.89	2.66	2.66	2.70	2.57	2.57	2.57
Mode =	8.63	0.18	1.83	3.97	0.09	29.13	2.33	0.05	167.05
Minimum =	6.02	0.127	1.35	3.20	0.067	21.72	2.00	0.042	163.64
5% Perc =	7.96	0.168	1.71	3.75	0.079	24.31	2.17	0.046	166.63
10% Perc =	8.34	0.176	1.78	3.88	0.082	24.90	2.21	0.046	167.23
15% Perc =	8.59	0.181	1.83	3.97	0.083	25.31	2.23	0.047	167.68
20% Perc =	8.79	0.185	1.86	4.05	0.085	25.62	2.25	0.047	168.05
25% Perc =	8.97	0.189	1.89	4.12	0.087	25.94	2.27	0.048	168.38
30% Perc =	9.13	0.192	1.92	4.19	0.088	26.22	2.29	0.048	168.72
35% Perc =	9.27	0.195	1.95	4.27	0.090	26.56	2.31	0.049	169.04
40% Perc =	9.42	0.198	1.97	4.33	0.091	26.83	2.33	0.049	169.38
45% Perc =	9.55	0.201	2.00	4.40	0.093	27.10	2.35	0.049	169.72
50% Perc =	9.67	0.204	2.02	4.46	0.094	27.38	2.37	0.050	170.05
55% Perc =	9.80	0.206	2.04	4.54	0.095	27.64	2.39	0.050	170.42
60% Perc =	9.95	0.209	2.07	4.61	0.097	27.94	2.41	0.051	170.81
65% Perc =	10.08	0.212	2.09	4.69	0.099	28.28	2.43	0.051	171.26
70% Perc =	10.22	0.215	2.11	4.79	0.101	28.65	2.46	0.052	171.73
75% Perc =	10.37	0.218	2.14	4.89	0.103	29.09	2.49	0.052	172.22
80% Perc =	10.54	0.222	2.17	5.00	0.105	29.49	2.52	0.053	172.78
85% Perc =	10.73	0.226	2.21	5.12	0.108	30.00	2.55	0.054	173.30
90% Perc =	11.01	0.232	2.26	5.28	0.111	30.67	2.60	0.055	174.12
95% Perc =	11.36	0.239	2.33	5.52	0.116	31.58	2.65	0.056	175.06
Maximum =	13.01	0.274	2.65	6.33	0.133	35.39	2.85	0.060	178.64

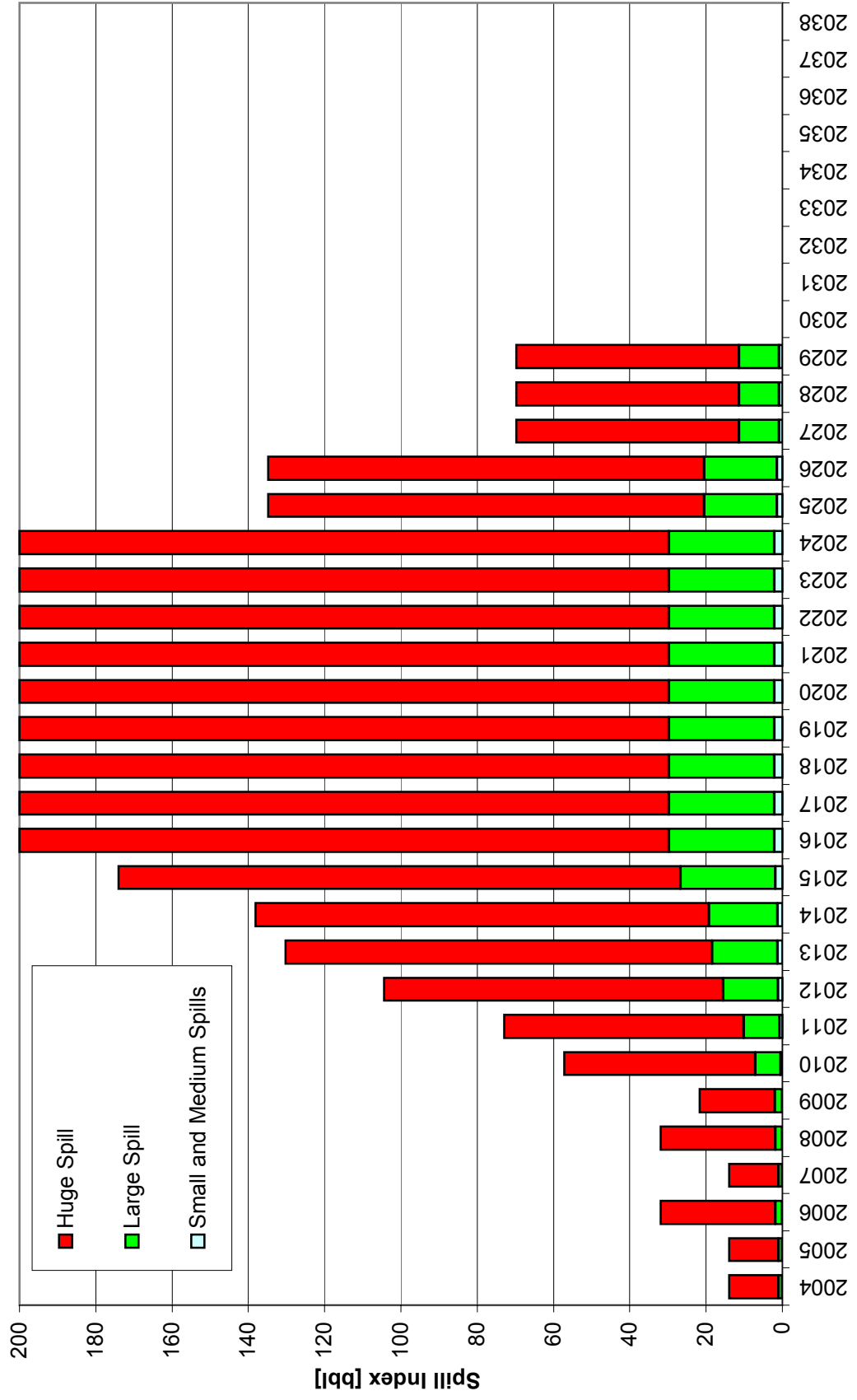
Beaufort Sea Sale 1 Spill Frequency



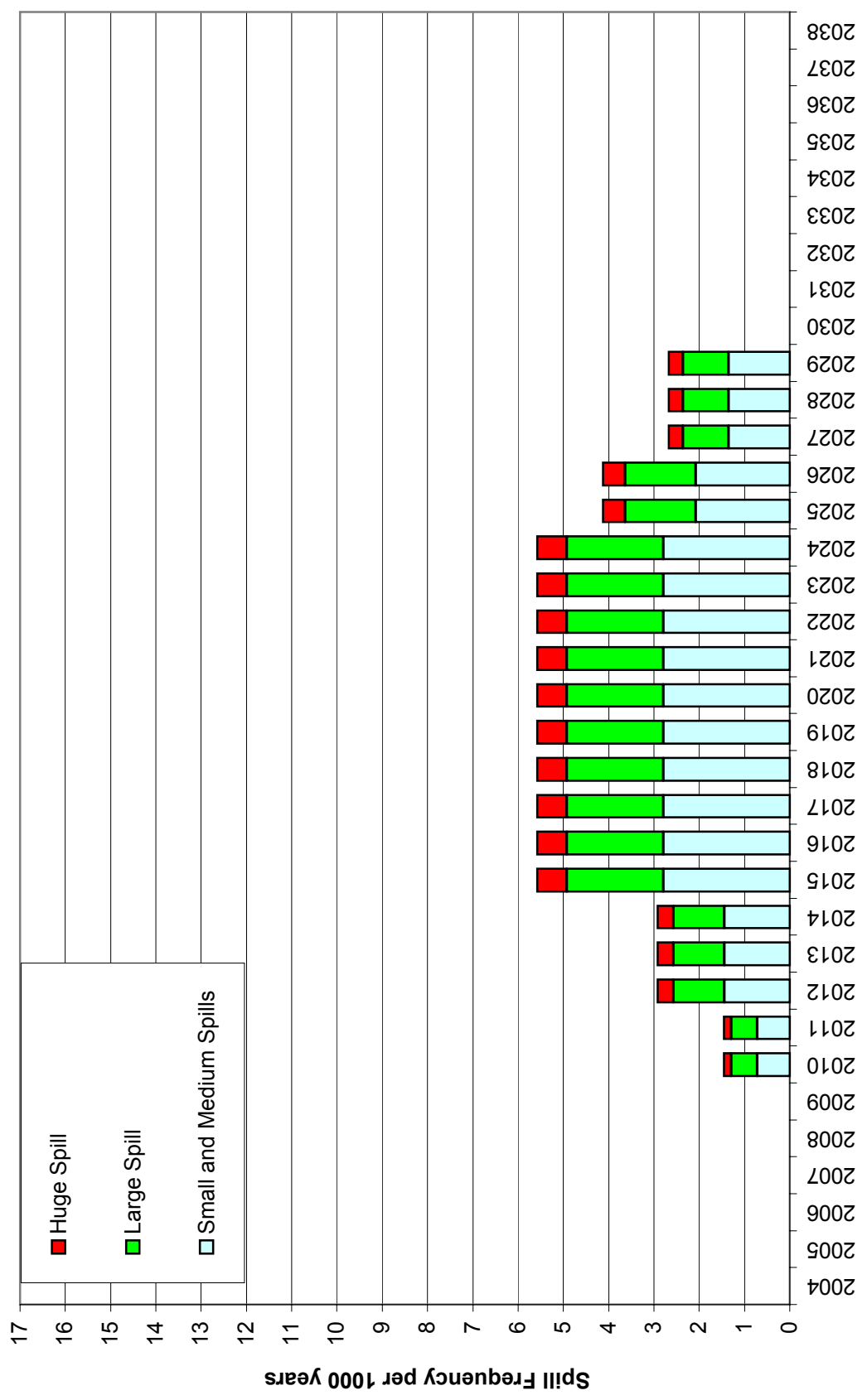
Beaufort Sea Sale 1 Spill Frequency per 10⁹ bbl Produced



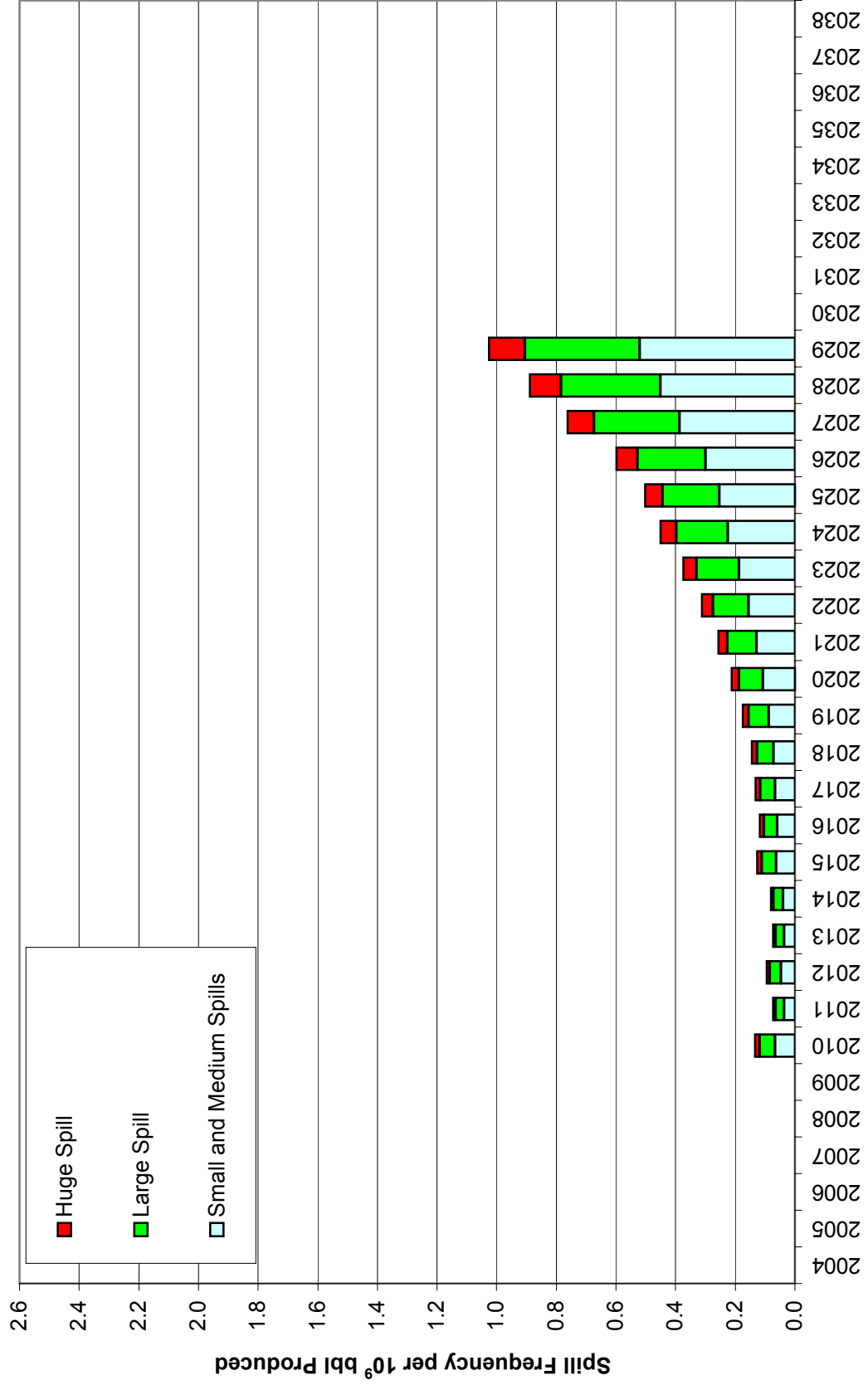
Beaufort Sea Sale 1 Spill Index



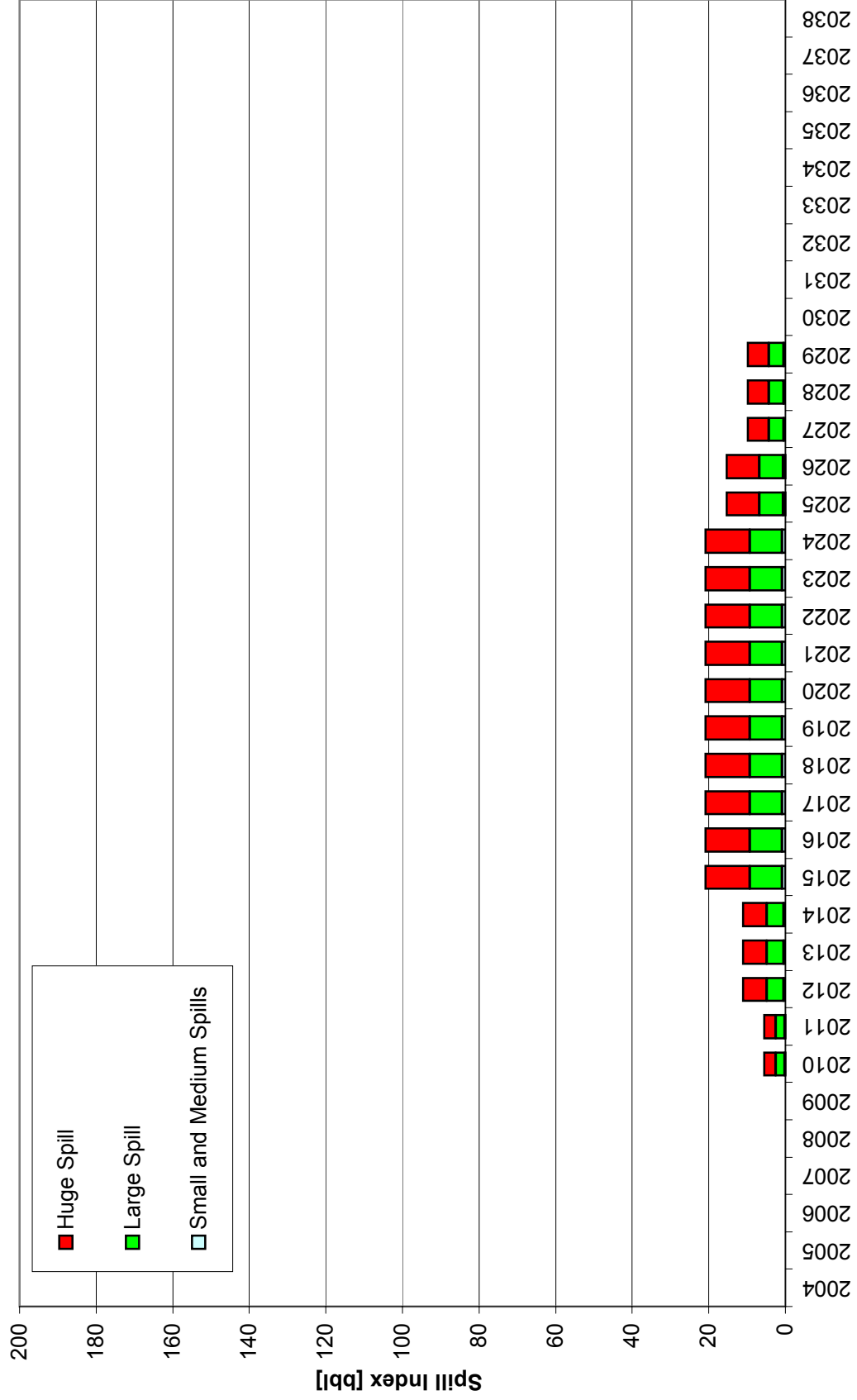
Beaufort Sea Sale 1 Spill Frequency - P/L



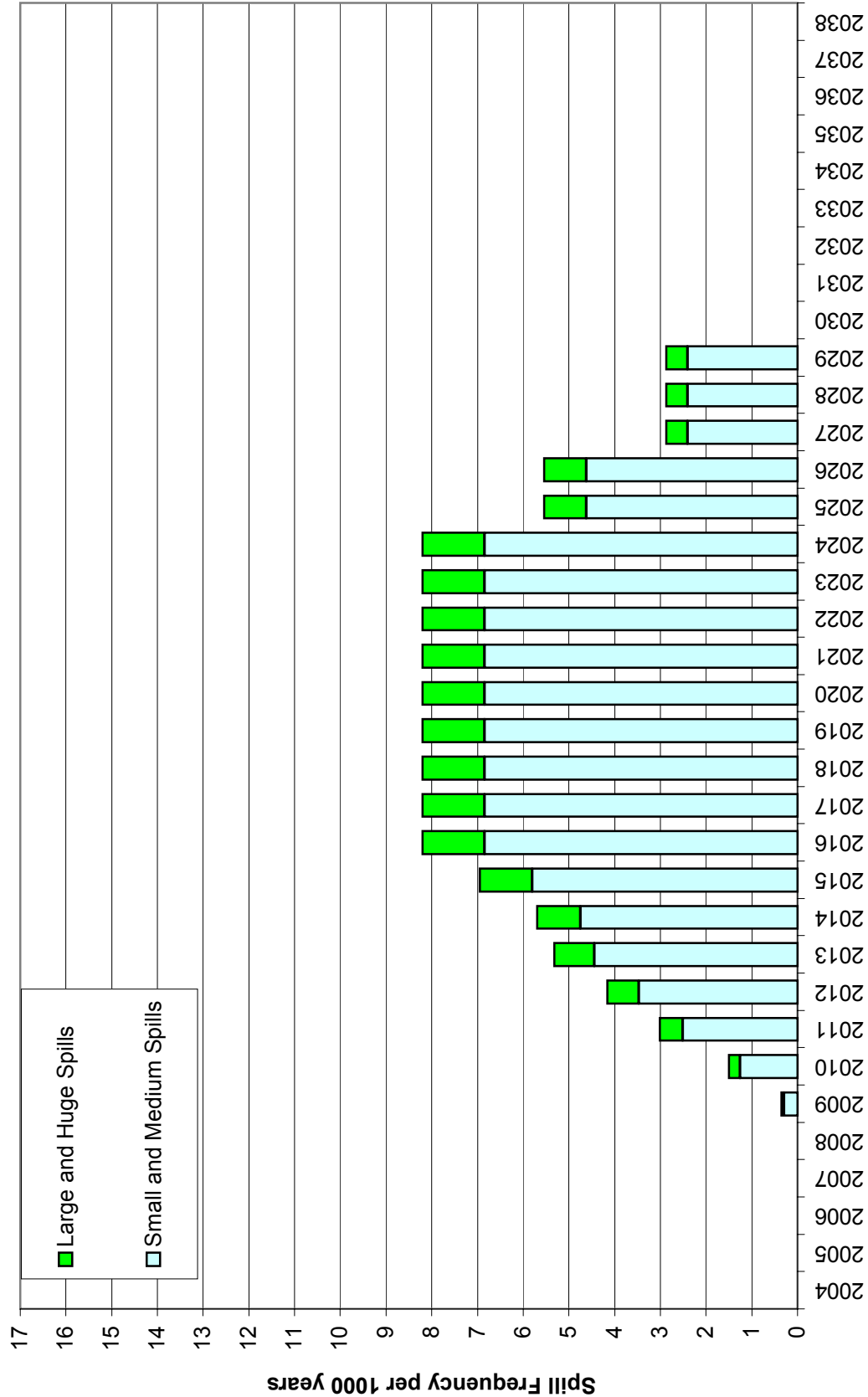
Beaufort Sea Sale 1 Spill Frequency per 10⁹ bbl Produced - P/L



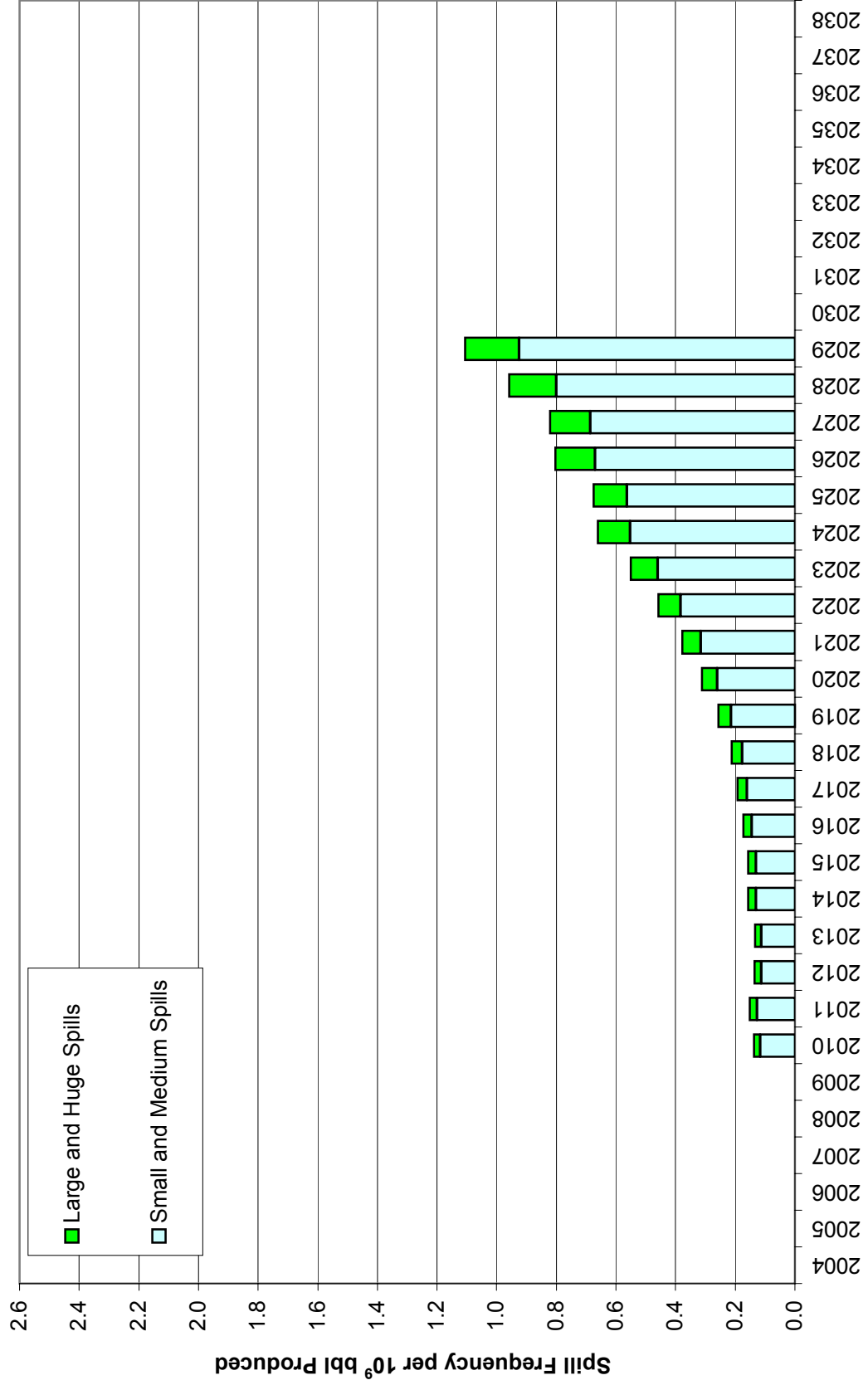
Beaufort Sea Sale 1 Spill Index - P/L



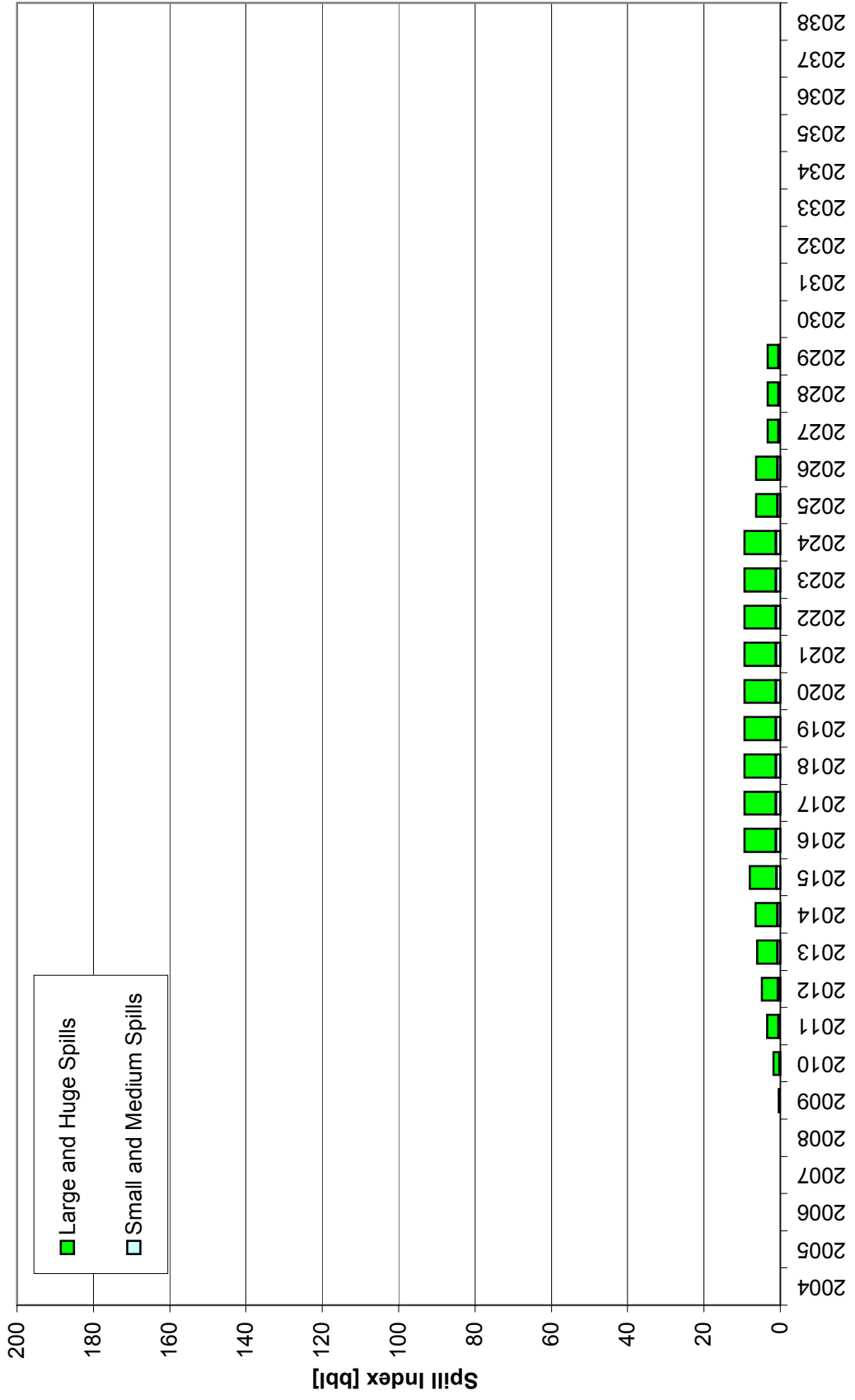
Beaufort Sea Sale 1 Spill Frequency - Platforms



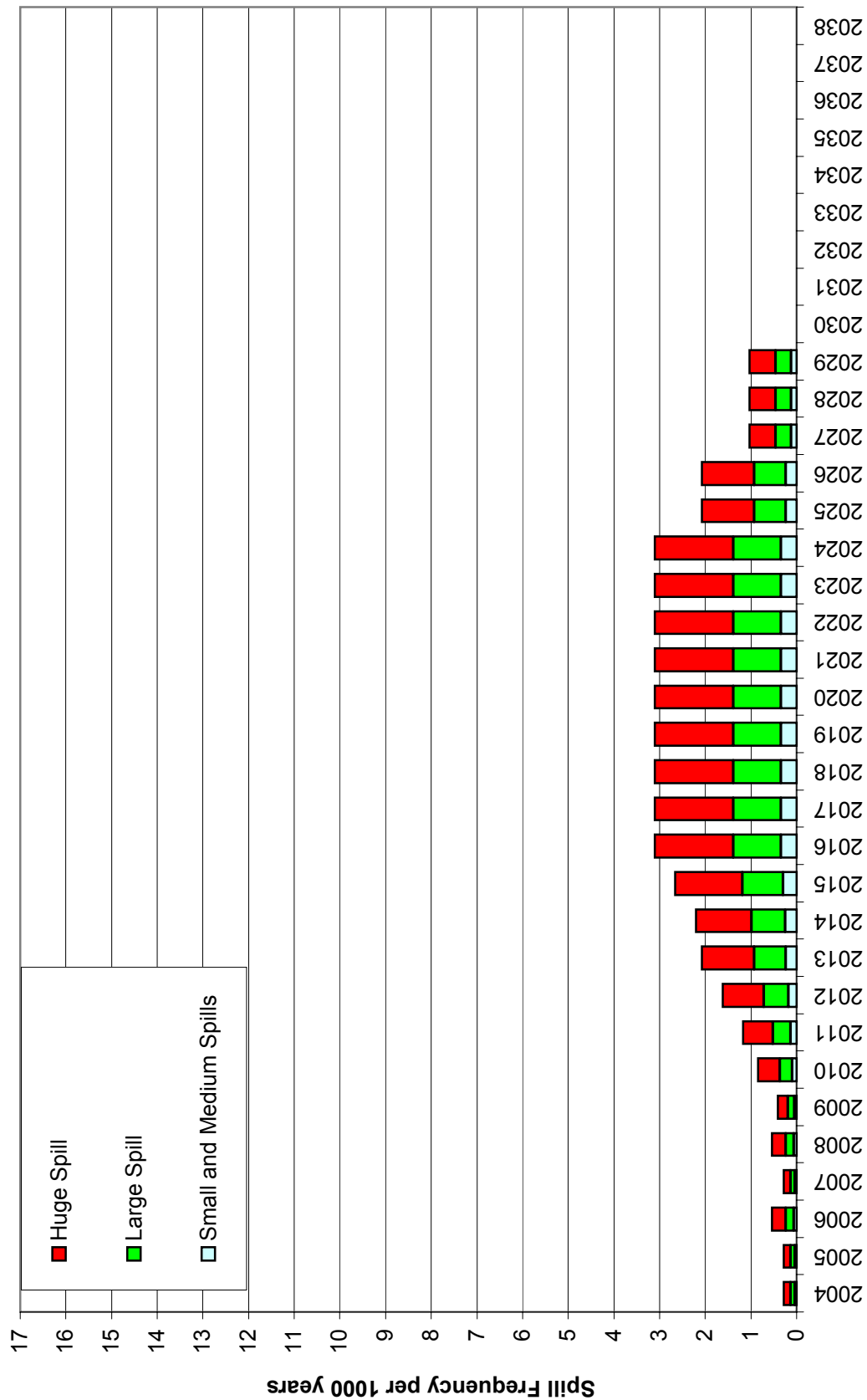
Beaufort Sea Sale 1 Spill Frequency per 10⁹ bbl Produced - Platforms



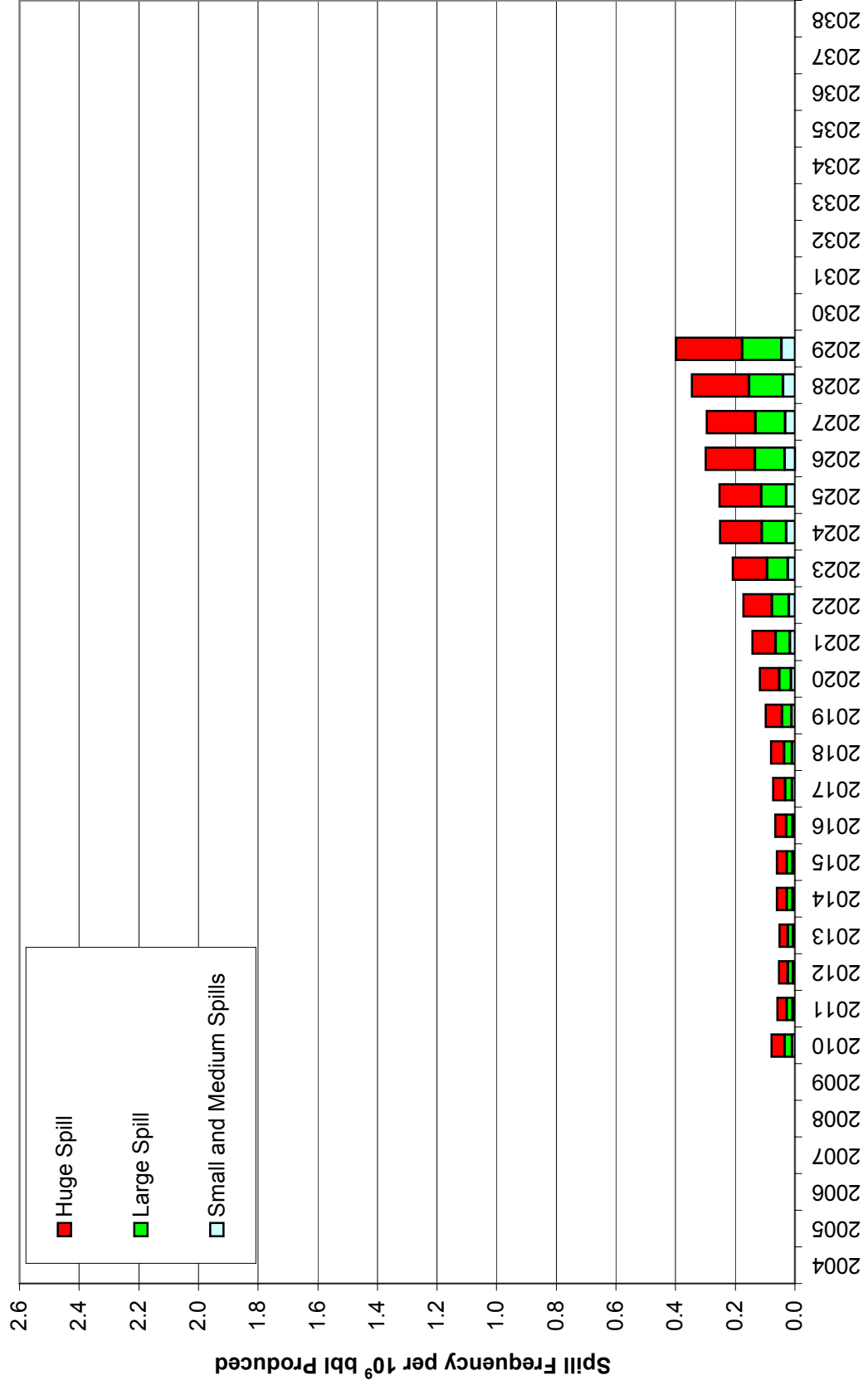
Beaufort Sea Sale 1 Spill Index - Platforms



Beaufort Sea Sale 1 Spill Frequency - Wells



Beaufort Sea Sale 1 Spill Frequency per 10⁹ bbl Produced - Wells



Beaufort Sea Sale 1 Spill Index - Wells

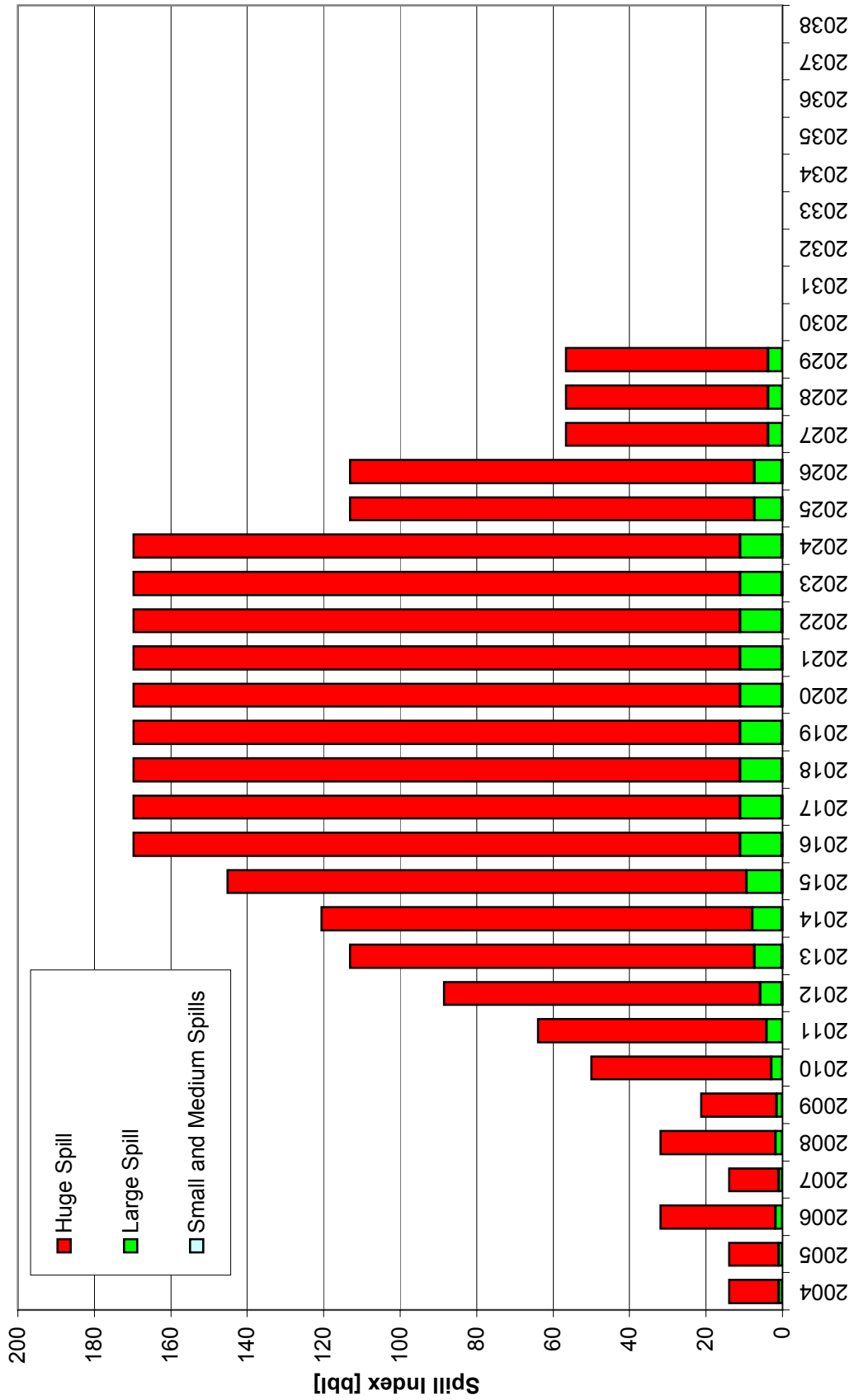
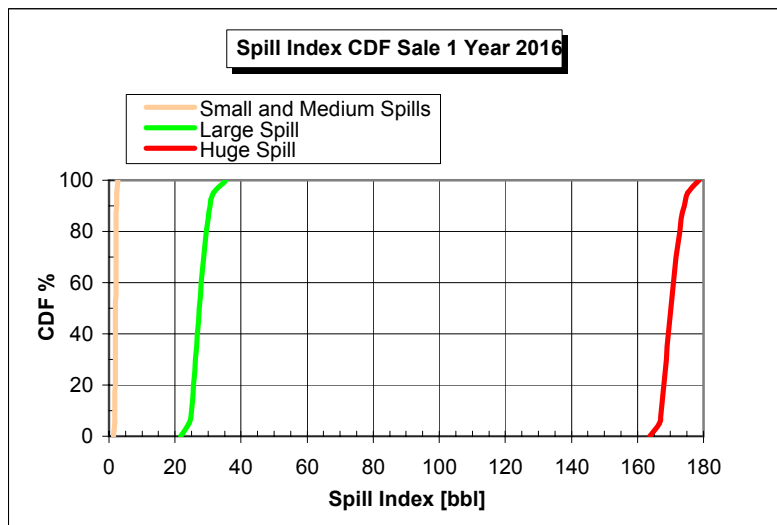
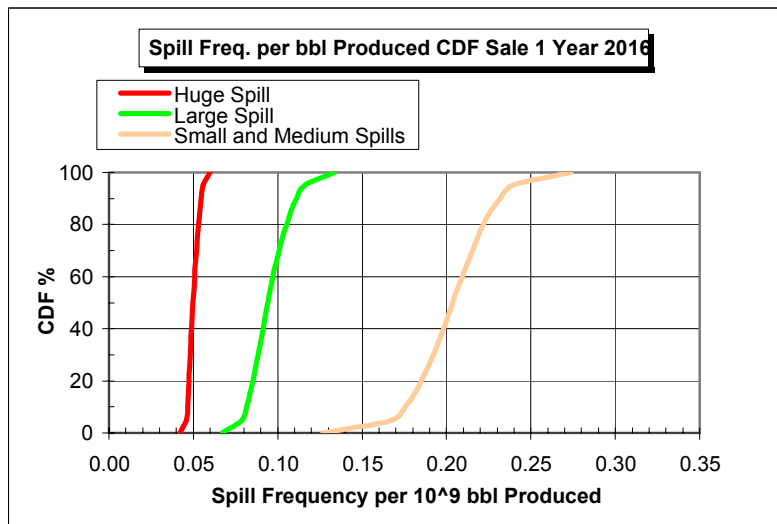
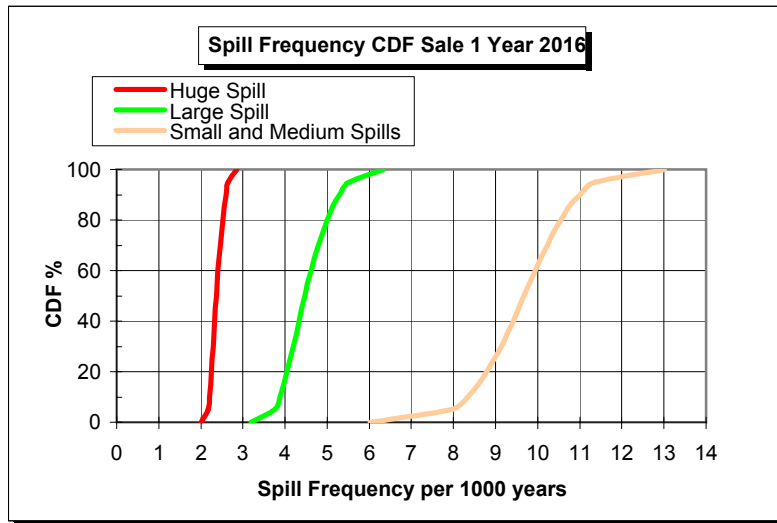


Figure 4.1.13



**Table 4.2.2
Arctic Spill Occurrence Beaufort Sea Sale 2 P/L Summary**

Year	Production [Mmbbl]			Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills					
	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]			
2004																								
2005																								
2006																								
2007																								
2008																								
2009																								
2010																								
2011																								
2012																								
2013	10.9	0.330	0.030	0.019	0.747	0.069	0.289	0.069	0.289	0.308	0.848	0.078	3.335	0.261	0.024	4.619	0.024	4.619	2.186	0.201	2.186	0.110	8.262	
2014	19.9	0.330	0.017	0.019	0.747	0.038	0.289	0.038	0.289	0.308	0.848	0.043	3.335	0.261	0.013	4.619	0.013	4.619	2.186	0.110	2.186	0.110	8.262	
2015	19.9	0.330	0.017	0.019	0.747	0.038	0.289	0.038	0.289	0.308	0.848	0.043	3.335	0.261	0.013	4.619	0.013	4.619	2.186	0.110	2.186	0.110	8.262	
2016	19.9	0.330	0.017	0.019	0.747	0.038	0.289	0.038	0.289	0.308	0.848	0.043	3.335	0.261	0.013	4.619	0.013	4.619	2.186	0.110	2.186	0.110	8.262	
2017	34.8	0.875	0.025	0.051	1.929	0.055	0.718	0.055	0.718	0.768	1.996	0.057	7.921	0.612	0.018	10.702	0.018	10.702	5.411	0.155	5.411	0.155	19.392	
2018	44.2	0.875	0.020	0.051	1.929	0.044	0.718	0.044	0.718	0.768	1.996	0.045	7.921	0.612	0.014	10.702	0.014	10.702	5.411	0.122	5.411	0.122	19.392	
2019	41.9	0.875	0.021	0.051	1.929	0.046	0.718	0.046	0.718	0.768	1.996	0.048	7.921	0.612	0.015	10.702	0.015	10.702	5.411	0.129	5.411	0.129	19.392	
2020	39.9	0.875	0.022	0.051	1.929	0.048	0.718	0.048	0.718	0.768	1.996	0.050	7.921	0.612	0.015	10.702	0.015	10.702	5.411	0.136	5.411	0.136	19.392	
2021	38.3	0.875	0.023	0.051	1.929	0.050	0.718	0.050	0.718	0.768	1.996	0.052	7.921	0.612	0.016	10.702	0.016	10.702	5.411	0.141	5.411	0.141	19.392	
2022	32.7	0.875	0.027	0.051	1.929	0.059	0.718	0.059	0.718	0.768	1.996	0.061	7.921	0.612	0.019	10.702	0.019	10.702	5.411	0.165	5.411	0.165	19.392	
2023	27.9	0.875	0.031	0.051	1.929	0.069	0.718	0.069	0.718	0.768	1.996	0.072	7.921	0.612	0.022	10.702	0.022	10.702	5.411	0.194	5.411	0.194	19.392	
2024	23.8	0.875	0.037	0.051	1.929	0.081	0.718	0.081	0.718	0.768	1.996	0.084	7.921	0.612	0.026	10.702	0.026	10.702	5.411	0.227	5.411	0.227	19.392	
2025	20.3	0.875	0.043	0.051	1.929	0.095	0.718	0.095	0.718	0.768	1.996	0.098	7.921	0.612	0.030	10.702	0.030	10.702	5.411	0.267	5.411	0.267	19.392	
2026	17.3	0.875	0.051	0.051	1.929	0.112	0.718	0.112	0.718	0.768	1.996	0.115	7.921	0.612	0.035	10.702	0.035	10.702	5.411	0.313	5.411	0.313	19.392	
2027	14.8	0.875	0.059	0.051	1.929	0.130	0.718	0.130	0.718	0.768	1.996	0.135	7.921	0.612	0.041	10.702	0.041	10.702	5.411	0.366	5.411	0.366	19.392	
2028	10.7	0.545	0.051	0.032	1.182	0.110	0.429	0.110	0.429	0.460	1.148	0.107	4.587	0.351	0.033	6.083	0.033	6.083	3.225	0.301	3.225	0.301	11.130	
2029	9.2	0.545	0.059	0.032	1.182	0.128	0.429	0.128	0.429	0.460	1.148	0.125	4.587	0.351	0.038	6.083	0.038	6.083	3.225	0.351	3.225	0.351	11.130	
2030	7.9	0.545	0.069	0.032	1.182	0.150	0.429	0.150	0.429	0.460	1.148	0.145	4.587	0.351	0.044	6.083	0.044	6.083	3.225	0.408	3.225	0.408	11.130	
2031	6.8	0.545	0.080	0.024	1.182	0.174	0.365	0.174	0.365	0.389	1.148	0.169	3.940	0.351	0.052	5.528	0.052	5.528	3.225	0.474	3.225	0.474	9.857	
2032	5.8	0.545	0.094	0.032	1.182	0.204	0.429	0.204	0.429	0.460	1.148	0.198	4.587	0.351	0.060	6.083	0.060	6.083	3.225	0.556	3.225	0.556	11.130	
2033	5.0	0.545	0.109	0.032	1.182	0.236	0.429	0.236	0.429	0.460	1.148	0.230	4.587	0.351	0.070	6.083	0.070	6.083	3.225	0.645	3.225	0.645	11.130	
2034	4.3	0.545	0.127	0.032	1.182	0.275	0.429	0.275	0.429	0.460	1.148	0.267	4.587	0.351	0.082	6.083	0.082	6.083	3.225	0.750	3.225	0.750	11.130	
2035	3.7	0.545	0.147	0.032	1.182	0.319	0.429	0.319	0.429	0.460	1.148	0.310	4.587	0.351	0.095	6.083	0.095	6.083	3.225	0.872	3.225	0.872	11.130	
2036																								
2037																								
2038																								

**Table 4.2.3
Arctic Spill Occurrence Beaufort Sea Sale 2 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2005	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2006	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2007	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2008	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2009	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2010	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2011	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2012	Shallow	1	3	0.964	0.289	0.05	0.192	0.058	0.35
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total	1	3		0.289	0.05		0.058	0.35
2013	Shallow	1	13	0.964	1.254	0.20	0.192	0.250	1.53
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total	1	13		1.254	0.20		0.250	1.53
2014	Shallow	1	23	0.964	2.218	0.35	0.192	0.442	2.71
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total	1	23		2.218	0.35		0.442	2.71
2015	Shallow	1	23	0.964	2.218	0.35	0.192	0.442	2.71
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total	1	23		2.218	0.35		0.442	2.71
2016	Shallow	1	23	0.964	2.218	0.35	0.192	0.442	2.71
	Medium	1	3	1.044	0.313	0.05	0.206	0.062	0.38
	Deep			1.163			0.227		
	Total	2	26		2.531	0.40		0.504	3.09
2017	Shallow	1	23	0.964	2.218	0.35	0.192	0.442	2.71
	Medium	2	16	1.044	1.670	0.26	0.206	0.330	2.02
	Deep			1.163			0.227		
	Total	3	39		3.889	0.61		0.772	4.73

**Table 4.2.3
Arctic Spill Occurrence Beaufort Sea Sale 2 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow	1	23	0.964	2.218	0.35	0.192	0.442	2.71
	Medium	2	36	1.044	3.758	0.59	0.206	0.743	4.55
	Deep			1.163			0.227		
	Total	3	59		5.977	0.94		1.185	7.26
2019	Shallow	1	23	0.964	2.218	0.35	0.192	0.442	2.71
	Medium	2	46	1.044	4.802	0.76	0.206	0.949	5.82
	Deep			1.163			0.227		
	Total	3	69		7.021	1.11		1.391	8.53
2020	Shallow	1	23	0.964	2.218	0.35	0.192	0.442	2.71
	Medium	2	46	1.044	4.802	0.76	0.206	0.949	5.82
	Deep			1.163			0.227		
	Total	3	69		7.021	1.11		1.391	8.53
2021	Shallow	1	23	0.964	2.218	0.35	0.192	0.442	2.71
	Medium	2	46	1.044	4.802	0.76	0.206	0.949	5.82
	Deep			1.163			0.227		
	Total	3	69		7.021	1.11		1.391	8.53
2022	Shallow	1	23	0.964	2.218	0.35	0.192	0.442	2.71
	Medium	2	46	1.044	4.802	0.76	0.206	0.949	5.82
	Deep			1.163			0.227		
	Total	3	69		7.021	1.11		1.391	8.53
2023	Shallow	1	23	0.964	2.218	0.35	0.192	0.442	2.71
	Medium	2	46	1.044	4.802	0.76	0.206	0.949	5.82
	Deep			1.163			0.227		
	Total	3	69		7.021	1.11		1.391	8.53
2024	Shallow	1	23	0.964	2.218	0.35	0.192	0.442	2.71
	Medium	2	46	1.044	4.802	0.76	0.206	0.949	5.82
	Deep			1.163			0.227		
	Total	3	69		7.021	1.11		1.391	8.53
2025	Shallow	1	23	0.964	2.218	0.35	0.192	0.442	2.71
	Medium	2	46	1.044	4.802	0.76	0.206	0.949	5.82
	Deep			1.163			0.227		
	Total	3	69		7.021	1.11		1.391	8.53
2026	Shallow	1	23	0.964	2.218	0.35	0.192	0.442	2.71
	Medium	2	46	1.044	4.802	0.76	0.206	0.949	5.82
	Deep			1.163			0.227		
	Total	3	69		7.021	1.11		1.391	8.53
2027	Shallow	1	23	0.964	2.218	0.35	0.192	0.442	2.71
	Medium	2	46	1.044	4.802	0.76	0.206	0.949	5.82
	Deep			1.163			0.227		
	Total	3	69		7.021	1.11		1.391	8.53
2028	Shallow			0.964			0.192		
	Medium	2	46	1.044	4.802	0.76	0.206	0.949	5.82
	Deep			1.163			0.227		
	Total	2	46		4.802	0.76		0.949	5.82
2029	Shallow			0.964			0.192		
	Medium	2	46	1.044	4.802	0.76	0.206	0.949	5.82
	Deep			1.163			0.227		
	Total	2	46		4.802	0.76		0.949	5.82
2030	Shallow			0.964			0.192		
	Medium	2	46	1.044	4.802	0.76	0.206	0.949	5.82
	Deep			1.163			0.227		
	Total	2	46		4.802	0.76		0.949	5.82
2031	Shallow			0.964			0.192		
	Medium	2	46	1.044	4.802	0.76	0.206	0.949	5.82
	Deep			1.163			0.227		
	Total	2	46		4.802	0.76		0.949	5.82

**Table 4.2.3
Arctic Spill Occurrence Beaufort Sea Sale 2 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow			0.964			0.192		
	Medium	2	46	1.044	4.802	0.76	0.206	0.949	5.82
	Deep			1.163			0.227		
	Total	2	46		4.802	0.76		0.949	5.82
2033	Shallow			0.964			0.192		
	Medium	2	46	1.044	4.802	0.76	0.206	0.949	5.82
	Deep			1.163			0.227		
	Total	2	46		4.802	0.76		0.949	5.82
2034	Shallow			0.964			0.192		
	Medium	2	46	1.044	4.802	0.76	0.206	0.949	5.82
	Deep			1.163			0.227		
	Total	2	46		4.802	0.76		0.949	5.82
2035	Shallow			0.964			0.192		
	Medium	2	46	1.044	4.802	0.76	0.206	0.949	5.82
	Deep			1.163			0.227		
	Total	2	46		4.802	0.76		0.949	5.82
2036	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2037	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2038	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								

**Table 4.2.4
Arctic Spill Occurrence Beaufort Sea Sale 2 Platforms Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004										
2005										
2006										
2007										
2008										
2009										
2010										
2011										
2012		0.289		0.046	0.058		0.354	0.347		0.399
2013	10.9	1.254	0.115	0.198	0.250	0.023	1.532	1.504	0.138	1.730
2014	19.9	2.218	0.111	0.350	0.442	0.022	2.711	2.660	0.134	3.061
2015	19.9	2.218	0.111	0.350	0.442	0.022	2.711	2.660	0.134	3.061
2016	19.9	2.531	0.127	0.400	0.504	0.025	3.090	3.036	0.153	3.490
2017	34.8	3.889	0.112	0.614	0.772	0.022	4.735	4.661	0.134	5.349
2018	44.2	5.977	0.135	0.944	1.185	0.027	7.264	7.162	0.162	8.208
2019	41.9	7.021	0.168	1.109	1.391	0.033	8.529	8.412	0.201	9.638
2020	39.9	7.021	0.176	1.109	1.391	0.035	8.529	8.412	0.211	9.638
2021	38.3	7.021	0.183	1.109	1.391	0.036	8.529	8.412	0.220	9.638
2022	32.7	7.021	0.215	1.109	1.391	0.043	8.529	8.412	0.257	9.638
2023	27.9	7.021	0.252	1.109	1.391	0.050	8.529	8.412	0.302	9.638
2024	23.8	7.021	0.295	1.109	1.391	0.058	8.529	8.412	0.353	9.638
2025	20.3	7.021	0.346	1.109	1.391	0.069	8.529	8.412	0.414	9.638
2026	17.3	7.021	0.406	1.109	1.391	0.080	8.529	8.412	0.486	9.638
2027	14.8	7.021	0.474	1.109	1.391	0.094	8.529	8.412	0.568	9.638
2028	10.7	4.802	0.449	0.759	0.949	0.089	5.818	5.752	0.538	6.577
2029	9.2	4.802	0.522	0.759	0.949	0.103	5.818	5.752	0.625	6.577
2030	7.9	4.802	0.608	0.759	0.949	0.120	5.818	5.752	0.728	6.577
2031	6.8	4.802	0.706	0.759	0.949	0.140	5.818	5.752	0.846	6.577
2032	5.8	4.802	0.828	0.759	0.949	0.164	5.818	5.752	0.992	6.577
2033	5.0	4.802	0.960	0.759	0.949	0.190	5.818	5.752	1.150	6.577
2034	4.3	4.802	1.117	0.759	0.949	0.221	5.818	5.752	1.338	6.577
2035	3.7	4.802	1.298	0.759	0.949	0.257	5.818	5.752	1.554	6.577
2036										
2037										
2038										

**Table 4.2.5
Arctic Spill Occurrence Beaufort Sea Sale 2 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2009	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2010	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2011	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2012	Shallow	3	0.500	0.015	0.01	3.500	0.105	0.47	1.500	0.045	0.90	1.000	0.030	6.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	3		0.015	0.01		0.105	0.47		0.045	0.90		0.030	6.00
2013	Shallow	13	0.500	0.065	0.03	3.500	0.455	2.05	1.500	0.195	3.90	1.000	0.130	26.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	13		0.065	0.03		0.455	2.05		0.195	3.90		0.130	26.00
2014	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	23		0.115	0.06		0.805	3.62		0.345	6.90		0.230	46.00
2015	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	23		0.115	0.06		0.805	3.62		0.345	6.90		0.230	46.00
2016	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	3	0.500	0.015	0.01	3.500	0.105	0.47	1.500	0.045	0.90	1.000	0.030	6.00
	Deep		0.500			3.500			1.500			1.000		
	Total	26		0.130	0.07		0.910	4.10		0.390	7.80		0.260	52.00
2017	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	16	0.500	0.080	0.04	3.500	0.560	2.52	1.500	0.240	4.80	1.000	0.160	32.00
	Deep		0.500			3.500			1.500			1.000		
	Total	39		0.195	0.10		1.365	6.14		0.585	11.70		0.390	78.00

**Table 4.2.5
Arctic Spill Occurrence Beaufort Sea Sale 2 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	36	0.500	0.180	0.09	3.500	1.260	5.67	1.500	0.540	10.80	1.000	0.360	72.00
	Deep		0.500			3.500			1.500			1.000		
	Total	59		0.295	0.15		2.065	9.29		0.885	17.70		0.590	118.00
2019	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2020	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2021	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2022	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2023	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2024	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2025	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2026	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2027	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2028	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2029	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2030	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2031	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00

**Table 4.2.5
Arctic Spill Occurrence Beaufort Sea Sale 2 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2033	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2034	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2035	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2036	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2037	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2038	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													

**Table 4.2.6
Arctic Spill Occurrence Beaufort Sea Sale 2 Production Wells Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009													
2010													
2011													
2012		0.015		0.008	0.045		0.473	0.075		6.900	0.135		7.380
2013	10.9	0.065	0.006	0.033	0.195	0.018	2.048	0.325	0.030	29.900	0.585	0.054	31.980
2014	19.9	0.115	0.006	0.058	0.345	0.017	3.623	0.575	0.029	52.900	1.035	0.052	56.580
2015	19.9	0.115	0.006	0.058	0.345	0.017	3.623	0.575	0.029	52.900	1.035	0.052	56.580
2016	19.9	0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
2017	34.8	0.195	0.006	0.098	0.585	0.017	6.143	0.975	0.028	89.700	1.755	0.050	95.940
2018	44.2	0.295	0.007	0.148	0.885	0.020	9.293	1.475	0.033	135.700	2.655	0.060	145.140
2019	41.9	0.345	0.008	0.173	1.035	0.025	10.868	1.725	0.041	158.700	3.105	0.074	169.740
2020	39.9	0.345	0.009	0.173	1.035	0.026	10.868	1.725	0.043	158.700	3.105	0.078	169.740
2021	38.3	0.345	0.009	0.173	1.035	0.027	10.868	1.725	0.045	158.700	3.105	0.081	169.740
2022	32.7	0.345	0.011	0.173	1.035	0.032	10.868	1.725	0.053	158.700	3.105	0.095	169.740
2023	27.9	0.345	0.012	0.173	1.035	0.037	10.868	1.725	0.062	158.700	3.105	0.111	169.740
2024	23.8	0.345	0.014	0.173	1.035	0.043	10.868	1.725	0.072	158.700	3.105	0.130	169.740
2025	20.3	0.345	0.017	0.173	1.035	0.051	10.868	1.725	0.085	158.700	3.105	0.153	169.740
2026	17.3	0.345	0.020	0.173	1.035	0.060	10.868	1.725	0.100	158.700	3.105	0.179	169.740
2027	14.8	0.345	0.023	0.173	1.035	0.070	10.868	1.725	0.117	158.700	3.105	0.210	169.740
2028	10.7	0.230	0.021	0.115	0.690	0.064	7.245	1.150	0.107	105.800	2.070	0.193	113.160
2029	9.2	0.230	0.025	0.115	0.690	0.075	7.245	1.150	0.125	105.800	2.070	0.225	113.160
2030	7.9	0.230	0.029	0.115	0.690	0.087	7.245	1.150	0.146	105.800	2.070	0.262	113.160
2031	6.8	0.230	0.034	0.115	0.690	0.101	7.245	1.150	0.169	105.800	2.070	0.304	113.160
2032	5.8	0.230	0.040	0.115	0.690	0.119	7.245	1.150	0.198	105.800	2.070	0.357	113.160
2033	5.0	0.230	0.046	0.115	0.690	0.138	7.245	1.150	0.230	105.800	2.070	0.414	113.160
2034	4.3	0.230	0.053	0.115	0.690	0.160	7.245	1.150	0.267	105.800	2.070	0.481	113.160
2035	3.7	0.230	0.062	0.115	0.690	0.186	7.245	1.150	0.311	105.800	2.070	0.559	113.160
2036													
2037													
2038													

**Table 4.2.7
Arctic Spill Occurrence Beaufort Sea Sale 2 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2005	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2006	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2007	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2008	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2010	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2011	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2012	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2013	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2014	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2015	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2016	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2017	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

**Table 4.2.7
Arctic Spill Occurrence Beaufort Sea Sale 2 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2019	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2020	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2021	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2022	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2023	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2024	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2025	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2026	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2027	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2028	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2029	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2030	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2031	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

**Table 4.2.7
Arctic Spill Occurrence Beaufort Sea Sale 2 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2033	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2034	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2035	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2036	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2037	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2038	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.2.8

Arctic Spill Occurrence Beaufort Sea Sale 2 Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2008		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2009													
2010		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2011													
2012		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2013	10.9	0.032	0.003	0.016	0.095	0.009	0.995	0.150	0.014	12.900	0.277	0.025	13.911
2014	19.9												
2015	19.9												
2016	19.9												
2017	34.8												
2018	44.2												
2019	41.9												
2020	39.9												
2021	38.3												
2022	32.7												
2023	27.9												
2024	23.8												
2025	20.3												
2026	17.3												
2027	14.8												
2028	10.7												
2029	9.2												
2030	7.9												
2031	6.8												
2032	5.8												
2033	5.0												
2034	4.3												
2035	3.7												
2036													
2037													
2038													

**Table 4.2.9
Arctic Spill Occurrence Beaufort Sea Sale 2 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2009	Shallow	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2011	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2012	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2013	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2014	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2015	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2016	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2017	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.2.9
Arctic Spill Occurrence Beaufort Sea Sale 2 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] = 500		Spill Index bbl	Average Spill [bbl] = 4500		Spill Index bbl	Average Spill [bbl] = 20000		Spill Index bbl	Average Spill [bbl] = 200000		Spill Index bbl
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2019	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2020	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2021	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2022	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2023	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2024	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2025	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2026	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2027	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2028	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2029	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2030	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2031	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.2.9
Arctic Spill Occurrence Beaufort Sea Sale 2 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2033	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2034	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2035	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2036	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2037	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2038	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.2.10

Arctic Spill Occurrence Beaufort Sea Sale 2 Development Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2010													
2011													
2012													
2013	10.9	0.026	0.002	0.013	0.078	0.007	0.817	0.156	0.014	17.160	0.260	0.024	17.990
2014	19.9	0.026	0.001	0.013	0.078	0.004	0.817	0.156	0.008	17.160	0.260	0.013	17.990
2015	19.9												
2016	19.9												
2017	34.8												
2018	44.2												
2019	41.9												
2020	39.9												
2021	38.3												
2022	32.7												
2023	27.9												
2024	23.8												
2025	20.3												
2026	17.3												
2027	14.8												
2028	10.7												
2029	9.2												
2030	7.9												
2031	6.8												
2032	5.8												
2033	5.0												
2034	4.3												
2035	3.7												
2036													
2037													
2038													

**Table 4.2.11
Arctic Spill Occurrence Beaufort Sea Sale 2 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2005	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2006	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2007	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
Total		0.032	0.016	0.095		0.995	0.150		12.900	0.277		13.911		
2008	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
Total		0.032	0.016	0.095		0.995	0.150		12.900	0.277		13.911		
2009	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
Total		0.026	0.013	0.078		0.817	0.156		17.160	0.260		17.990		
2010	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
Total		0.032	0.016	0.095		0.995	0.150		12.900	0.277		13.911		
2011	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2012	Pipeline													
	Platforms		0.289		0.046	0.058		0.354			0.347		0.399	
	Production Wells		0.015		0.008	0.045		0.473	0.075		6.900	0.135	7.380	
	Exploration Wells		0.063		0.032	0.190		1.990	0.300		25.800	0.553	27.822	
	Development Wells													
Total		0.368	0.085	0.293		2.816	0.375		32.700	1.035		35.601		
2013	Pipeline	10.9	1.077	0.099	0.308	0.848	0.078	3.335	0.261	0.024	4.619	2.186	0.201	8.262
	Platforms		1.254	0.115	0.198	0.250	0.023	1.532				1.504	0.138	1.730
	Production Wells		0.065	0.006	0.033	0.195	0.018	2.048	0.325	0.030	29.900	0.585	0.054	31.980
	Exploration Wells		0.032	0.003	0.016	0.095	0.009	0.995	0.150	0.014	12.900	0.277	0.025	13.911
	Development Wells		0.026	0.002	0.013	0.078	0.007	0.817	0.156	0.014	17.160	0.260	0.024	17.990
	Total			2.453	0.225	0.568	1.466	0.135	8.727	0.892	0.082	64.579	4.811	0.441

**Table 4.2.11
Arctic Spill Occurrence Beaufort Sea Sale 2 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
2014	Pipeline	19.9	1.077	0.054	0.308	0.848	0.043	3.335	0.261	0.013	4.619	2.186	0.110	8.262
	Platforms		2.218	0.111	0.350	0.442	0.022	2.711				2.660	0.134	3.061
	Production Wells		0.115	0.006	0.058	0.345	0.017	3.623	0.575	0.029	52.900	1.035	0.052	56.580
	Exploration Wells													
	Development Wells		0.026	0.001	0.013	0.078	0.004	0.817	0.156	0.008	17.160	0.260	0.013	17.990
	Total		3.436	0.173	0.729	1.713	0.086	10.485	0.992	0.050	74.679	6.141	0.309	85.894
2015	Pipeline	19.9	1.077	0.054	0.308	0.848	0.043	3.335	0.261	0.013	4.619	2.186	0.110	8.262
	Platforms		2.218	0.111	0.350	0.442	0.022	2.711				2.660	0.134	3.061
	Production Wells		0.115	0.006	0.058	0.345	0.017	3.623	0.575	0.029	52.900	1.035	0.052	56.580
	Exploration Wells													
	Development Wells													
	Total		3.410	0.171	0.716	1.635	0.082	9.668	0.836	0.042	57.519	5.881	0.296	67.903
2016	Pipeline	19.9	1.077	0.054	0.308	0.848	0.043	3.335	0.261	0.013	4.619	2.186	0.110	8.262
	Platforms		2.531	0.127	0.400	0.504	0.025	3.090				3.036	0.153	3.490
	Production Wells		0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
	Exploration Wells													
	Development Wells													
	Total		3.738	0.188	0.773	1.742	0.088	10.520	0.911	0.046	64.419	6.392	0.321	75.712
2017	Pipeline	34.8	2.804	0.081	0.768	1.996	0.057	7.921	0.612	0.018	10.702	5.411	0.155	19.392
	Platforms		3.889	0.112	0.614	0.772	0.022	4.735				4.661	0.134	5.349
	Production Wells		0.195	0.006	0.098	0.585	0.017	6.143	0.975	0.028	89.700	1.755	0.050	95.940
	Exploration Wells													
	Development Wells													
	Total		6.887	0.198	1.480	3.353	0.096	18.798	1.587	0.046	100.402	11.827	0.340	120.681
2018	Pipeline	44.2	2.804	0.063	0.768	1.996	0.045	7.921	0.612	0.014	10.702	5.411	0.122	19.392
	Platforms		5.977	0.135	0.944	1.185	0.027	7.264				7.162	0.162	8.208
	Production Wells		0.295	0.007	0.148	0.885	0.020	9.293	1.475	0.033	135.700	2.655	0.060	145.140
	Exploration Wells													
	Development Wells													
	Total		9.075	0.205	1.860	4.066	0.092	24.478	2.087	0.047	146.402	15.228	0.345	172.740
2019	Pipeline	41.9	2.804	0.067	0.768	1.996	0.048	7.921	0.612	0.015	10.702	5.411	0.129	19.392
	Platforms		7.021	0.168	1.109	1.391	0.033	8.529				8.412	0.201	9.638
	Production Wells		0.345	0.008	0.173	1.035	0.025	10.868	1.725	0.041	158.700	3.105	0.074	169.740
	Exploration Wells													
	Development Wells													
	Total		10.169	0.243	2.050	4.422	0.106	27.318	2.337	0.056	169.402	16.928	0.404	198.770
2020	Pipeline	39.9	2.804	0.070	0.768	1.996	0.050	7.921	0.612	0.015	10.702	5.411	0.136	19.392
	Platforms		7.021	0.176	1.109	1.391	0.035	8.529				8.412	0.211	9.638
	Production Wells		0.345	0.009	0.173	1.035	0.026	10.868	1.725	0.043	158.700	3.105	0.078	169.740
	Exploration Wells													
	Development Wells													
	Total		10.169	0.255	2.050	4.422	0.111	27.318	2.337	0.059	169.402	16.928	0.424	198.770
2021	Pipeline	38.3	2.804	0.073	0.768	1.996	0.052	7.921	0.612	0.016	10.702	5.411	0.141	19.392
	Platforms		7.021	0.183	1.109	1.391	0.036	8.529				8.412	0.220	9.638
	Production Wells		0.345	0.009	0.173	1.035	0.027	10.868	1.725	0.045	158.700	3.105	0.081	169.740
	Exploration Wells													
	Development Wells													
	Total		10.169	0.266	2.050	4.422	0.115	27.318	2.337	0.061	169.402	16.928	0.442	198.770
2022	Pipeline	32.7	2.804	0.086	0.768	1.996	0.061	7.921	0.612	0.019	10.702	5.411	0.165	19.392
	Platforms		7.021	0.215	1.109	1.391	0.043	8.529				8.412	0.257	9.638
	Production Wells		0.345	0.011	0.173	1.035	0.032	10.868	1.725	0.053	158.700	3.105	0.095	169.740
	Exploration Wells													
	Development Wells													
	Total		10.169	0.311	2.050	4.422	0.135	27.318	2.337	0.071	169.402	16.928	0.518	198.770
2023	Pipeline	27.9	2.804	0.100	0.768	1.996	0.072	7.921	0.612	0.022	10.702	5.411	0.194	19.392
	Platforms		7.021	0.252	1.109	1.391	0.050	8.529				8.412	0.302	9.638
	Production Wells		0.345	0.012	0.173	1.035	0.037	10.868	1.725	0.062	158.700	3.105	0.111	169.740
	Exploration Wells													
	Development Wells													
	Total		10.169	0.364	2.050	4.422	0.159	27.318	2.337	0.084	169.402	16.928	0.607	198.770

**Table 4.2.11
Arctic Spill Occurrence Beaufort Sea Sale 2 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2024	Pipeline	23.8	2.804	0.118	0.768	1.996	0.084	7.921	0.612	0.026	10.702	5.411	0.227	19.392
	Platforms		7.021	0.295	1.109	1.391	0.058	8.529				8.412	0.353	9.638
	Production Wells		0.345	0.014	0.173	1.035	0.043	10.868	1.725	0.072	158.700	3.105	0.130	169.740
	Exploration Wells													
	Development Wells													
Total			10.169	0.427	2.050	4.422	0.186	27.318	2.337	0.098	169.402	16.928	0.711	198.770
2025	Pipeline	20.3	2.804	0.138	0.768	1.996	0.098	7.921	0.612	0.030	10.702	5.411	0.267	19.392
	Platforms		7.021	0.346	1.109	1.391	0.069	8.529				8.412	0.414	9.638
	Production Wells		0.345	0.017	0.173	1.035	0.051	10.868	1.725	0.085	158.700	3.105	0.153	169.740
	Exploration Wells													
	Development Wells													
Total			10.169	0.501	2.050	4.422	0.218	27.318	2.337	0.115	169.402	16.928	0.834	198.770
2026	Pipeline	17.3	2.804	0.162	0.768	1.996	0.115	7.921	0.612	0.035	10.702	5.411	0.313	19.392
	Platforms		7.021	0.406	1.109	1.391	0.080	8.529				8.412	0.486	9.638
	Production Wells		0.345	0.020	0.173	1.035	0.060	10.868	1.725	0.100	158.700	3.105	0.179	169.740
	Exploration Wells													
	Development Wells													
Total			10.169	0.588	2.050	4.422	0.256	27.318	2.337	0.135	169.402	16.928	0.979	198.770
2027	Pipeline	14.8	2.804	0.189	0.768	1.996	0.135	7.921	0.612	0.041	10.702	5.411	0.366	19.392
	Platforms		7.021	0.474	1.109	1.391	0.094	8.529				8.412	0.568	9.638
	Production Wells		0.345	0.023	0.173	1.035	0.070	10.868	1.725	0.117	158.700	3.105	0.210	169.740
	Exploration Wells													
	Development Wells													
Total			10.169	0.687	2.050	4.422	0.299	27.318	2.337	0.158	169.402	16.928	1.144	198.770
2028	Pipeline	10.7	1.727	0.161	0.460	1.148	0.107	4.587	0.351	0.033	6.083	3.225	0.301	11.130
	Platforms		4.802	0.449	0.759	0.949	0.089	5.818				5.752	0.538	6.577
	Production Wells		0.230	0.021	0.115	0.690	0.064	7.245	1.150	0.107	105.800	2.070	0.193	113.160
	Exploration Wells													
	Development Wells													
Total			6.759	0.632	1.334	2.787	0.260	17.650	1.501	0.140	111.883	11.047	1.032	130.867
2029	Pipeline	9.2	1.727	0.188	0.460	1.148	0.125	4.587	0.351	0.038	6.083	3.225	0.351	11.130
	Platforms		4.802	0.522	0.759	0.949	0.103	5.818				5.752	0.625	6.577
	Production Wells		0.230	0.025	0.115	0.690	0.075	7.245	1.150	0.125	105.800	2.070	0.225	113.160
	Exploration Wells													
	Development Wells													
Total			6.759	0.735	1.334	2.787	0.303	17.650	1.501	0.163	111.883	11.047	1.201	130.867
2030	Pipeline	7.9	1.727	0.219	0.460	1.148	0.145	4.587	0.351	0.044	6.083	3.225	0.408	11.130
	Platforms		4.802	0.608	0.759	0.949	0.120	5.818				5.752	0.728	6.577
	Production Wells		0.230	0.029	0.115	0.690	0.087	7.245	1.150	0.146	105.800	2.070	0.262	113.160
	Exploration Wells													
	Development Wells													
Total			6.759	0.856	1.334	2.787	0.353	17.650	1.501	0.190	111.883	11.047	1.398	130.867
2031	Pipeline	5.8	1.727	0.254	0.389	1.148	0.169	3.940	0.351	0.052	5.528	3.225	0.474	9.857
	Platforms		4.802	0.706	0.759	0.949	0.140	5.818				5.752	0.846	6.577
	Production Wells		0.230	0.034	0.115	0.690	0.101	7.245	1.150	0.169	105.800	2.070	0.304	113.160
	Exploration Wells													
	Development Wells													
Total			6.759	0.994	1.262	2.787	0.410	17.003	1.501	0.221	111.328	11.047	1.625	129.594
2032	Pipeline	5.0	1.727	0.298	0.460	1.148	0.198	4.587	0.351	0.060	6.083	3.225	0.556	11.130
	Platforms		4.802	0.828	0.759	0.949	0.164	5.818				5.752	0.992	6.577
	Production Wells		0.230	0.040	0.115	0.690	0.119	7.245	1.150	0.198	105.800	2.070	0.357	113.160
	Exploration Wells													
	Development Wells													
Total			6.759	1.165	1.334	2.787	0.481	17.650	1.501	0.259	111.883	11.047	1.905	130.867
2033	Pipeline	3.7	1.727	0.345	0.460	1.148	0.230	4.587	0.351	0.070	6.083	3.225	0.645	11.130
	Platforms		4.802	0.960	0.759	0.949	0.190	5.818				5.752	1.150	6.577
	Production Wells		0.230	0.046	0.115	0.690	0.138	7.245	1.150	0.230	105.800	2.070	0.414	113.160
	Exploration Wells													
	Development Wells													
Total			6.759	1.352	1.334	2.787	0.557	17.650	1.501	0.300	111.883	11.047	2.209	130.867

**Table 4.2.11
Arctic Spill Occurrence Beaufort Sea Sale 2 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2034	Pipeline		1.727	0.402	0.460	1.148	0.267	4.587	0.351	0.082	6.083	3.225	0.750	11.130
	Platforms		4.802	1.117	0.759	0.949	0.221	5.818				5.752	1.338	6.577
	Production Wells		0.230	0.053	0.115	0.690	0.160	7.245	1.150	0.267	105.800	2.070	0.481	113.160
	Exploration Wells													
	Development Wells													
	Total			6.759	1.572	1.334	2.787	0.648	17.650	1.501	0.349	111.883	11.047	2.569
2035	Pipeline		1.727	0.467	0.460	1.148	0.310	4.587	0.351	0.095	6.083	3.225	0.872	11.130
	Platforms		4.802	1.298	0.759	0.949	0.257	5.818				5.752	1.554	6.577
	Production Wells		0.230	0.062	0.115	0.690	0.186	7.245	1.150	0.311	105.800	2.070	0.559	113.160
	Exploration Wells													
	Development Wells													
	Total			6.759	1.827	1.334	2.787	0.753	17.650	1.501	0.406	111.883	11.047	2.986
2036	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2037	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2038	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													

**Table 4.2.12
Arctic Spill Occurrence Beaufort Sea Sale 2 Annual Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2008		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2009		0.03		0.013	0.08		0.817	0.156		17.16	0.260		17.990
2010		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2011													
2012		0.37		0.085	0.29		2.816	0.375		32.70	1.035		35.601
2013	10.9	2.45	0.225	0.568	1.47	0.135	8.727	0.892	0.082	64.58	4.811	0.441	73.873
2014	19.9	3.44	0.173	0.729	1.71	0.086	10.485	0.992	0.050	74.68	6.141	0.309	85.894
2015	19.9	3.41	0.171	0.716	1.64	0.082	9.668	0.836	0.042	57.52	5.881	0.296	67.903
2016	19.9	3.74	0.188	0.773	1.74	0.088	10.520	0.911	0.046	64.42	6.392	0.321	75.712
2017	34.8	6.89	0.198	1.480	3.35	0.096	18.798	1.587	0.046	100.40	11.827	0.340	120.681
2018	44.2	9.08	0.205	1.860	4.07	0.092	24.478	2.087	0.047	146.40	15.228	0.345	172.740
2019	41.9	10.17	0.243	2.050	4.42	0.106	27.318	2.337	0.056	169.40	16.928	0.404	198.770
2020	39.9	10.17	0.255	2.050	4.42	0.111	27.318	2.337	0.059	169.40	16.928	0.424	198.770
2021	38.3	10.17	0.266	2.050	4.42	0.115	27.318	2.337	0.061	169.40	16.928	0.442	198.770
2022	32.7	10.17	0.311	2.050	4.42	0.135	27.318	2.337	0.071	169.40	16.928	0.518	198.770
2023	27.9	10.17	0.364	2.050	4.42	0.159	27.318	2.337	0.084	169.40	16.928	0.607	198.770
2024	23.8	10.17	0.427	2.050	4.42	0.186	27.318	2.337	0.098	169.40	16.928	0.711	198.770
2025	20.3	10.17	0.501	2.050	4.42	0.218	27.318	2.337	0.115	169.40	16.928	0.834	198.770
2026	17.3	10.17	0.588	2.050	4.42	0.256	27.318	2.337	0.135	169.40	16.928	0.979	198.770
2027	14.8	10.17	0.687	2.050	4.42	0.299	27.318	2.337	0.158	169.40	16.928	1.144	198.770
2028	10.7	6.76	0.632	1.334	2.79	0.260	17.650	1.501	0.140	111.88	11.047	1.032	130.867
2029	9.2	6.76	0.735	1.334	2.79	0.303	17.650	1.501	0.163	111.88	11.047	1.201	130.867
2030	7.9	6.76	0.856	1.334	2.79	0.353	17.650	1.501	0.190	111.88	11.047	1.398	130.867
2031	6.8	6.76	0.994	1.262	2.79	0.410	17.003	1.501	0.221	111.33	11.047	1.625	129.594
2032	5.8	6.76	1.165	1.334	2.79	0.481	17.650	1.501	0.259	111.88	11.047	1.905	130.867
2033	5.0	6.76	1.352	1.334	2.79	0.557	17.650	1.501	0.300	111.88	11.047	2.209	130.867
2034	4.3	6.76	1.572	1.334	2.79	0.648	17.650	1.501	0.349	111.88	11.047	2.569	130.867
2035	3.7	6.76	1.827	1.334	2.79	0.753	17.650	1.501	0.406	111.88	11.047	2.986	130.867
2036													
2037													
2038													

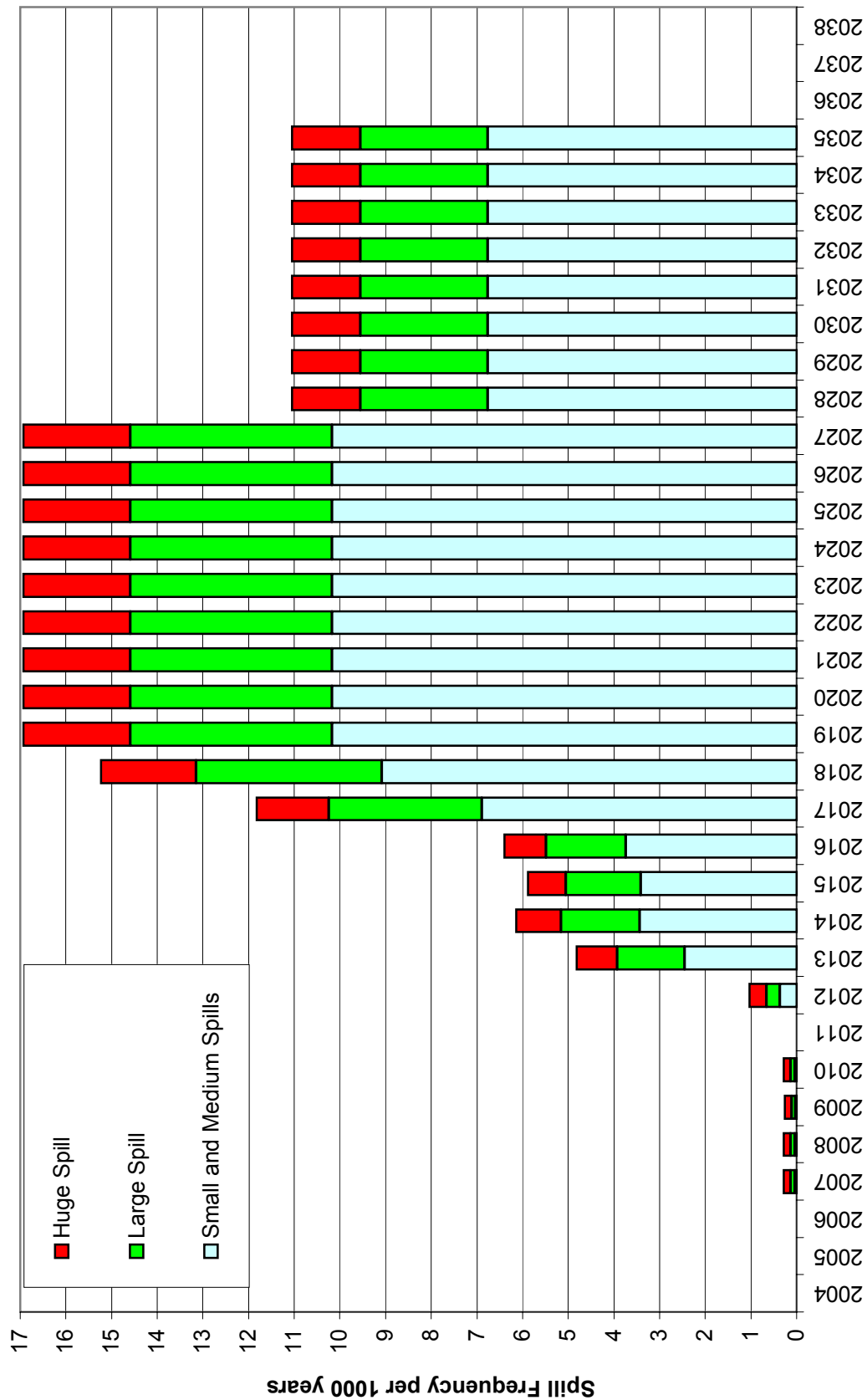
**Table 4.2.13
Arctic Spill Occurrence Beaufort Sea Sale 2 Wells Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2008		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2009		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2010		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2011													
2012		0.078		0.039	0.235		2.462	0.375		32.700	0.688		35.202
2013	10.9	0.123	0.011	0.061	0.368	0.034	3.860	0.631	0.058	59.960	1.122	0.103	63.881
2014	19.9	0.141	0.007	0.071	0.423	0.021	4.440	0.731	0.037	70.060	1.295	0.065	74.570
2015	19.9	0.115	0.006	0.058	0.345	0.017	3.623	0.575	0.029	52.900	1.035	0.052	56.580
2016	19.9	0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
2017	34.8	0.195	0.006	0.098	0.585	0.017	6.143	0.975	0.028	89.700	1.755	0.050	95.940
2018	44.2	0.295	0.007	0.148	0.885	0.020	9.293	1.475	0.033	135.700	2.655	0.060	145.140
2019	41.9	0.345	0.008	0.173	1.035	0.025	10.868	1.725	0.041	158.700	3.105	0.074	169.740
2020	39.9	0.345	0.009	0.173	1.035	0.026	10.868	1.725	0.043	158.700	3.105	0.078	169.740
2021	38.3	0.345	0.009	0.173	1.035	0.027	10.868	1.725	0.045	158.700	3.105	0.081	169.740
2022	32.7	0.345	0.011	0.173	1.035	0.032	10.868	1.725	0.053	158.700	3.105	0.095	169.740
2023	27.9	0.345	0.012	0.173	1.035	0.037	10.868	1.725	0.062	158.700	3.105	0.111	169.740
2024	23.8	0.345	0.014	0.173	1.035	0.043	10.868	1.725	0.072	158.700	3.105	0.130	169.740
2025	20.3	0.345	0.017	0.173	1.035	0.051	10.868	1.725	0.085	158.700	3.105	0.153	169.740
2026	17.3	0.345	0.020	0.173	1.035	0.060	10.868	1.725	0.100	158.700	3.105	0.179	169.740
2027	14.8	0.345	0.023	0.173	1.035	0.070	10.868	1.725	0.117	158.700	3.105	0.210	169.740
2028	10.7	0.230	0.021	0.115	0.690	0.064	7.245	1.150	0.107	105.800	2.070	0.193	113.160
2029	9.2	0.230	0.025	0.115	0.690	0.075	7.245	1.150	0.125	105.800	2.070	0.225	113.160
2030	7.9	0.230	0.029	0.115	0.690	0.087	7.245	1.150	0.146	105.800	2.070	0.262	113.160
2031	6.8	0.230	0.034	0.115	0.690	0.101	7.245	1.150	0.169	105.800	2.070	0.304	113.160
2032	5.8	0.230	0.040	0.115	0.690	0.119	7.245	1.150	0.198	105.800	2.070	0.357	113.160
2033	5.0	0.230	0.046	0.115	0.690	0.138	7.245	1.150	0.230	105.800	2.070	0.414	113.160
2034	4.3	0.230	0.053	0.115	0.690	0.160	7.245	1.150	0.267	105.800	2.070	0.481	113.160
2035	3.7	0.230	0.062	0.115	0.690	0.186	7.245	1.150	0.311	105.800	2.070	0.559	113.160
2036													
2037													
2038													

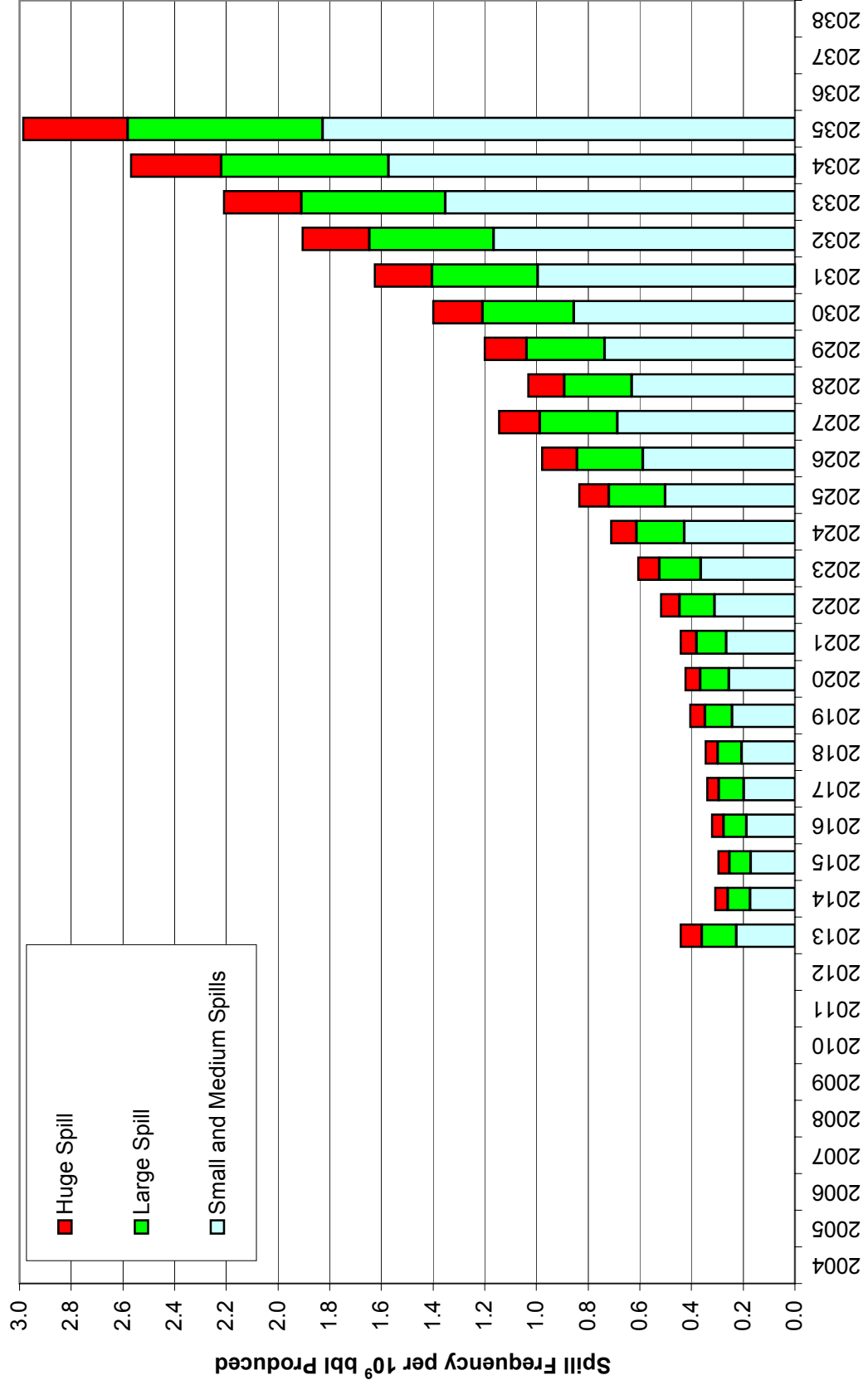
**Table 4.2.14
Beaufort Sea Sale 2 Year 2019 - Monte Carlo Results**

SALE 2	Small and Medium Spills			Large Spill			Huge Spill		
Year 2019	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
Mean =	9.90	0.236	2.02	4.42	0.106	27.32	2.34	0.056	169.40
Std Deviation =	1.14	0.027	0.19	0.47	0.011	2.01	0.13	0.003	2.23
Variance =	1.29	0.001	0.04	0.22	0.000	4.03	0.02	0.000	4.99
Skewness =	0.12	0.116	0.09	0.33	0.327	0.28	0.39	0.386	0.39
Kurtosis =	2.85	2.854	2.86	2.64	2.645	2.72	2.69	2.688	2.68
Mode =	9.10	0.220	1.92	4.12	0.095	25.30	2.17	0.056	166.10
Minimum =	6.44	0.154	1.38	3.23	0.077	21.85	2.01	0.048	163.60
5% Perc =	8.06	0.192	1.70	3.71	0.089	24.22	2.15	0.051	166.12
10% Perc =	8.46	0.202	1.77	3.84	0.092	24.81	2.18	0.052	166.64
15% Perc =	8.72	0.208	1.82	3.92	0.094	25.17	2.20	0.053	167.04
20% Perc =	8.93	0.213	1.86	4.00	0.095	25.52	2.22	0.053	167.41
25% Perc =	9.12	0.218	1.89	4.07	0.097	25.86	2.24	0.053	167.70
30% Perc =	9.29	0.222	1.91	4.13	0.098	26.13	2.26	0.054	168.01
35% Perc =	9.43	0.225	1.94	4.19	0.100	26.39	2.28	0.054	168.32
40% Perc =	9.57	0.228	1.96	4.26	0.102	26.68	2.29	0.055	168.61
45% Perc =	9.72	0.232	1.99	4.32	0.103	26.96	2.31	0.055	168.92
50% Perc =	9.85	0.235	2.02	4.39	0.105	27.23	2.33	0.056	169.21
55% Perc =	9.99	0.239	2.04	4.46	0.106	27.49	2.34	0.056	169.50
60% Perc =	10.15	0.242	2.06	4.52	0.108	27.74	2.36	0.056	169.79
65% Perc =	10.31	0.246	2.09	4.58	0.109	27.99	2.38	0.057	170.14
70% Perc =	10.50	0.250	2.12	4.66	0.111	28.32	2.40	0.057	170.49
75% Perc =	10.67	0.255	2.15	4.75	0.113	28.65	2.42	0.058	170.90
80% Perc =	10.87	0.259	2.18	4.83	0.115	29.02	2.45	0.058	171.33
85% Perc =	11.08	0.264	2.22	4.94	0.118	29.50	2.47	0.059	171.85
90% Perc =	11.37	0.271	2.26	5.07	0.121	30.06	2.51	0.060	172.51
95% Perc =	11.79	0.281	2.34	5.26	0.126	30.87	2.57	0.061	173.45
Maximum =	13.52	0.323	2.61	6.09	0.145	34.20	2.81	0.067	177.76

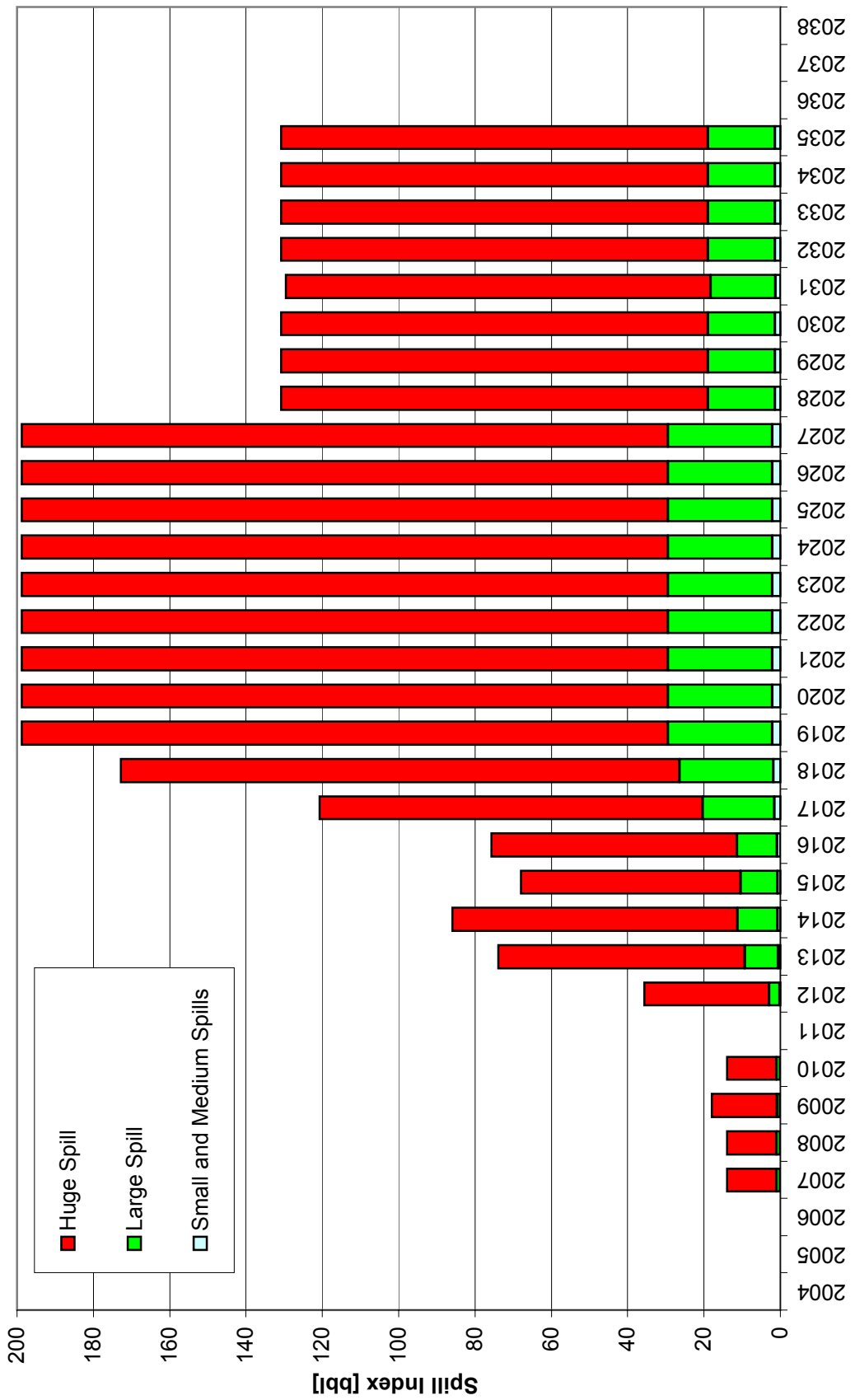
Beaufort Sea Sale 2 Spill Frequency



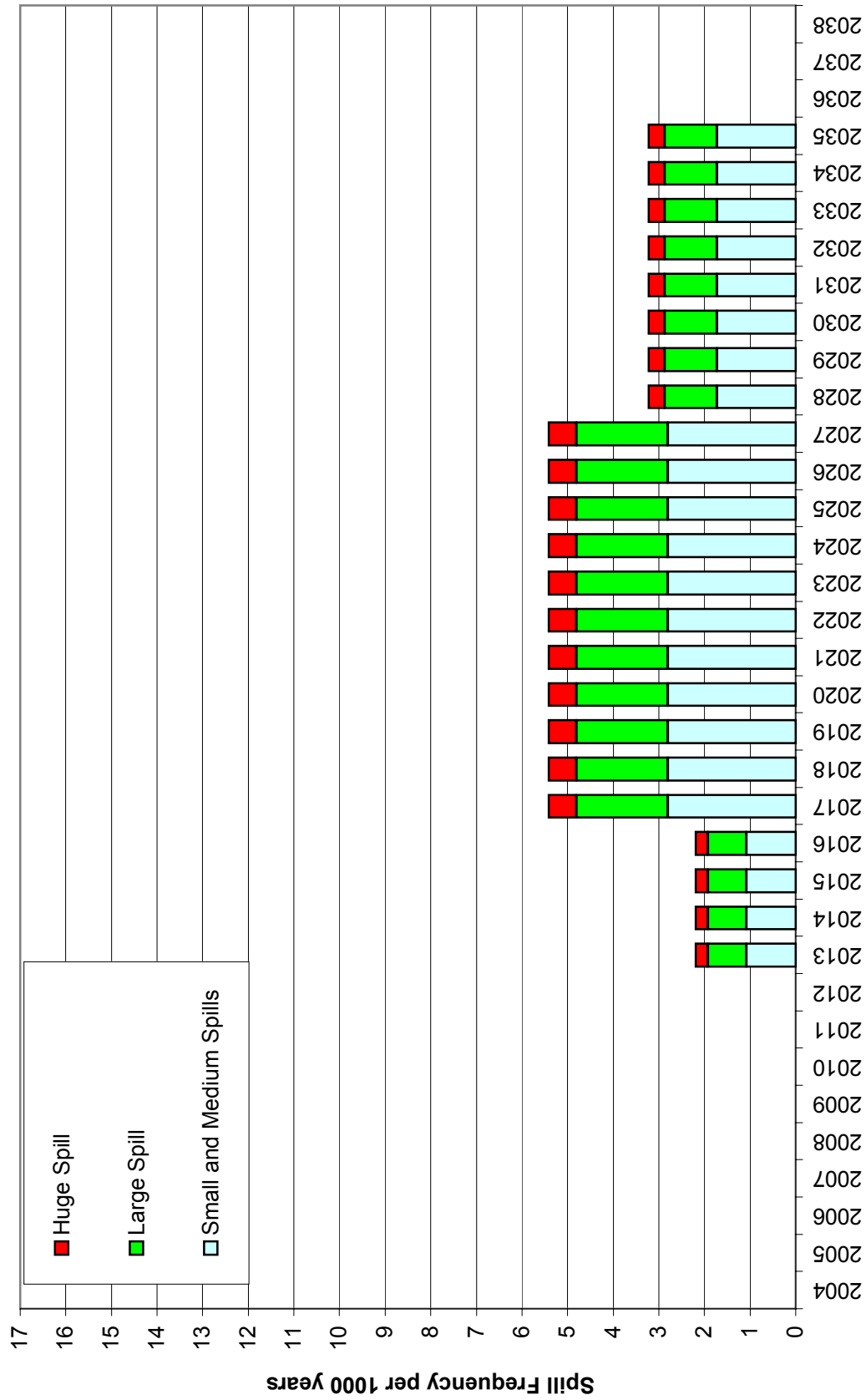
Beaufort Sea Sale 2 Spill Frequency per 10⁹ bbl Produced



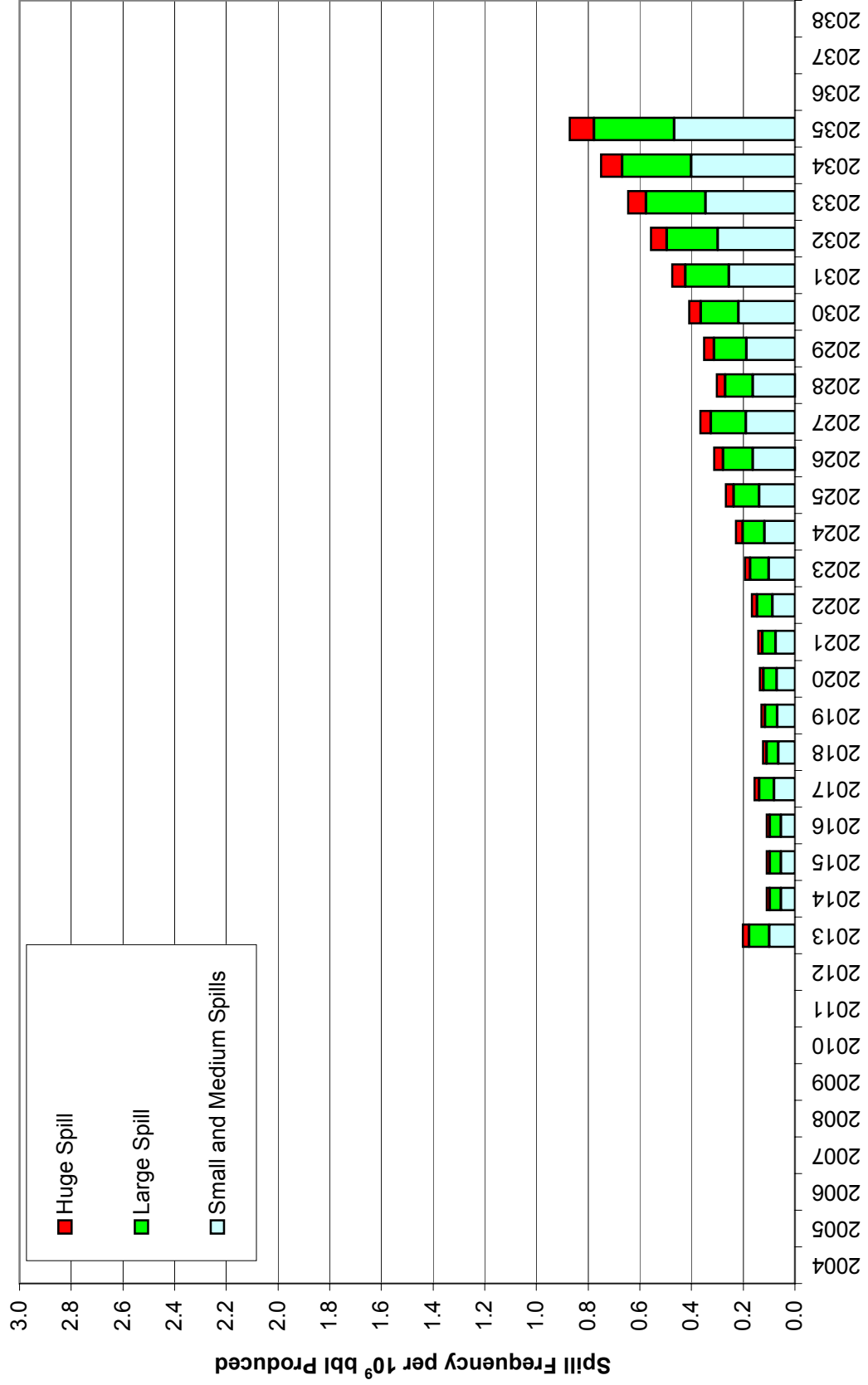
Beaufort Sea Sale 2 Spill Index



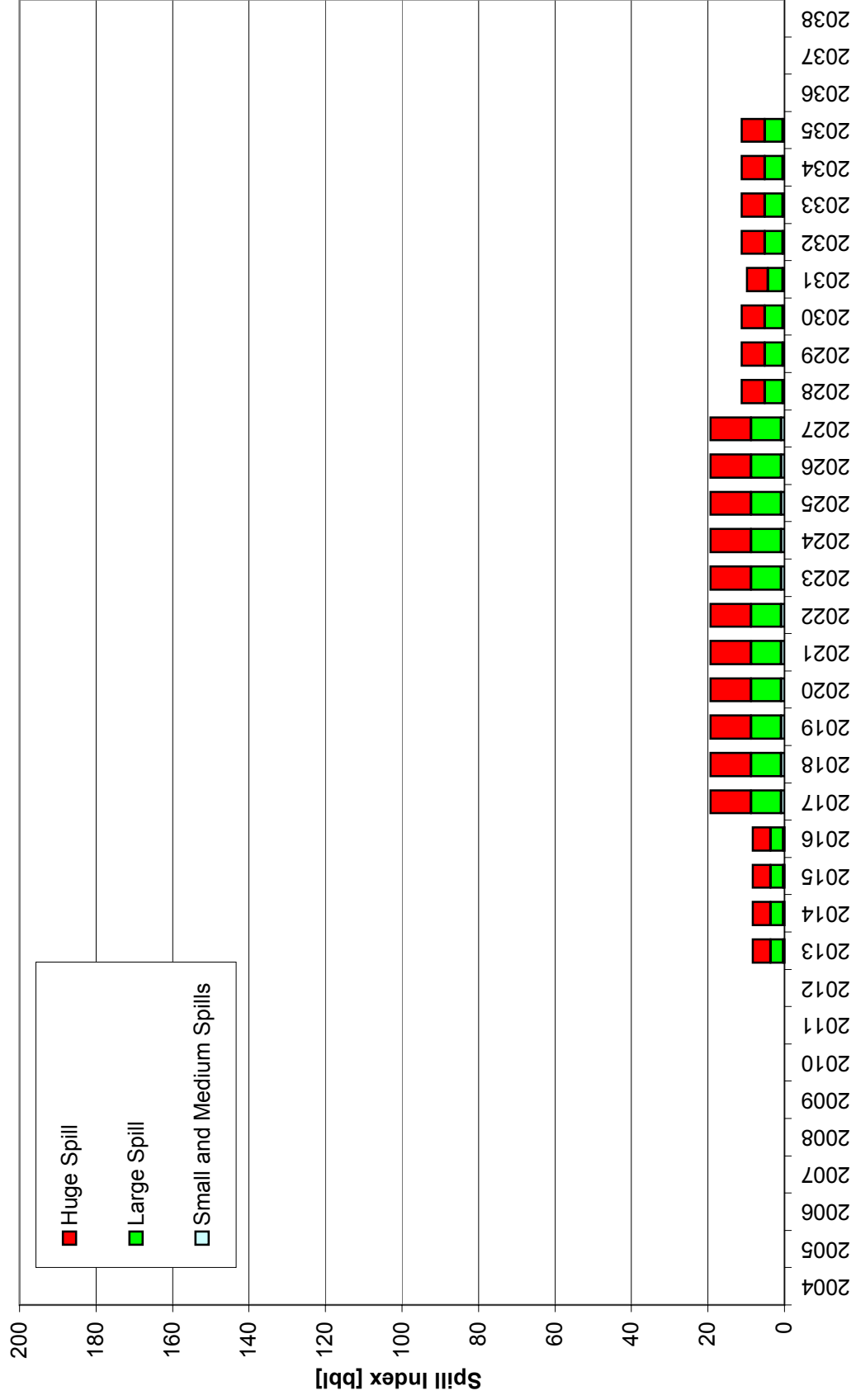
Beaufort Sea Sale 2 Spill Frequency - P/L



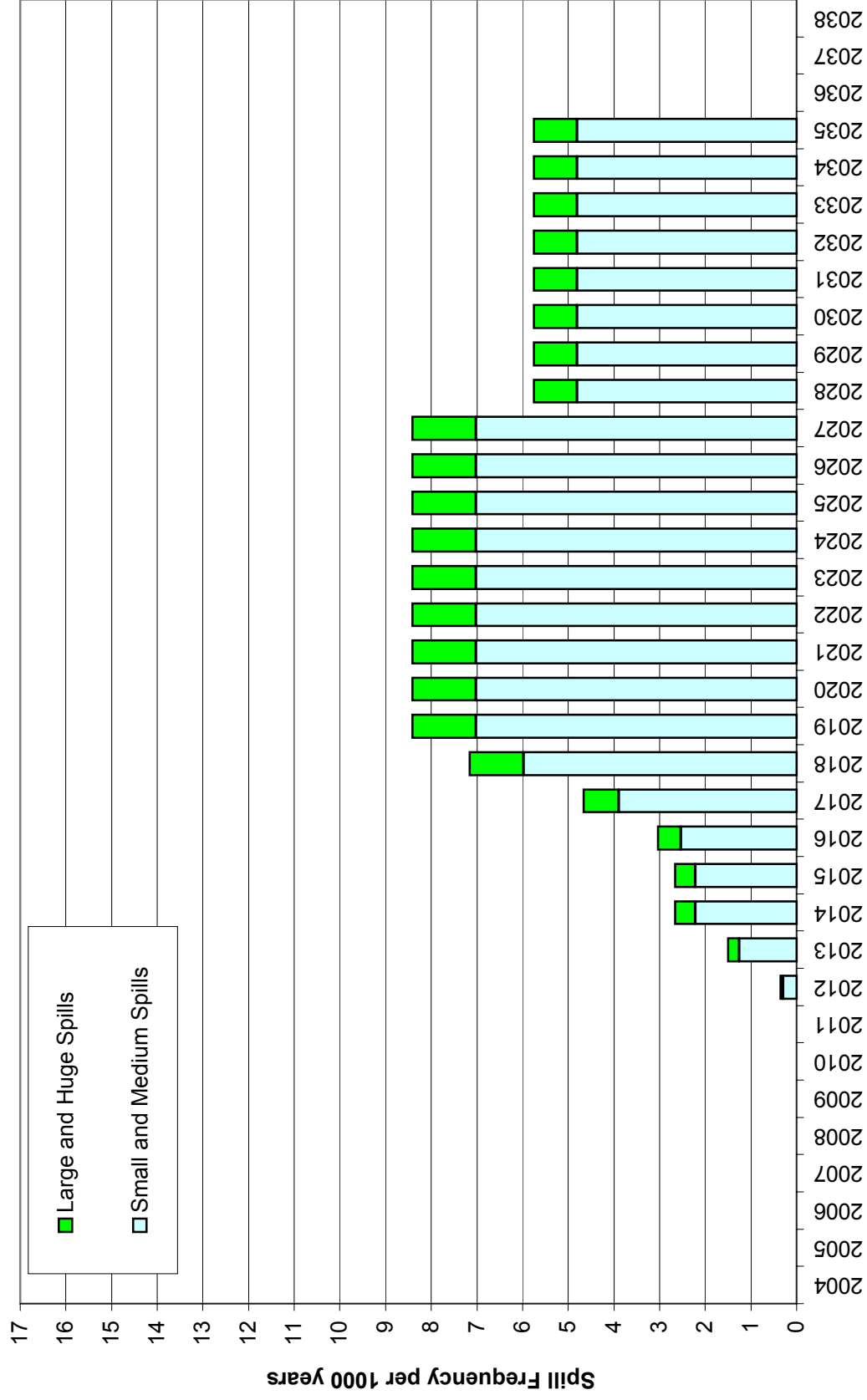
Beaufort Sea Sale 2 Spill Frequency per 10⁹ bbl Produced - P/L



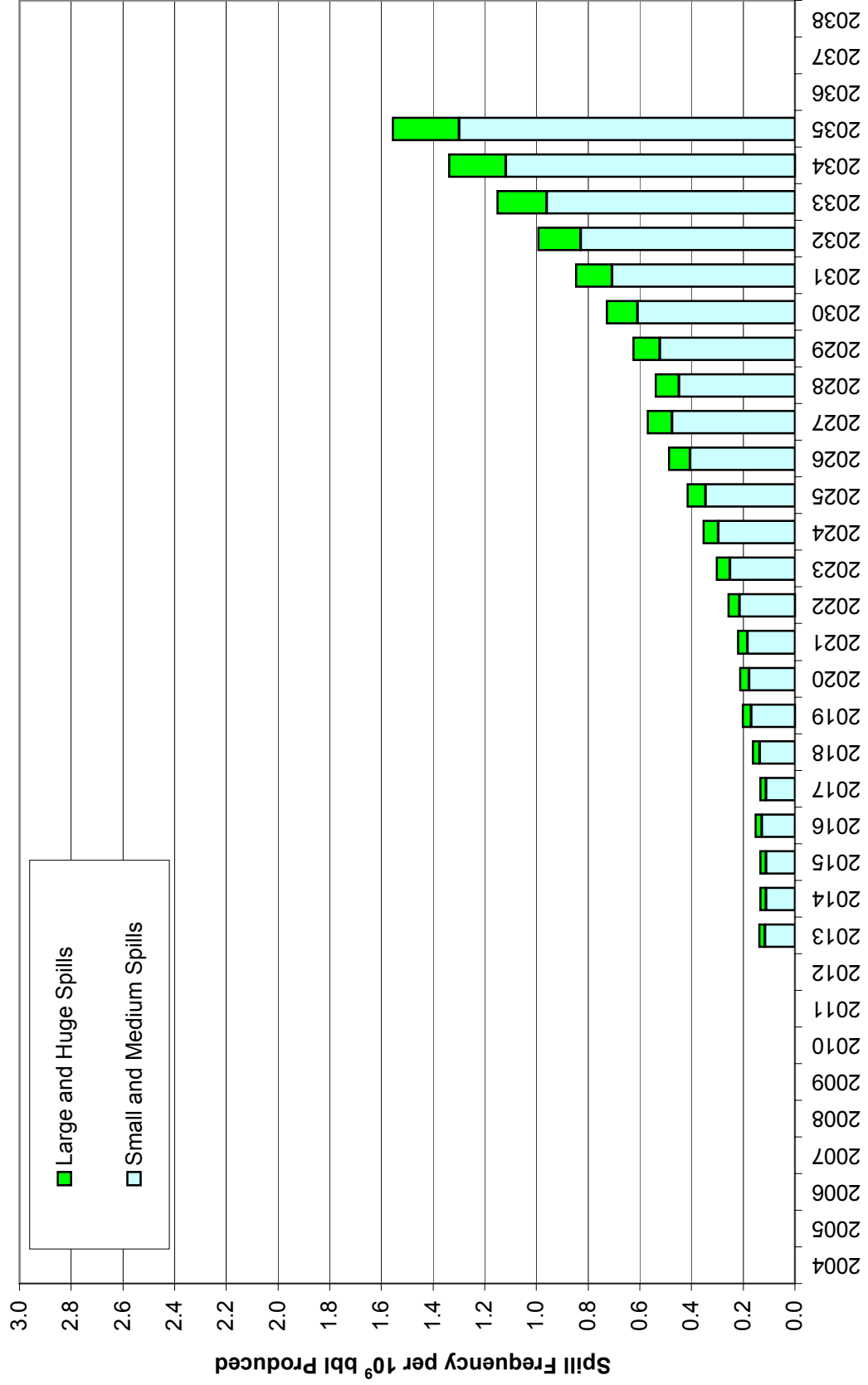
Beaufort Sea Sale 2 Spill Index - P/L



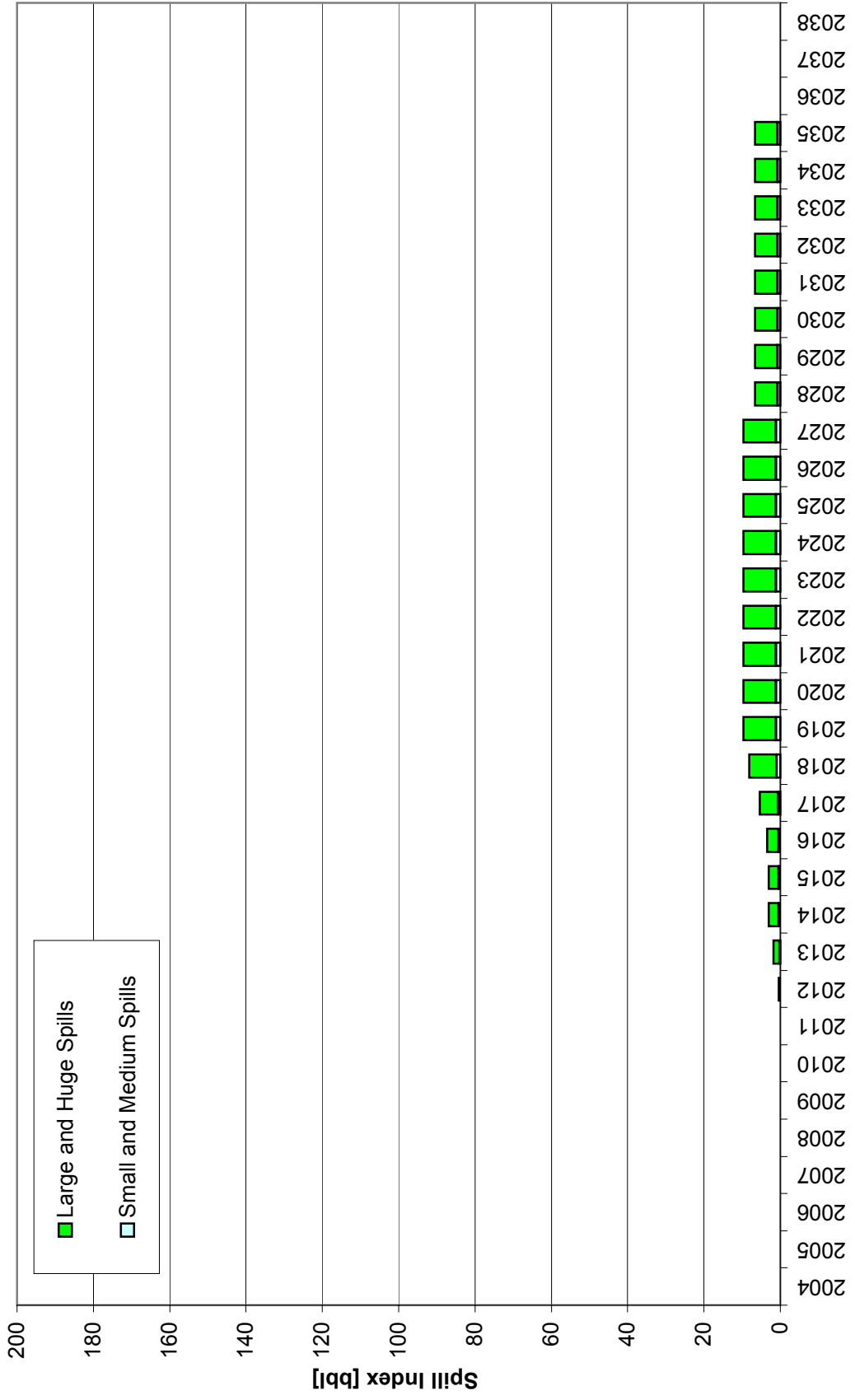
Beaufort Sea Sale 2 Spill Frequency - Platforms



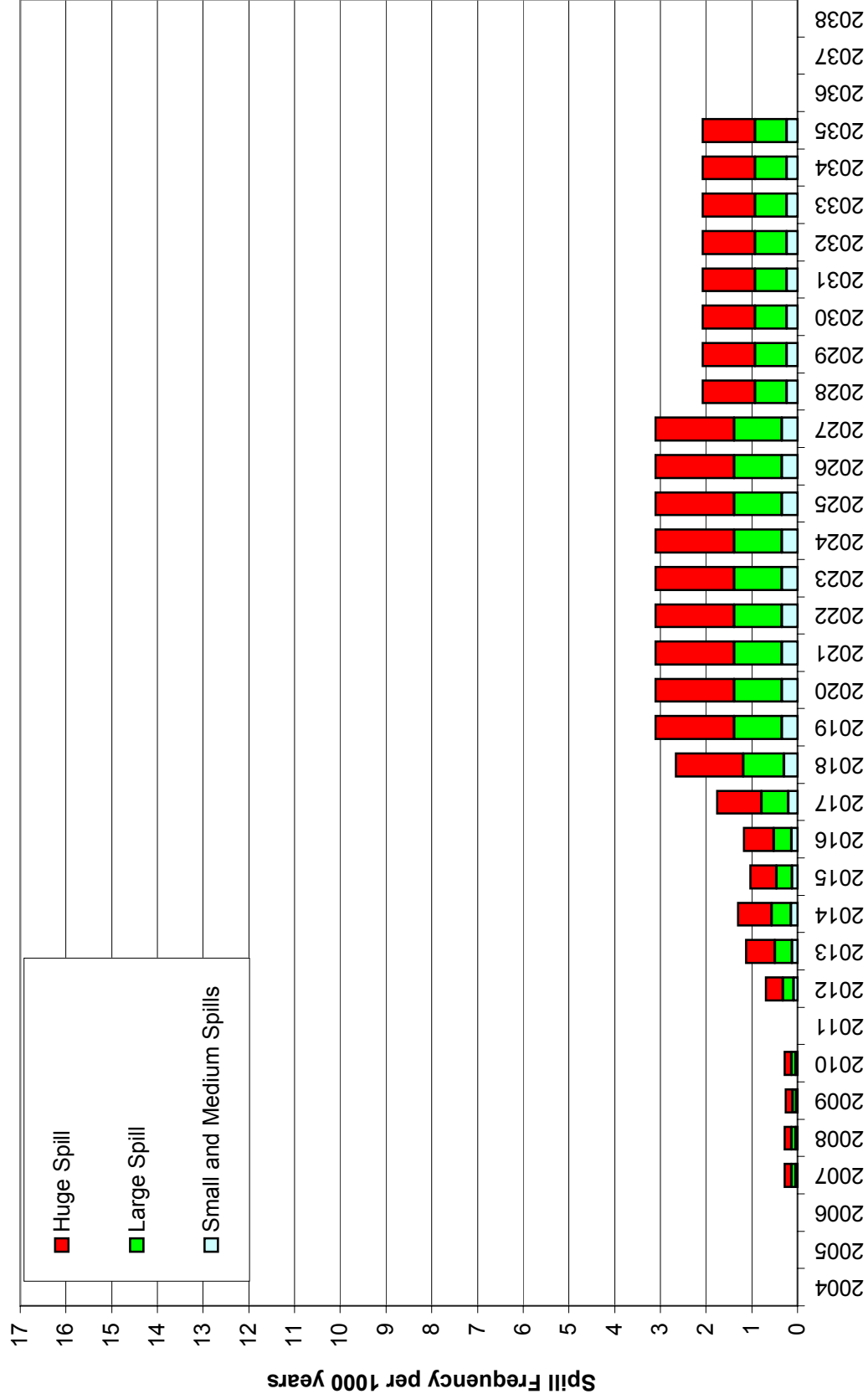
Beaufort Sea Sale 2 Spill Frequency per 10⁹ bbl Produced - Platforms



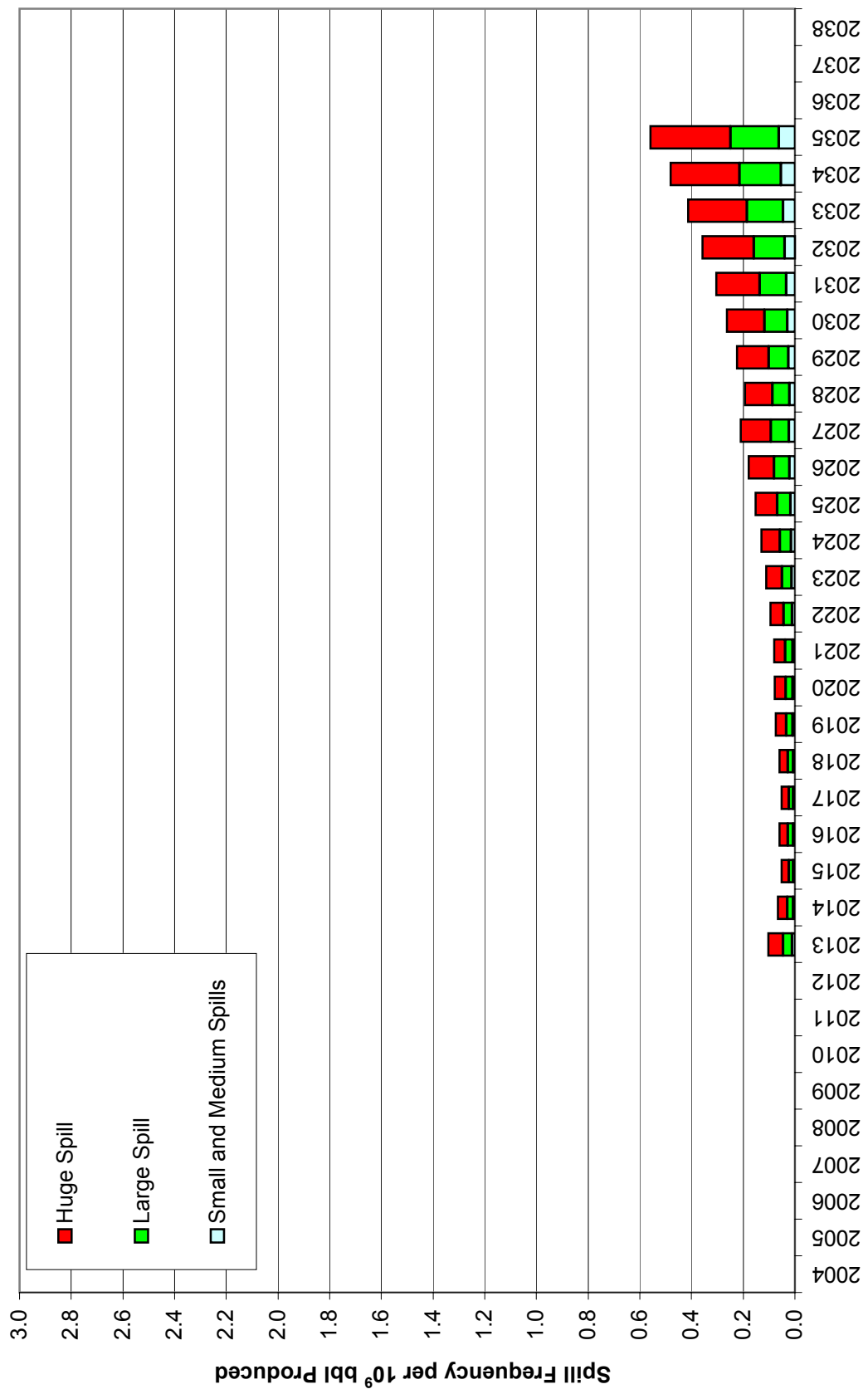
Beaufort Sea Sale 2 Spill Index - Platforms



Beaufort Sea Sale 2 Spill Frequency - Wells



Beaufort Sea Sale 2 Spill Frequency per 10⁹ bbl Produced - Wells



Beaufort Sea Sale 2 Spill Index - Wells

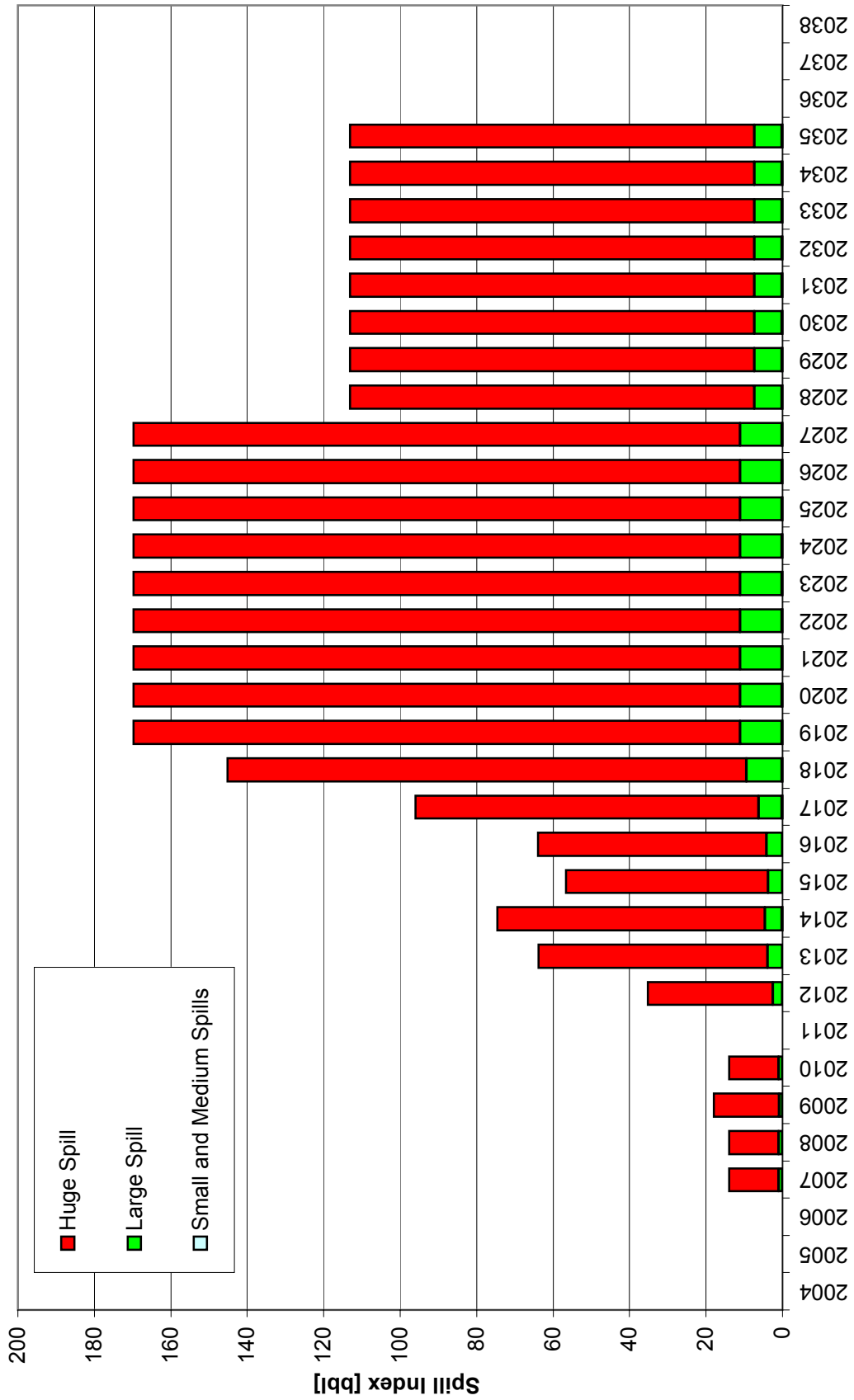
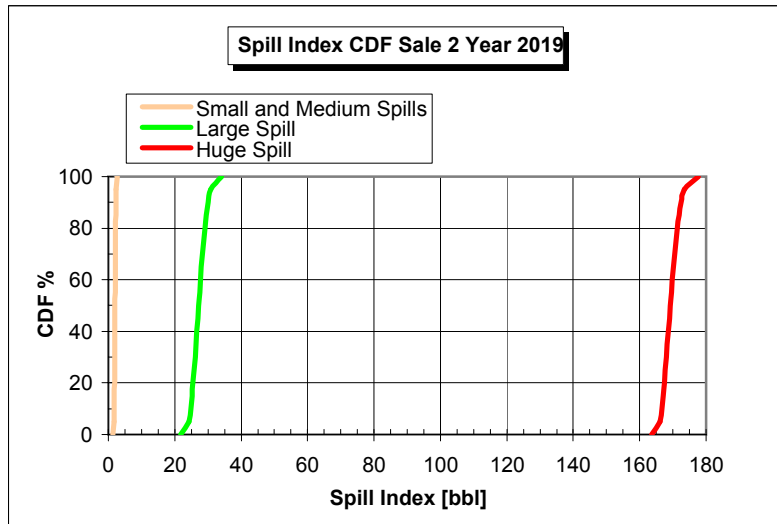
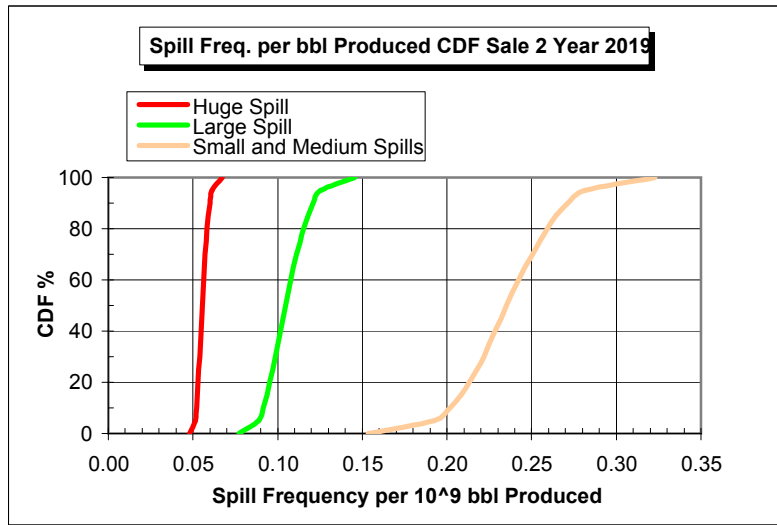
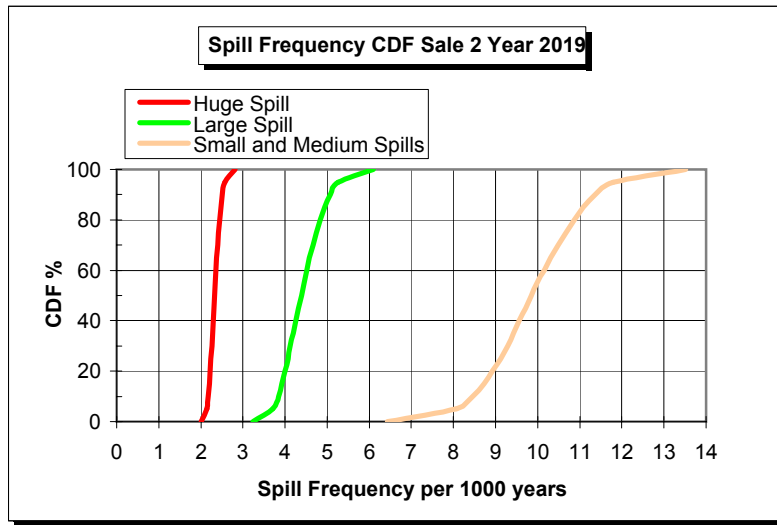


Figure 4.2.13



**Table 4.3.1
 Artic Spill Occurrence Beaufort Sea Sale 3 P/L**

17706	
Spill Index	8.29
bbl	4.62
	3.67
	8.29
	4.62
	3.67
	8.29
	4.62
	3.67
	8.29
	4.62
	3.67
	8.29
	4.62
	3.67
	8.29
	4.62
	3.67
	8.29
	4.62
	3.67
	8.29
	4.62
	3.67
	8.29
	4.62
	3.67
	8.29
	4.62
	3.67
	8.29
	4.62
	3.67
	8.29
	4.62
	3.67
	8.29
	4.62
	3.67
	8.29
	4.62
	3.67

**Table 4.3.2
Arctic Spill Occurrence Beaufort Sea Sale 3 P/L Summary**

Year	Production [Mmbbl]			Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills				
	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]		
2004																							
2005																							
2006																							
2007																							
2008																							
2009																							
2010																							
2011																							
2012																							
2013																							
2014																							
2015																							
2016																							
2017																							
2018																							
2019	30.8	0.749	0.024	0.043	1.653	0.054	0.611	2.402	0.078	0.654	1.649	0.054	6.557	0.507	0.016	8.847	4.558	0.148	16.058				
2020	38.6	0.749	0.019	0.043	1.653	0.043	0.611	2.402	0.062	0.654	1.649	0.043	6.557	0.507	0.013	8.847	4.558	0.118	16.058				
2021	38.6	0.749	0.019	0.043	1.653	0.043	0.611	2.402	0.062	0.654	1.649	0.043	6.557	0.507	0.013	8.847	4.558	0.118	16.058				
2022	38.6	0.749	0.019	0.043	1.653	0.043	0.611	2.402	0.062	0.654	1.649	0.043	6.557	0.507	0.013	8.847	4.558	0.118	16.058				
2023	38.6	0.749	0.019	0.043	1.653	0.043	0.611	2.402	0.062	0.654	1.649	0.043	6.557	0.507	0.013	8.847	4.558	0.118	16.058				
2024	38.6	0.749	0.019	0.043	1.653	0.043	0.611	2.402	0.062	0.654	1.649	0.043	6.557	0.507	0.013	8.847	4.558	0.118	16.058				
2025	34.0	0.749	0.022	0.043	1.653	0.049	0.611	2.402	0.071	0.654	1.649	0.048	6.557	0.507	0.015	8.847	4.558	0.134	16.058				
2026	29.9	0.749	0.025	0.043	1.653	0.055	0.611	2.402	0.080	0.654	1.649	0.055	6.557	0.507	0.017	8.847	4.558	0.152	16.058				
2027	26.3	0.749	0.028	0.043	1.653	0.063	0.611	2.402	0.091	0.654	1.649	0.063	6.557	0.507	0.019	8.847	4.558	0.173	16.058				
2028	23.2	0.749	0.032	0.043	1.653	0.071	0.611	2.402	0.104	0.654	1.649	0.071	6.557	0.507	0.022	8.847	4.558	0.196	16.058				
2029	20.4	0.749	0.037	0.043	1.653	0.081	0.611	2.402	0.118	0.654	1.649	0.081	6.557	0.507	0.025	8.847	4.558	0.223	16.058				
2030	17.9	0.749	0.042	0.043	1.653	0.092	0.611	2.402	0.134	0.654	1.649	0.092	6.557	0.507	0.028	8.847	4.558	0.255	16.058				
2031	15.8	0.749	0.047	0.036	1.653	0.105	0.547	2.402	0.152	0.583	1.649	0.104	5.910	0.507	0.032	8.292	4.558	0.288	14.785				
2032	13.9	0.749	0.054	0.043	1.653	0.119	0.611	2.402	0.173	0.654	1.649	0.119	6.557	0.507	0.036	8.847	4.558	0.328	16.058				
2033	12.2	0.749	0.061	0.043	1.653	0.136	0.611	2.402	0.197	0.654	1.649	0.135	6.557	0.507	0.042	8.847	4.558	0.374	16.058				
2034	10.8	0.749	0.069	0.043	1.653	0.153	0.611	2.402	0.222	0.654	1.649	0.153	6.557	0.507	0.047	8.847	4.558	0.422	16.058				
2035	9.5	0.749	0.079	0.043	1.653	0.174	0.611	2.402	0.253	0.654	1.649	0.174	6.557	0.507	0.053	8.847	4.558	0.480	16.058				
2036	8.3	0.749	0.090	0.043	1.653	0.199	0.611	2.402	0.289	0.654	1.649	0.199	6.557	0.507	0.061	8.847	4.558	0.549	16.058				
2037	7.3	0.749	0.103	0.043	1.653	0.227	0.611	2.402	0.329	0.654	1.649	0.226	6.557	0.507	0.069	8.847	4.558	0.624	16.058				
2038	6.5	0.749	0.115	0.043	1.653	0.254	0.611	2.402	0.370	0.654	1.649	0.254	6.557	0.507	0.078	8.847	4.558	0.701	16.058				

**Table 4.3.3
Arctic Spill Occurrence Beaufort Sea Sale 3 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2005	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2006	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2007	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2008	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2009	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2010	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2011	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2012	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2013	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2014	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2015	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2016	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2017	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								

**Table 4.3.3
Arctic Spill Occurrence Beaufort Sea Sale 3 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow			0.964			0.192		
	Medium	1	4	1.044	0.418	0.07	0.206	0.083	0.51
	Deep			1.163			0.227		
	Total	1	4		0.418	0.07		0.083	0.51
2019	Shallow			0.964			0.192		
	Medium	2	18	1.044	1.879	0.30	0.206	0.371	2.28
	Deep			1.163			0.227		
	Total	2	18		1.879	0.30		0.371	2.28
2020	Shallow			0.964			0.192		
	Medium	2	38	1.044	3.967	0.63	0.206	0.784	4.81
	Deep			1.163			0.227		
	Total	2	38		3.967	0.63		0.784	4.81
2021	Shallow			0.964			0.192		
	Medium	2	58	1.044	6.055	0.96	0.206	1.197	7.34
	Deep			1.163			0.227		
	Total	2	58		6.055	0.96		1.197	7.34
2022	Shallow			0.964			0.192		
	Medium	2	68	1.044	7.099	1.12	0.206	1.403	8.60
	Deep			1.163			0.227		
	Total	2	68		7.099	1.12		1.403	8.60
2023	Shallow			0.964			0.192		
	Medium	2	68	1.044	7.099	1.12	0.206	1.403	8.60
	Deep			1.163			0.227		
	Total	2	68		7.099	1.12		1.403	8.60
2024	Shallow			0.964			0.192		
	Medium	2	68	1.044	7.099	1.12	0.206	1.403	8.60
	Deep			1.163			0.227		
	Total	2	68		7.099	1.12		1.403	8.60
2025	Shallow			0.964			0.192		
	Medium	2	68	1.044	7.099	1.12	0.206	1.403	8.60
	Deep			1.163			0.227		
	Total	2	68		7.099	1.12		1.403	8.60
2026	Shallow			0.964			0.192		
	Medium	2	68	1.044	7.099	1.12	0.206	1.403	8.60
	Deep			1.163			0.227		
	Total	2	68		7.099	1.12		1.403	8.60
2027	Shallow			0.964			0.192		
	Medium	2	68	1.044	7.099	1.12	0.206	1.403	8.60
	Deep			1.163			0.227		
	Total	2	68		7.099	1.12		1.403	8.60
2028	Shallow			0.964			0.192		
	Medium	2	68	1.044	7.099	1.12	0.206	1.403	8.60
	Deep			1.163			0.227		
	Total	2	68		7.099	1.12		1.403	8.60
2029	Shallow			0.964			0.192		
	Medium	2	68	1.044	7.099	1.12	0.206	1.403	8.60
	Deep			1.163			0.227		
	Total	2	68		7.099	1.12		1.403	8.60
2030	Shallow			0.964			0.192		
	Medium	2	68	1.044	7.099	1.12	0.206	1.403	8.60
	Deep			1.163			0.227		
	Total	2	68		7.099	1.12		1.403	8.60
2031	Shallow			0.964			0.192		
	Medium	2	68	1.044	7.099	1.12	0.206	1.403	8.60
	Deep			1.163			0.227		
	Total	2	68		7.099	1.12		1.403	8.60

**Table 4.3.3
Arctic Spill Occurrence Beaufort Sea Sale 3 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow			0.964			0.192		
	Medium	2	68	1.044	7.099	1.12	0.206	1.403	8.60
	Deep			1.163			0.227		
	Total	2	68		7.099	1.12		1.403	8.60
2033	Shallow			0.964			0.192		
	Medium	2	68	1.044	7.099	1.12	0.206	1.403	8.60
	Deep			1.163			0.227		
	Total	2	68		7.099	1.12		1.403	8.60
2034	Shallow			0.964			0.192		
	Medium	2	68	1.044	7.099	1.12	0.206	1.403	8.60
	Deep			1.163			0.227		
	Total	2	68		7.099	1.12		1.403	8.60
2035	Shallow			0.964			0.192		
	Medium	2	68	1.044	7.099	1.12	0.206	1.403	8.60
	Deep			1.163			0.227		
	Total	2	68		7.099	1.12		1.403	8.60
2036	Shallow			0.964			0.192		
	Medium	2	68	1.044	7.099	1.12	0.206	1.403	8.60
	Deep			1.163			0.227		
	Total	2	68		7.099	1.12		1.403	8.60
2037	Shallow			0.964			0.192		
	Medium	2	68	1.044	7.099	1.12	0.206	1.403	8.60
	Deep			1.163			0.227		
	Total	2	68		7.099	1.12		1.403	8.60
2038	Shallow			0.964			0.192		
	Medium	2	68	1.044	7.099	1.12	0.206	1.403	8.60
	Deep			1.163			0.227		
	Total	2	68		7.099	1.12		1.403	8.60

**Table 4.3.4
Arctic Spill Occurrence Beaufort Sea Sale 3 Platforms Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]
2004										
2005										
2006										
2007										
2008										
2009										
2010										
2011										
2012										
2013										
2014										
2015										
2016										
2017										
2018		0.418		0.066	0.083		0.506	0.500		0.572
2019	30.8	1.879	0.061	0.297	0.371	0.012	2.277	2.251	0.073	2.573
2020	38.6	3.967	0.103	0.627	0.784	0.020	4.806	4.751	0.123	5.433
2021	38.6	6.055	0.157	0.957	1.197	0.031	7.336	7.252	0.188	8.292
2022	38.6	7.099	0.184	1.122	1.403	0.036	8.600	8.502	0.220	9.722
2023	38.6	7.099	0.184	1.122	1.403	0.036	8.600	8.502	0.220	9.722
2024	38.6	7.099	0.184	1.122	1.403	0.036	8.600	8.502	0.220	9.722
2025	34.0	7.099	0.209	1.122	1.403	0.041	8.600	8.502	0.250	9.722
2026	29.9	7.099	0.237	1.122	1.403	0.047	8.600	8.502	0.284	9.722
2027	26.3	7.099	0.270	1.122	1.403	0.053	8.600	8.502	0.323	9.722
2028	23.2	7.099	0.306	1.122	1.403	0.060	8.600	8.502	0.366	9.722
2029	20.4	7.099	0.348	1.122	1.403	0.069	8.600	8.502	0.417	9.722
2030	17.9	7.099	0.397	1.122	1.403	0.078	8.600	8.502	0.475	9.722
2031	15.8	7.099	0.449	1.122	1.403	0.089	8.600	8.502	0.538	9.722
2032	13.9	7.099	0.511	1.122	1.403	0.101	8.600	8.502	0.612	9.722
2033	12.2	7.099	0.582	1.122	1.403	0.115	8.600	8.502	0.697	9.722
2034	10.8	7.099	0.657	1.122	1.403	0.130	8.600	8.502	0.787	9.722
2035	9.5	7.099	0.747	1.122	1.403	0.148	8.600	8.502	0.895	9.722
2036	8.3	7.099	0.855	1.122	1.403	0.169	8.600	8.502	1.024	9.722
2037	7.3	7.099	0.973	1.122	1.403	0.192	8.600	8.502	1.165	9.722
2038	6.5	7.099	1.092	1.122	1.403	0.216	8.600	8.502	1.308	9.722

**Table 4.3.5
Arctic Spill Occurrence Beaufort Sea Sale 3 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2009	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2010	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2011	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2012	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2013	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2014	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2015	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2016	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2017	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													

**Table 4.3.5
Arctic Spill Occurrence Beaufort Sea Sale 3 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		0.500			3.500			1.500			1.000		
	Medium	4	0.500	0.020	0.01	3.500	0.140	0.63	1.500	0.060	1.20	1.000	0.040	8.00
	Deep		0.500			3.500			1.500			1.000		
	Total	4		0.020	0.01		0.140	0.63		0.060	1.20		0.040	8.00
2019	Shallow		0.500			3.500			1.500			1.000		
	Medium	18	0.500	0.090	0.05	3.500	0.630	2.84	1.500	0.270	5.40	1.000	0.180	36.00
	Deep		0.500			3.500			1.500			1.000		
	Total	18		0.090	0.05		0.630	2.84		0.270	5.40		0.180	36.00
2020	Shallow		0.500			3.500			1.500			1.000		
	Medium	38	0.500	0.190	0.10	3.500	1.330	5.99	1.500	0.570	11.40	1.000	0.380	76.00
	Deep		0.500			3.500			1.500			1.000		
	Total	38		0.190	0.10		1.330	5.99		0.570	11.40		0.380	76.00
2021	Shallow		0.500			3.500			1.500			1.000		
	Medium	58	0.500	0.290	0.15	3.500	2.030	9.14	1.500	0.870	17.40	1.000	0.580	116.00
	Deep		0.500			3.500			1.500			1.000		
	Total	58		0.290	0.15		2.030	9.14		0.870	17.40		0.580	116.00
2022	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2023	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2024	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2025	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2026	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2027	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2028	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2029	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2030	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2031	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00

**Table 4.3.5
Arctic Spill Occurrence Beaufort Sea Sale 3 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2033	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2034	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2035	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2036	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2037	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2038	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00

**Table 4.3.6
Arctic Spill Occurrence Beaufort Sea Sale 3 Production Wells Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009													
2010													
2011													
2012													
2013													
2014													
2015													
2016													
2017													
2018		0.020		0.010	0.060		0.630	0.100		9.200	0.180		9.840
2019	30.8	0.090	0.003	0.045	0.270	0.009	2.835	0.450	0.015	41.400	0.810	0.026	44.280
2020	38.6	0.190	0.005	0.095	0.570	0.015	5.985	0.950	0.025	87.400	1.710	0.044	93.480
2021	38.6	0.290	0.008	0.145	0.870	0.023	9.135	1.450	0.038	133.400	2.610	0.068	142.680
2022	38.6	0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
2023	38.6	0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
2024	38.6	0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
2025	34.0	0.340	0.010	0.170	1.020	0.030	10.710	1.700	0.050	156.400	3.060	0.090	167.280
2026	29.9	0.340	0.011	0.170	1.020	0.034	10.710	1.700	0.057	156.400	3.060	0.102	167.280
2027	26.3	0.340	0.013	0.170	1.020	0.039	10.710	1.700	0.065	156.400	3.060	0.116	167.280
2028	23.2	0.340	0.015	0.170	1.020	0.044	10.710	1.700	0.073	156.400	3.060	0.132	167.280
2029	20.4	0.340	0.017	0.170	1.020	0.050	10.710	1.700	0.083	156.400	3.060	0.150	167.280
2030	17.9	0.340	0.019	0.170	1.020	0.057	10.710	1.700	0.095	156.400	3.060	0.171	167.280
2031	15.8	0.340	0.022	0.170	1.020	0.065	10.710	1.700	0.108	156.400	3.060	0.194	167.280
2032	13.9	0.340	0.024	0.170	1.020	0.073	10.710	1.700	0.122	156.400	3.060	0.220	167.280
2033	12.2	0.340	0.028	0.170	1.020	0.084	10.710	1.700	0.139	156.400	3.060	0.251	167.280
2034	10.8	0.340	0.031	0.170	1.020	0.094	10.710	1.700	0.157	156.400	3.060	0.283	167.280
2035	9.5	0.340	0.036	0.170	1.020	0.107	10.710	1.700	0.179	156.400	3.060	0.322	167.280
2036	8.3	0.340	0.041	0.170	1.020	0.123	10.710	1.700	0.205	156.400	3.060	0.369	167.280
2037	7.3	0.340	0.047	0.170	1.020	0.140	10.710	1.700	0.233	156.400	3.060	0.419	167.280
2038	6.5	0.340	0.052	0.170	1.020	0.157	10.710	1.700	0.262	156.400	3.060	0.471	167.280

**Table 4.3.7
Arctic Spill Occurrence Beaufort Sea Sale 3 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2005	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2006	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2007	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2008	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2010	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2011	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2012	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2013	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2014	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2015	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2016	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2017	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00

**Table 4.3.7
Arctic Spill Occurrence Beaufort Sea Sale 3 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2019	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2020	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2021	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2022	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2023	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2024	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2025	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2026	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2027	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2028	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2029	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2030	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2031	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

**Table 4.3.7
Arctic Spill Occurrence Beaufort Sea Sale 3 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2033	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2034	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2035	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2036	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2037	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2038	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.3.8

Arctic Spill Occurrence Beaufort Sea Sale 3 Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009													
2010		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2011													
2012		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2013		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2014													
2015		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2016													
2017		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2018		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2019	30.8												
2020	38.6												
2021	38.6												
2022	38.6												
2023	38.6												
2024	38.6												
2025	34.0												
2026	29.9												
2027	26.3												
2028	23.2												
2029	20.4												
2030	17.9												
2031	15.8												
2032	13.9												
2033	12.2												
2034	10.8												
2035	9.5												
2036	8.3												
2037	7.3												
2038	6.5												

**Table 4.3.9
Arctic Spill Occurrence Beaufort Sea Sale 3 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2009	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2011	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2012	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2013	Shallow		1.300			9.080			3.900			3.900		
	Medium	1	1.300	0.013	0.01	9.080	0.091	0.41	3.900	0.039	0.78	3.900	0.039	7.80
	Deep		1.300			9.080			3.900			3.900		
	Total	1		0.013	0.01		0.091	0.41		0.039	0.78		0.039	7.80
2014	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2015	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2016	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2017	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.3.9
Arctic Spill Occurrence Beaufort Sea Sale 3 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] = 500		Spill Index bbl	Average Spill [bbl] = 4500		Spill Index bbl	Average Spill [bbl] = 20000		Spill Index bbl	Average Spill [bbl] = 200000		Spill Index bbl
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2019	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2020	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2021	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2022	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2023	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2024	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2025	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2026	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2027	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2028	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2029	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2030	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2031	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.3.9
Arctic Spill Occurrence Beaufort Sea Sale 3 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2033	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2034	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2035	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2036	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2037	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2038	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.3.10

Arctic Spill Occurrence Beaufort Sea Sale 3 Development Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009													
2010													
2011													
2012													
2013		0.013	0.007	0.039	0.409	0.078	8.580	0.130	8.995				
2014		0.026	0.013	0.078	0.817	0.156	17.160	0.260	17.990				
2015		0.026	0.013	0.078	0.817	0.156	17.160	0.260	17.990				
2016													
2017													
2018													
2019	30.8												
2020	38.6												
2021	38.6												
2022	38.6												
2023	38.6												
2024	38.6												
2025	34.0												
2026	29.9												
2027	26.3												
2028	23.2												
2029	20.4												
2030	17.9												
2031	15.8												
2032	13.9												
2033	12.2												
2034	10.8												
2035	9.5												
2036	8.3												
2037	7.3												
2038	6.5												

**Table 4.3.11
Arctic Spill Occurrence Beaufort Sea Sale 3 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2005	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2006	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2007	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2008	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2009	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2010	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032	0.016	0.095	0.995	0.150		12.900	0.277		13.911		
	Development Wells													
Total		0.032	0.016	0.095	0.995	0.150		12.900	0.277		13.911			
2011	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2012	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032	0.016	0.095	0.995	0.150		12.900	0.277		13.911		
	Development Wells													
Total		0.032	0.016	0.095	0.995	0.150		12.900	0.277		13.911			
2013	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032	0.016	0.095	0.995	0.150		12.900	0.277		13.911		
	Development Wells		0.013	0.007	0.039	0.409	0.078		8.580	0.130		8.995		
Total		0.045	0.022	0.134	1.404	0.228		21.480	0.407		22.906			

**Table 4.3.11
Arctic Spill Occurrence Beaufort Sea Sale 3 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2014	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells		0.026	0.013	0.078	0.817	0.156		17.160	0.260		17.990		
	Total		0.026	0.013	0.078	0.817	0.156		17.160	0.260		17.990		
2015	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032	0.016	0.095	0.995	0.150		12.900	0.277		13.911		
	Development Wells		0.026	0.013	0.078	0.817	0.156		17.160	0.260		17.990		
	Total		0.058	0.029	0.173	1.812	0.306		30.060	0.537		31.901		
2016	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2017	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032	0.016	0.095	0.995	0.150		12.900	0.277		13.911		
	Development Wells													
	Total		0.032	0.016	0.095	0.995	0.150		12.900	0.277		13.911		
2018	Pipeline													
	Platforms		0.418	0.066	0.083	0.506				0.500		0.572		
	Production Wells		0.020	0.010	0.060	0.630	0.100		9.200	0.180		9.840		
	Exploration Wells		0.032	0.016	0.095	0.995	0.150		12.900	0.277		13.911		
	Development Wells													
	Total		0.469	0.092	0.238	2.131	0.250		22.100	0.957		24.323		
2019	Pipeline		2.402	0.078	0.654	1.649	0.054	6.557	0.507	0.016	8.847	4.558	0.148	16.058
	Platforms		1.879	0.061	0.297	0.371	0.012	2.277				2.251	0.073	2.573
	Production Wells		0.090	0.003	0.045	0.270	0.009	2.835	0.450	0.015	41.400	0.810	0.026	44.280
	Exploration Wells													
	Development Wells													
	Total		4.372	0.142	0.996	2.290	0.074	11.668	0.957	0.031	50.247	7.619	0.247	62.912
2020	Pipeline		2.402	0.062	0.654	1.649	0.043	6.557	0.507	0.013	8.847	4.558	0.118	16.058
	Platforms		3.967	0.103	0.627	0.784	0.020	4.806				4.751	0.123	5.433
	Production Wells		0.190	0.005	0.095	0.570	0.015	5.985	0.950	0.025	87.400	1.710	0.044	93.480
	Exploration Wells													
	Development Wells													
	Total		6.560	0.170	1.376	3.003	0.078	17.348	1.457	0.038	96.247	11.019	0.285	114.971
2021	Pipeline		2.402	0.062	0.654	1.649	0.043	6.557	0.507	0.013	8.847	4.558	0.118	16.058
	Platforms		6.055	0.157	0.957	1.197	0.031	7.336				7.252	0.188	8.292
	Production Wells		0.290	0.008	0.145	0.870	0.023	9.135	1.450	0.038	133.400	2.610	0.068	142.680
	Exploration Wells													
	Development Wells													
	Total		8.748	0.227	1.756	3.716	0.096	23.027	1.957	0.051	142.247	14.420	0.374	167.031
2022	Pipeline		2.402	0.062	0.654	1.649	0.043	6.557	0.507	0.013	8.847	4.558	0.118	16.058
	Platforms		7.099	0.184	1.122	1.403	0.036	8.600				8.502	0.220	9.722
	Production Wells		0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
	Exploration Wells													
	Development Wells													
	Total		9.842	0.255	1.946	4.072	0.105	25.867	2.207	0.057	165.247	16.120	0.418	193.061
2023	Pipeline		2.402	0.062	0.654	1.649	0.043	6.557	0.507	0.013	8.847	4.558	0.118	16.058
	Platforms		7.099	0.184	1.122	1.403	0.036	8.600				8.502	0.220	9.722
	Production Wells		0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
	Exploration Wells													
	Development Wells													
	Total		9.842	0.255	1.946	4.072	0.105	25.867	2.207	0.057	165.247	16.120	0.418	193.061

**Table 4.3.11
Arctic Spill Occurrence Beaufort Sea Sale 3 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills			
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	
2024	Pipeline	38.6	2.402	0.062	0.654	1.649	0.043	6.557	0.507	0.013	8.847	4.558	0.118	16.058	
	Platforms		7.099	0.184	1.122	1.403	0.036	8.600				8.502	0.220	9.722	
	Production Wells		0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280	
	Exploration Wells														
	Development Wells														
	Total		9.842	0.255	1.946	4.072	0.105	25.867	2.207	0.057	165.247	16.120	0.418	193.061	
2025	Pipeline	34.0	2.402	0.071	0.654	1.649	0.048	6.557	0.507	0.015	8.847	4.558	0.134	16.058	
	Platforms		7.099	0.209	1.122	1.403	0.041	8.600				8.502	0.250	9.722	
	Production Wells		0.340	0.010	0.170	1.020	0.030	10.710	1.700	0.050	156.400	3.060	0.090	167.280	
	Exploration Wells														
	Development Wells														
	Total		9.842	0.289	1.946	4.072	0.120	25.867	2.207	0.065	165.247	16.120	0.474	193.061	
2026	Pipeline	29.9	2.402	0.080	0.654	1.649	0.055	6.557	0.507	0.017	8.847	4.558	0.152	16.058	
	Platforms		7.099	0.237	1.122	1.403	0.047	8.600				8.502	0.284	9.722	
	Production Wells		0.340	0.011	0.170	1.020	0.034	10.710	1.700	0.057	156.400	3.060	0.102	167.280	
	Exploration Wells														
	Development Wells														
	Total		9.842	0.329	1.946	4.072	0.136	25.867	2.207	0.074	165.247	16.120	0.539	193.061	
2027	Pipeline	26.3	2.402	0.091	0.654	1.649	0.063	6.557	0.507	0.019	8.847	4.558	0.173	16.058	
	Platforms		7.099	0.270	1.122	1.403	0.053	8.600				8.502	0.323	9.722	
	Production Wells		0.340	0.013	0.170	1.020	0.039	10.710	1.700	0.065	156.400	3.060	0.116	167.280	
	Exploration Wells														
	Development Wells														
	Total		9.842	0.374	1.946	4.072	0.155	25.867	2.207	0.084	165.247	16.120	0.613	193.061	
2028	Pipeline	23.2	2.402	0.104	0.654	1.649	0.071	6.557	0.507	0.022	8.847	4.558	0.196	16.058	
	Platforms		7.099	0.306	1.122	1.403	0.060	8.600				8.502	0.366	9.722	
	Production Wells		0.340	0.015	0.170	1.020	0.044	10.710	1.700	0.073	156.400	3.060	0.132	167.280	
	Exploration Wells														
	Development Wells														
	Total		9.842	0.424	1.946	4.072	0.176	25.867	2.207	0.095	165.247	16.120	0.695	193.061	
2029	Pipeline	20.4	2.402	0.118	0.654	1.649	0.081	6.557	0.507	0.025	8.847	4.558	0.223	16.058	
	Platforms		7.099	0.348	1.122	1.403	0.069	8.600				8.502	0.417	9.722	
	Production Wells		0.340	0.017	0.170	1.020	0.050	10.710	1.700	0.083	156.400	3.060	0.150	167.280	
	Exploration Wells														
	Development Wells														
	Total		9.842	0.482	1.946	4.072	0.200	25.867	2.207	0.108	165.247	16.120	0.790	193.061	
2030	Pipeline	17.9	2.402	0.134	0.654	1.649	0.092	6.557	0.507	0.028	8.847	4.558	0.255	16.058	
	Platforms		7.099	0.397	1.122	1.403	0.078	8.600				8.502	0.475	9.722	
	Production Wells		0.340	0.019	0.170	1.020	0.057	10.710	1.700	0.095	156.400	3.060	0.171	167.280	
	Exploration Wells														
	Development Wells														
	Total		9.842	0.550	1.946	4.072	0.227	25.867	2.207	0.123	165.247	16.120	0.901	193.061	
2031	Pipeline	15.8	2.402	0.152	0.583	1.649	0.104	5.910	0.507	0.032	8.292	4.558	0.288	14.785	
	Platforms		7.099	0.449	1.122	1.403	0.089	8.600				8.502	0.538	9.722	
	Production Wells		0.340	0.022	0.170	1.020	0.065	10.710	1.700	0.108	156.400	3.060	0.194	167.280	
	Exploration Wells														
	Development Wells														
	Total		9.842	0.623	1.875	4.072	0.258	25.221	2.207	0.140	164.692	16.120	1.020	191.787	
2032	Pipeline	13.9	2.402	0.173	0.654	1.649	0.119	6.557	0.507	0.036	8.847	4.558	0.328	16.058	
	Platforms		7.099	0.511	1.122	1.403	0.101	8.600				8.502	0.612	9.722	
	Production Wells		0.340	0.024	0.170	1.020	0.073	10.710	1.700	0.122	156.400	3.060	0.220	167.280	
	Exploration Wells														
	Development Wells														
	Total		9.842	0.708	1.946	4.072	0.293	25.867	2.207	0.159	165.247	16.120	1.160	193.061	
2033	Pipeline	12.2	2.402	0.197	0.654	1.649	0.135	6.557	0.507	0.042	8.847	4.558	0.374	16.058	
	Platforms		7.099	0.582	1.122	1.403	0.115	8.600				8.502	0.697	9.722	
	Production Wells		0.340	0.028	0.170	1.020	0.084	10.710	1.700	0.139	156.400	3.060	0.251	167.280	
	Exploration Wells														
	Development Wells														
	Total		9.842	0.807	1.946	4.072	0.334	25.867	2.207	0.181	165.247	16.120	1.321	193.061	

**Table 4.3.11
Arctic Spill Occurrence Beaufort Sea Sale 3 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills			
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	
2034	Pipeline	10.8	2.402	0.222	0.654	1.649	0.153	6.557	0.507	0.047	8.847	4.558	0.422	16.058	
	Platforms		7.099	0.657	1.122	1.403	0.130	8.600				8.502	0.787	9.722	
	Production Wells		0.340	0.031	0.170	1.020	0.094	10.710	1.700	0.157	156.400	3.060	0.283	167.280	
	Exploration Wells														
	Development Wells														
	Total		9.842	0.911	1.946	4.072	0.377	25.867	2.207	0.204	165.247	16.120	1.493	193.061	
2035	Pipeline	9.5	2.402	0.253	0.654	1.649	0.174	6.557	0.507	0.053	8.847	4.558	0.480	16.058	
	Platforms		7.099	0.747	1.122	1.403	0.148	8.600				8.502	0.895	9.722	
	Production Wells		0.340	0.036	0.170	1.020	0.107	10.710	1.700	0.179	156.400	3.060	0.322	167.280	
	Exploration Wells														
	Development Wells														
	Total		9.842	1.036	1.946	4.072	0.429	25.867	2.207	0.232	165.247	16.120	1.697	193.061	
2036	Pipeline	8.3	2.402	0.289	0.654	1.649	0.199	6.557	0.507	0.061	8.847	4.558	0.549	16.058	
	Platforms		7.099	0.855	1.122	1.403	0.169	8.600				8.502	1.024	9.722	
	Production Wells		0.340	0.041	0.170	1.020	0.123	10.710	1.700	0.205	156.400	3.060	0.369	167.280	
	Exploration Wells														
	Development Wells														
	Total		9.842	1.186	1.946	4.072	0.491	25.867	2.207	0.266	165.247	16.120	1.942	193.061	
2037	Pipeline	7.3	2.402	0.329	0.654	1.649	0.226	6.557	0.507	0.069	8.847	4.558	0.624	16.058	
	Platforms		7.099	0.973	1.122	1.403	0.192	8.600				8.502	1.165	9.722	
	Production Wells		0.340	0.047	0.170	1.020	0.140	10.710	1.700	0.233	156.400	3.060	0.419	167.280	
	Exploration Wells														
	Development Wells														
	Total		9.842	1.348	1.946	4.072	0.558	25.867	2.207	0.302	165.247	16.120	2.208	193.061	
2038	Pipeline	6.5	2.402	0.370	0.654	1.649	0.254	6.557	0.507	0.078	8.847	4.558	0.701	16.058	
	Platforms		7.099	1.092	1.122	1.403	0.216	8.600				8.502	1.308	9.722	
	Production Wells		0.340	0.052	0.170	1.020	0.157	10.710	1.700	0.262	156.400	3.060	0.471	167.280	
	Exploration Wells														
	Development Wells														
	Total		9.842	1.514	1.946	4.072	0.626	25.867	2.207	0.340	165.247	16.120	2.480	193.061	

**Table 4.3.12
Arctic Spill Occurrence Beaufort Sea Sale 3 Annual Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009													
2010		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2011													
2012		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2013		0.04		0.022	0.13		1.404	0.228		21.48	0.407		22.906
2014		0.03		0.013	0.08		0.817	0.156		17.16	0.260		17.990
2015		0.06		0.029	0.17		1.812	0.306		30.06	0.537		31.901
2016													
2017		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2018		0.47		0.092	0.24		2.131	0.250		22.10	0.957		24.323
2019	30.8	4.37	0.142	0.996	2.29	0.074	11.668	0.957	0.031	50.25	7.619	0.247	62.912
2020	38.6	6.56	0.170	1.376	3.00	0.078	17.348	1.457	0.038	96.25	11.019	0.285	114.971
2021	38.6	8.75	0.227	1.756	3.72	0.096	23.027	1.957	0.051	142.25	14.420	0.374	167.031
2022	38.6	9.84	0.255	1.946	4.07	0.105	25.867	2.207	0.057	165.25	16.120	0.418	193.061
2023	38.6	9.84	0.255	1.946	4.07	0.105	25.867	2.207	0.057	165.25	16.120	0.418	193.061
2024	38.6	9.84	0.255	1.946	4.07	0.105	25.867	2.207	0.057	165.25	16.120	0.418	193.061
2025	34.0	9.84	0.289	1.946	4.07	0.120	25.867	2.207	0.065	165.25	16.120	0.474	193.061
2026	29.9	9.84	0.329	1.946	4.07	0.136	25.867	2.207	0.074	165.25	16.120	0.539	193.061
2027	26.3	9.84	0.374	1.946	4.07	0.155	25.867	2.207	0.084	165.25	16.120	0.613	193.061
2028	23.2	9.84	0.424	1.946	4.07	0.176	25.867	2.207	0.095	165.25	16.120	0.695	193.061
2029	20.4	9.84	0.482	1.946	4.07	0.200	25.867	2.207	0.108	165.25	16.120	0.790	193.061
2030	17.9	9.84	0.550	1.946	4.07	0.227	25.867	2.207	0.123	165.25	16.120	0.901	193.061
2031	15.8	9.84	0.623	1.875	4.07	0.258	25.221	2.207	0.140	164.69	16.120	1.020	191.787
2032	13.9	9.84	0.708	1.946	4.07	0.293	25.867	2.207	0.159	165.25	16.120	1.160	193.061
2033	12.2	9.84	0.807	1.946	4.07	0.334	25.867	2.207	0.181	165.25	16.120	1.321	193.061
2034	10.8	9.84	0.911	1.946	4.07	0.377	25.867	2.207	0.204	165.25	16.120	1.493	193.061
2035	9.5	9.84	1.036	1.946	4.07	0.429	25.867	2.207	0.232	165.25	16.120	1.697	193.061
2036	8.3	9.84	1.186	1.946	4.07	0.491	25.867	2.207	0.266	165.25	16.120	1.942	193.061
2037	7.3	9.84	1.348	1.946	4.07	0.558	25.867	2.207	0.302	165.25	16.120	2.208	193.061
2038	6.5	9.84	1.514	1.946	4.07	0.626	25.867	2.207	0.340	165.25	16.120	2.480	193.061

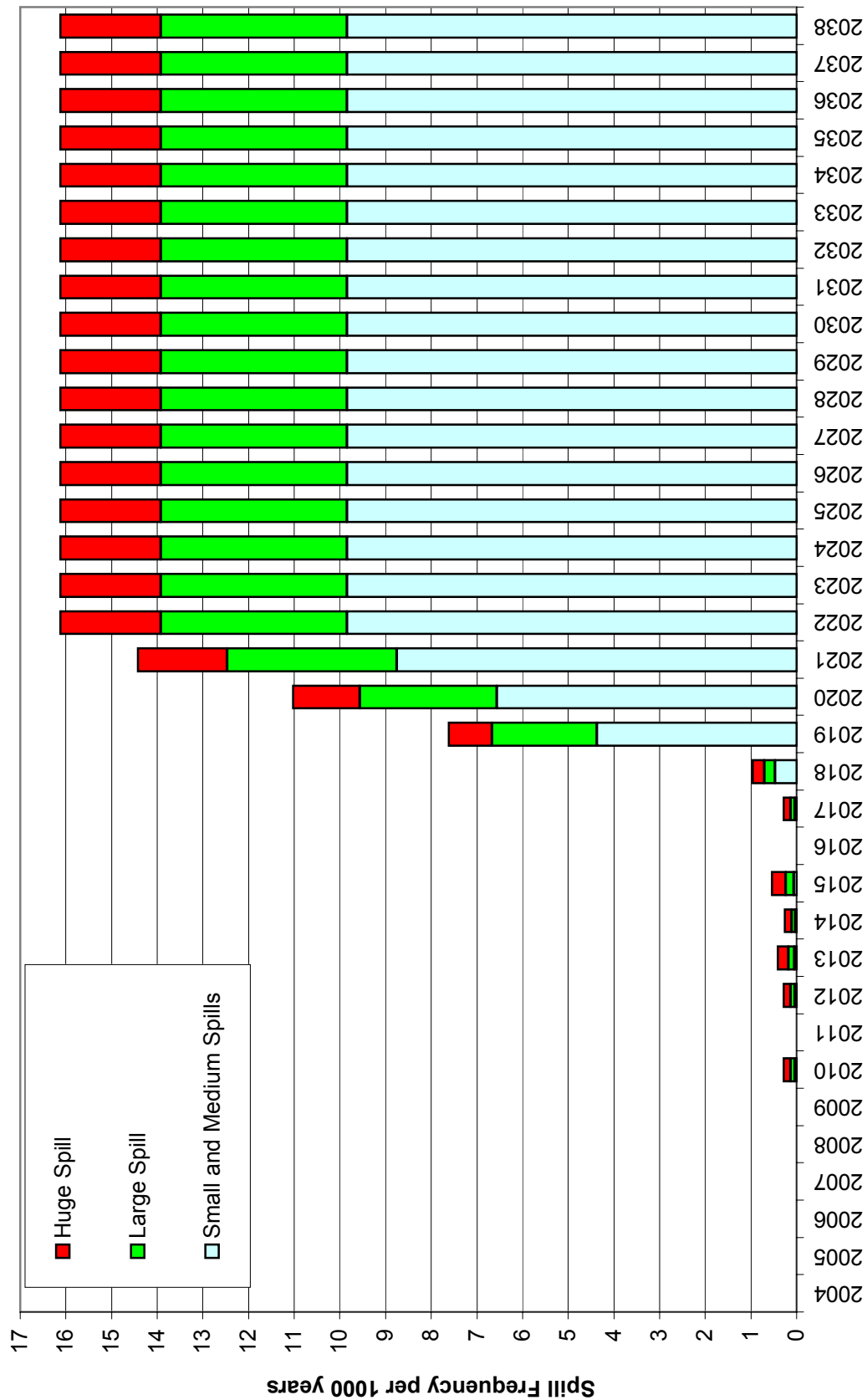
**Table 4.3.13
Arctic Spill Occurrence Beaufort Sea Sale 3 Wells Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009													
2010		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2011													
2012		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2013		0.045		0.022	0.134		1.404	0.228		21.480	0.407		22.906
2014		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2015		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901
2016													
2017		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2018		0.052		0.026	0.155		1.625	0.250		22.100	0.457		23.751
2019	30.8	0.090	0.003	0.045	0.270	0.009	2.835	0.450	0.015	41.400	0.810	0.026	44.280
2020	38.6	0.190	0.005	0.095	0.570	0.015	5.985	0.950	0.025	87.400	1.710	0.044	93.480
2021	38.6	0.290	0.008	0.145	0.870	0.023	9.135	1.450	0.038	133.400	2.610	0.068	142.680
2022	38.6	0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
2023	38.6	0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
2024	38.6	0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
2025	34.0	0.340	0.010	0.170	1.020	0.030	10.710	1.700	0.050	156.400	3.060	0.090	167.280
2026	29.9	0.340	0.011	0.170	1.020	0.034	10.710	1.700	0.057	156.400	3.060	0.102	167.280
2027	26.3	0.340	0.013	0.170	1.020	0.039	10.710	1.700	0.065	156.400	3.060	0.116	167.280
2028	23.2	0.340	0.015	0.170	1.020	0.044	10.710	1.700	0.073	156.400	3.060	0.132	167.280
2029	20.4	0.340	0.017	0.170	1.020	0.050	10.710	1.700	0.083	156.400	3.060	0.150	167.280
2030	17.9	0.340	0.019	0.170	1.020	0.057	10.710	1.700	0.095	156.400	3.060	0.171	167.280
2031	15.8	0.340	0.022	0.170	1.020	0.065	10.710	1.700	0.108	156.400	3.060	0.194	167.280
2032	13.9	0.340	0.024	0.170	1.020	0.073	10.710	1.700	0.122	156.400	3.060	0.220	167.280
2033	12.2	0.340	0.028	0.170	1.020	0.084	10.710	1.700	0.139	156.400	3.060	0.251	167.280
2034	10.8	0.340	0.031	0.170	1.020	0.094	10.710	1.700	0.157	156.400	3.060	0.283	167.280
2035	9.5	0.340	0.036	0.170	1.020	0.107	10.710	1.700	0.179	156.400	3.060	0.322	167.280
2036	8.3	0.340	0.041	0.170	1.020	0.123	10.710	1.700	0.205	156.400	3.060	0.369	167.280
2037	7.3	0.340	0.047	0.170	1.020	0.140	10.710	1.700	0.233	156.400	3.060	0.419	167.280
2038	6.5	0.340	0.052	0.170	1.020	0.157	10.710	1.700	0.262	156.400	3.060	0.471	167.280

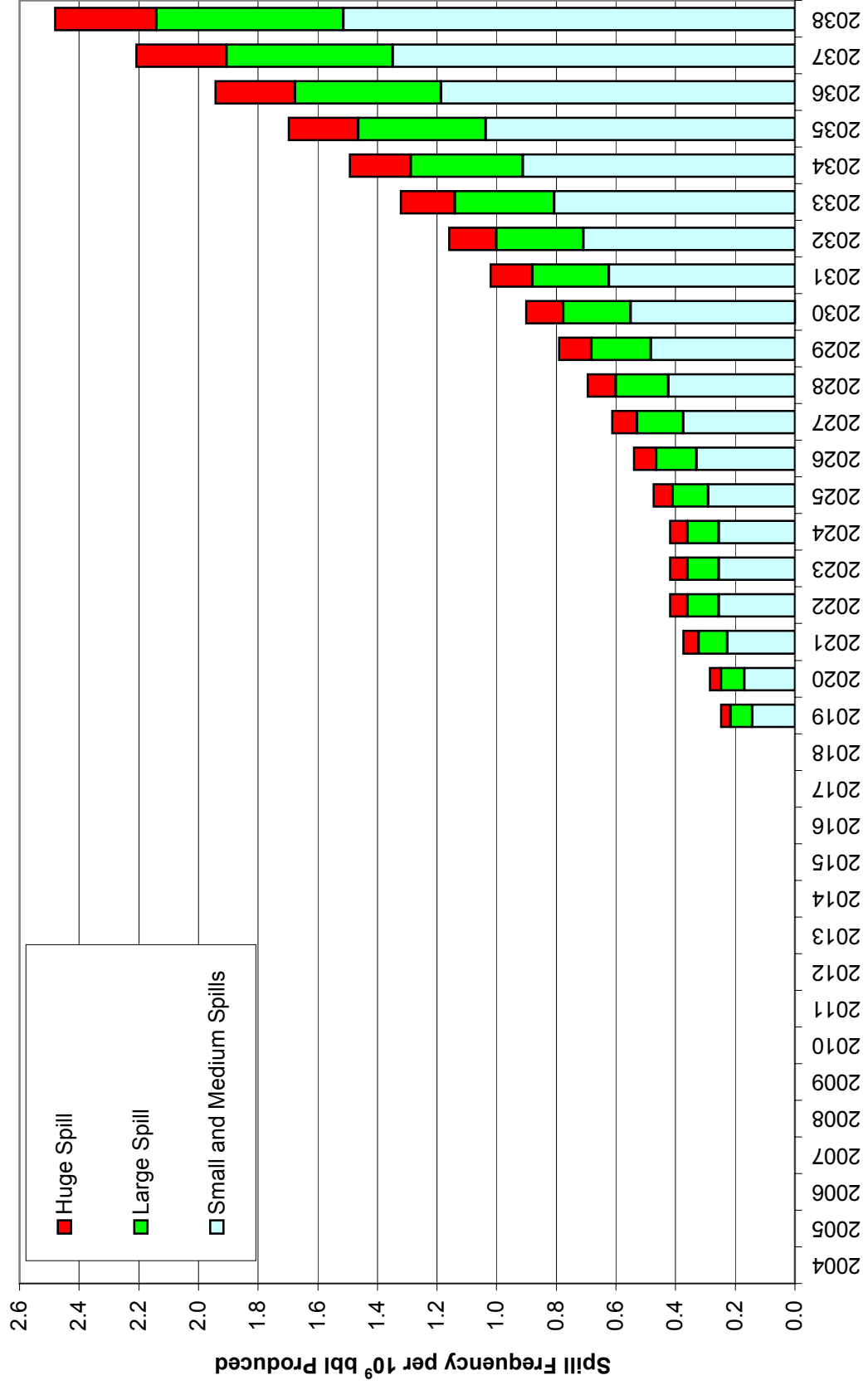
Table 4.3.14
Beaufort Sea Sale 3 Year 2024 - Monte Carlo Results

SALE 3	Small and Medium Spills			Large Spill			Huge Spill		
Year 2024	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
Mean =	9.60	0.249	1.92	4.07	0.105	25.87	2.21	0.057	165.25
Std Deviation =	1.52	0.039	0.25	0.38	0.010	1.85	0.09	0.002	1.55
Variance =	2.31	0.002	0.06	0.15	0.000	3.41	0.01	0.000	2.40
Skewness =	0.13	0.129	0.13	0.19	0.185	0.17	0.27	0.271	0.27
Kurtosis =	2.75	2.752	2.78	2.73	2.728	2.72	2.78	2.778	2.77
Mode =	11.52	0.273	1.84	4.13	0.098	24.75	2.11	0.055	163.36
Minimum =	5.25	0.136	1.22	2.99	0.077	20.62	1.97	0.051	161.06
5% Perc =	7.15	0.185	1.52	3.47	0.090	22.96	2.07	0.054	162.81
10% Perc =	7.62	0.197	1.60	3.58	0.093	23.49	2.10	0.054	163.31
15% Perc =	8.00	0.207	1.66	3.67	0.095	23.91	2.11	0.055	163.63
20% Perc =	8.29	0.215	1.70	3.74	0.097	24.26	2.13	0.055	163.92
25% Perc =	8.54	0.221	1.75	3.79	0.098	24.56	2.14	0.056	164.13
30% Perc =	8.76	0.227	1.78	3.85	0.100	24.82	2.15	0.056	164.34
35% Perc =	8.98	0.233	1.82	3.90	0.101	25.07	2.17	0.056	164.53
40% Perc =	9.18	0.238	1.85	3.95	0.102	25.30	2.18	0.056	164.75
45% Perc =	9.38	0.243	1.88	4.01	0.104	25.52	2.19	0.057	164.94
50% Perc =	9.57	0.248	1.91	4.05	0.105	25.77	2.20	0.057	165.15
55% Perc =	9.77	0.253	1.95	4.10	0.106	26.02	2.21	0.057	165.36
60% Perc =	9.96	0.258	1.98	4.16	0.108	26.30	2.23	0.058	165.58
65% Perc =	10.16	0.263	2.01	4.22	0.109	26.56	2.24	0.058	165.80
70% Perc =	10.37	0.269	2.04	4.27	0.111	26.87	2.25	0.058	166.02
75% Perc =	10.61	0.275	2.08	4.34	0.112	27.14	2.27	0.059	166.29
80% Perc =	10.88	0.282	2.12	4.41	0.114	27.46	2.28	0.059	166.60
85% Perc =	11.21	0.290	2.18	4.49	0.116	27.88	2.30	0.060	166.93
90% Perc =	11.65	0.302	2.24	4.58	0.119	28.32	2.33	0.060	167.32
95% Perc =	12.16	0.315	2.33	4.73	0.122	29.02	2.36	0.061	167.93
Maximum =	14.38	0.372	2.67	5.40	0.140	32.13	2.51	0.065	170.58

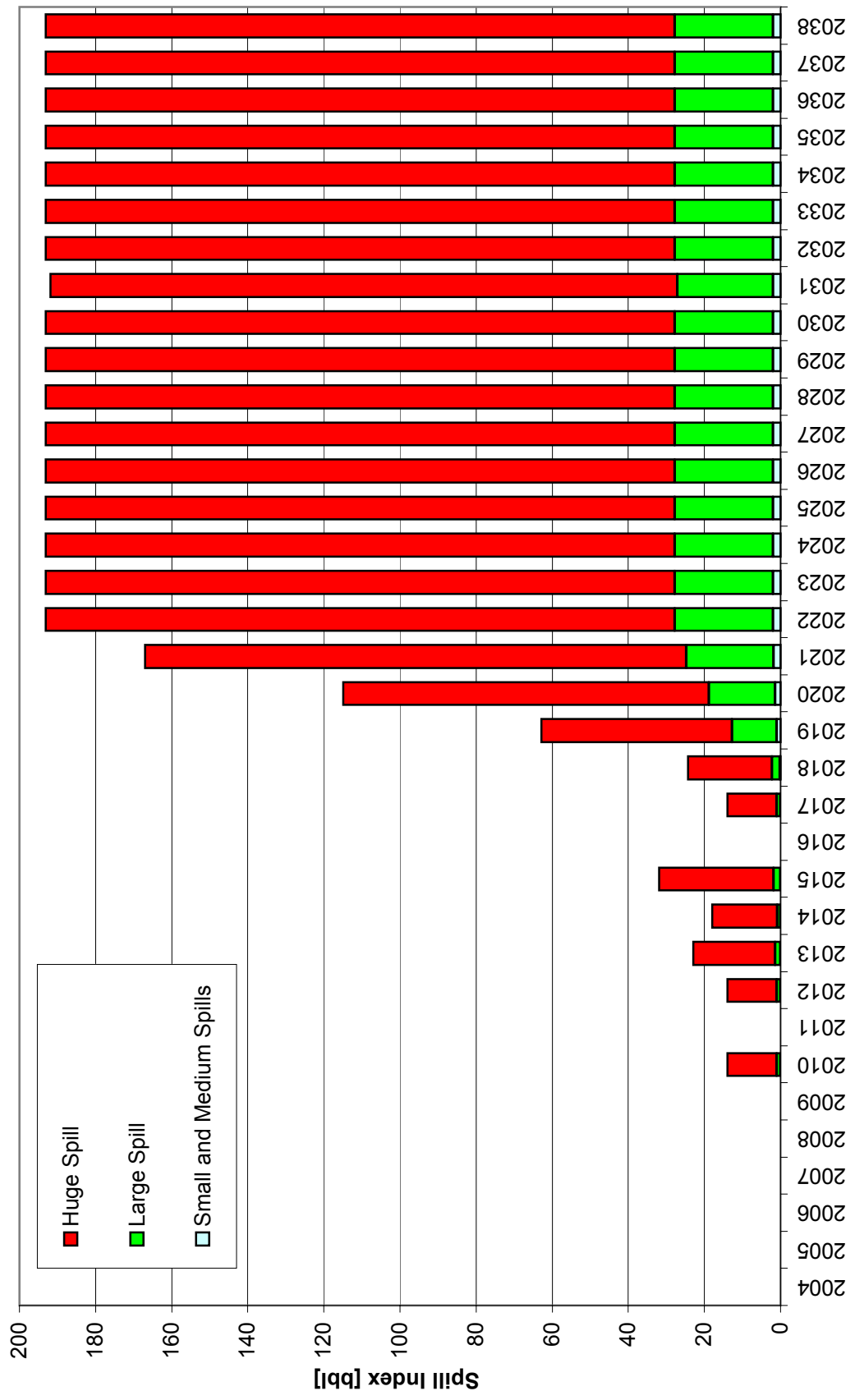
Beaufort Sea Sale 3 Spill Frequency



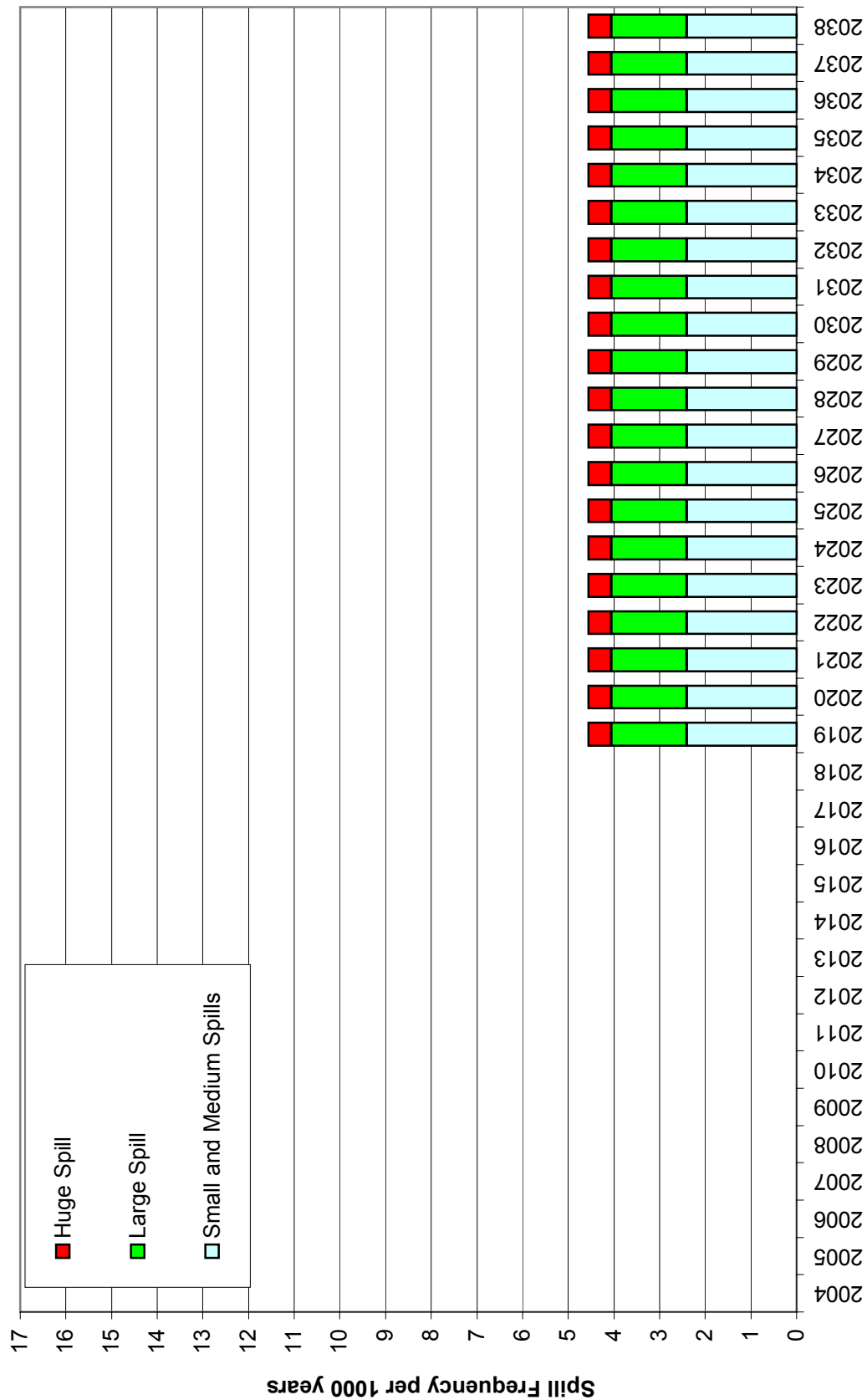
Beaufort Sea Sale 3 Spill Frequency per 10⁹ bbl Produced



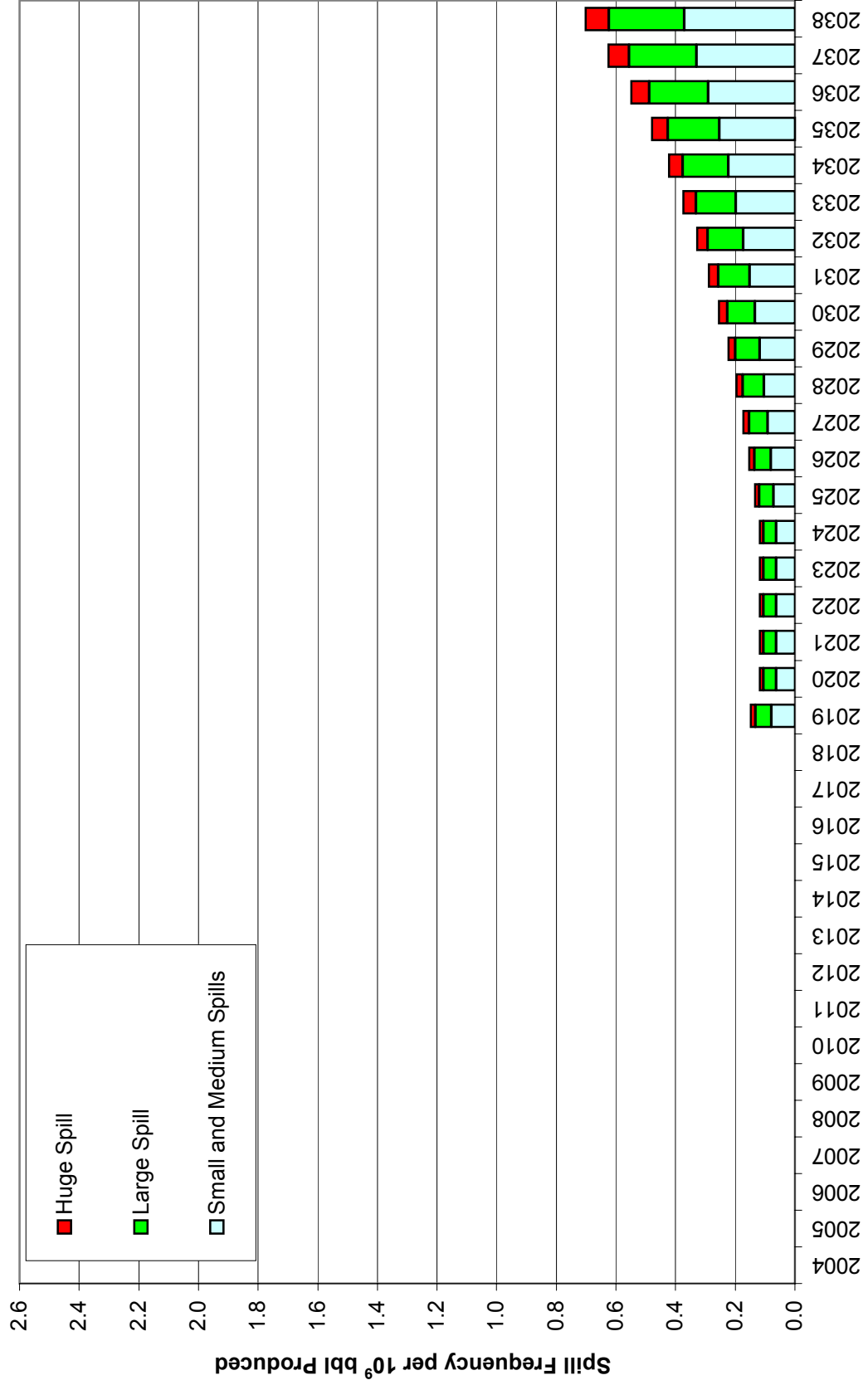
Beaufort Sea Sale 3 Spill Index



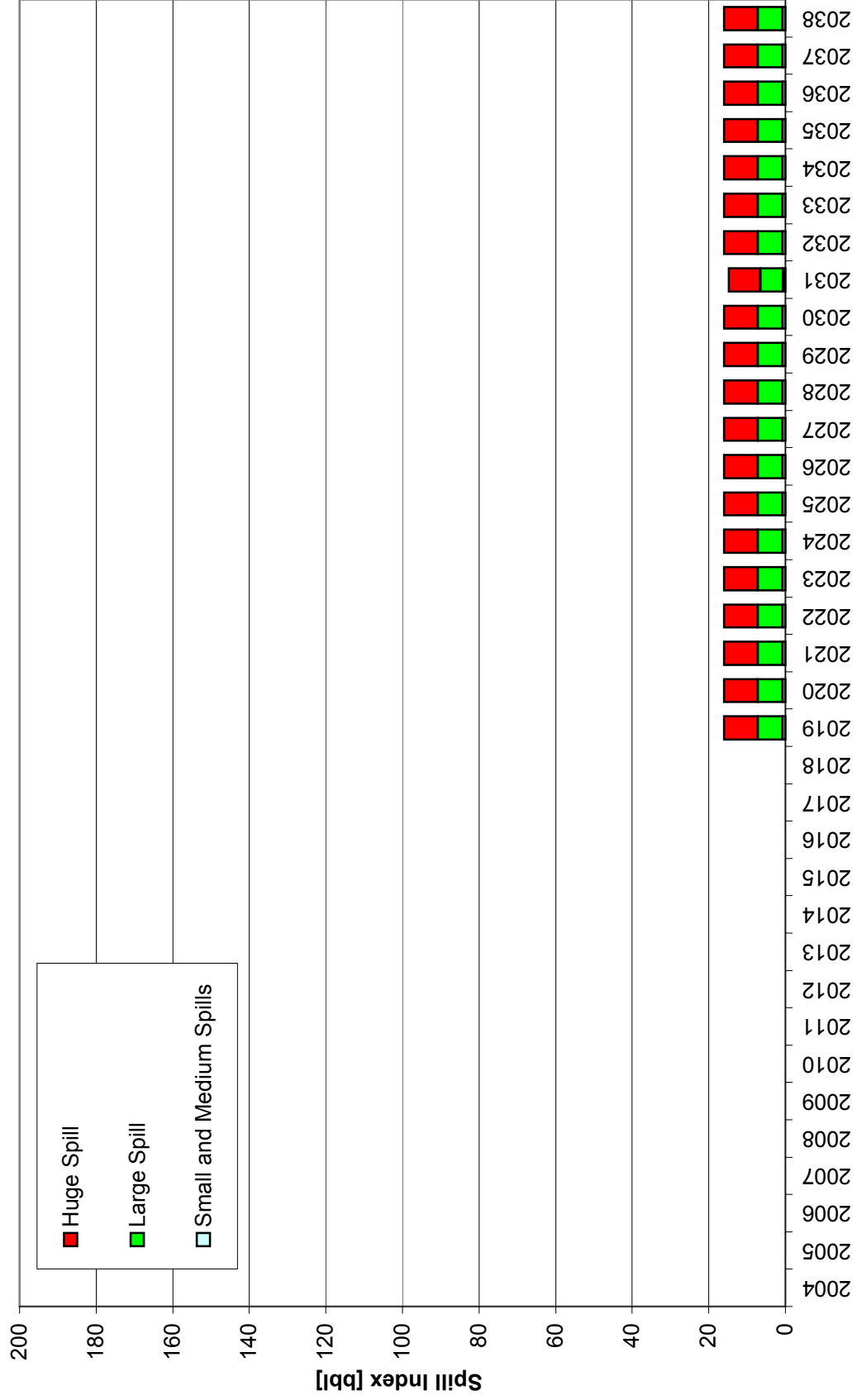
Beaufort Sea Sale 3 Spill Frequency - P/L



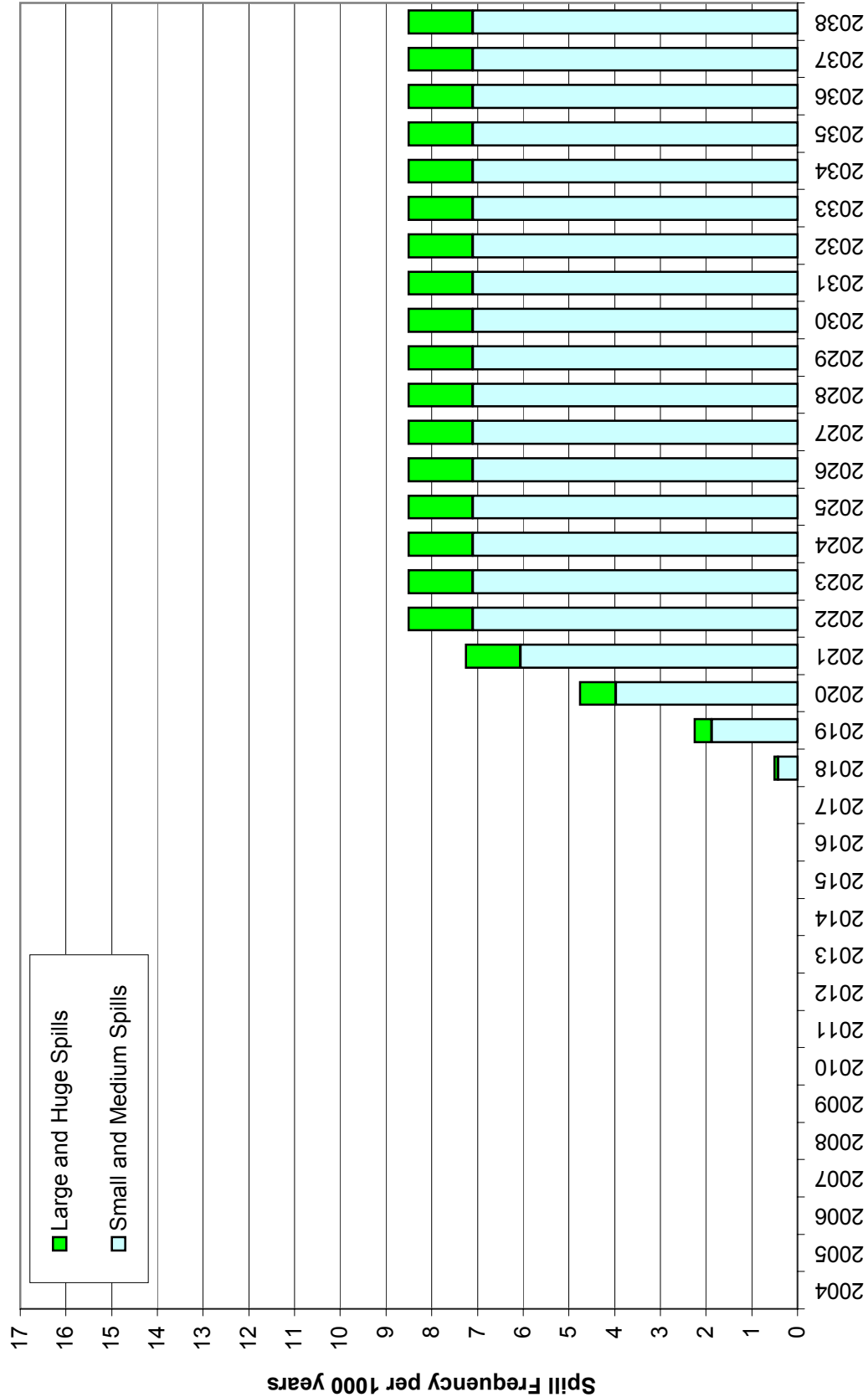
Beaufort Sea Sale 3 Spill Frequency per 10⁹ bbl Produced - P/L



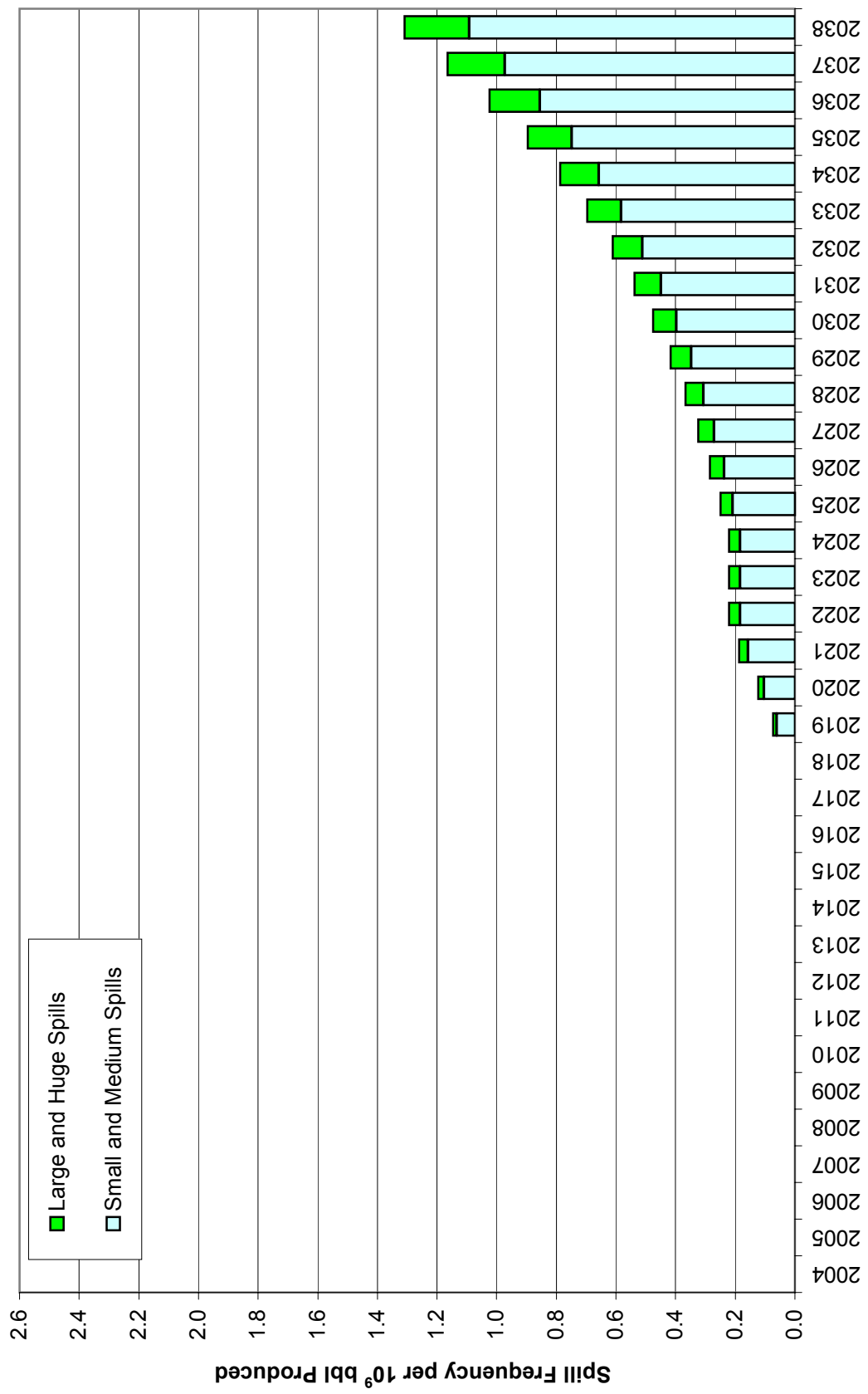
Beaufort Sea Sale 3 Spill Index - P/L



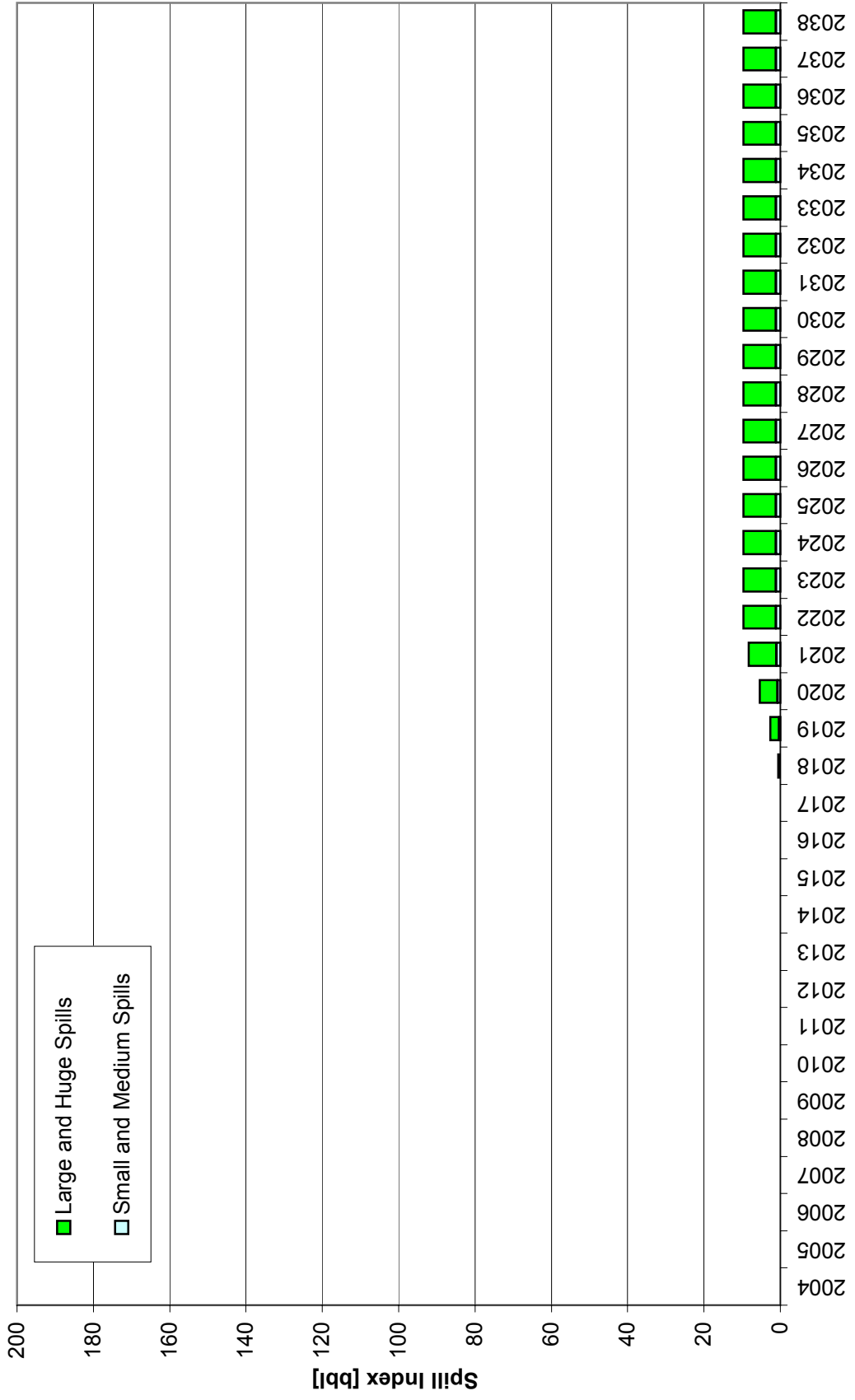
Beaufort Sea Sale 3 Spill Frequency - Platforms



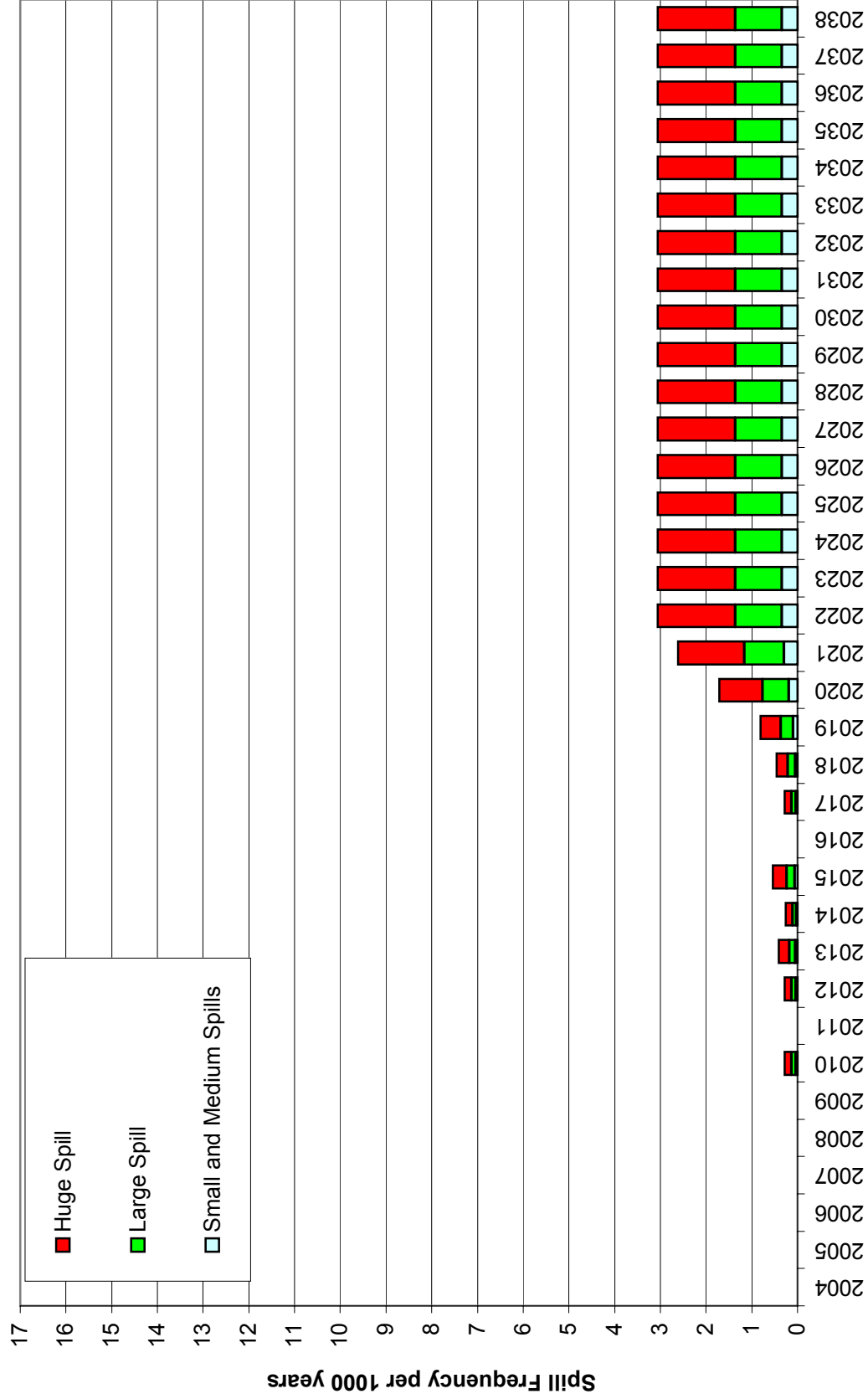
Beaufort Sea Sale 3 Spill Frequency per 10⁹ bbl Produced - Platforms



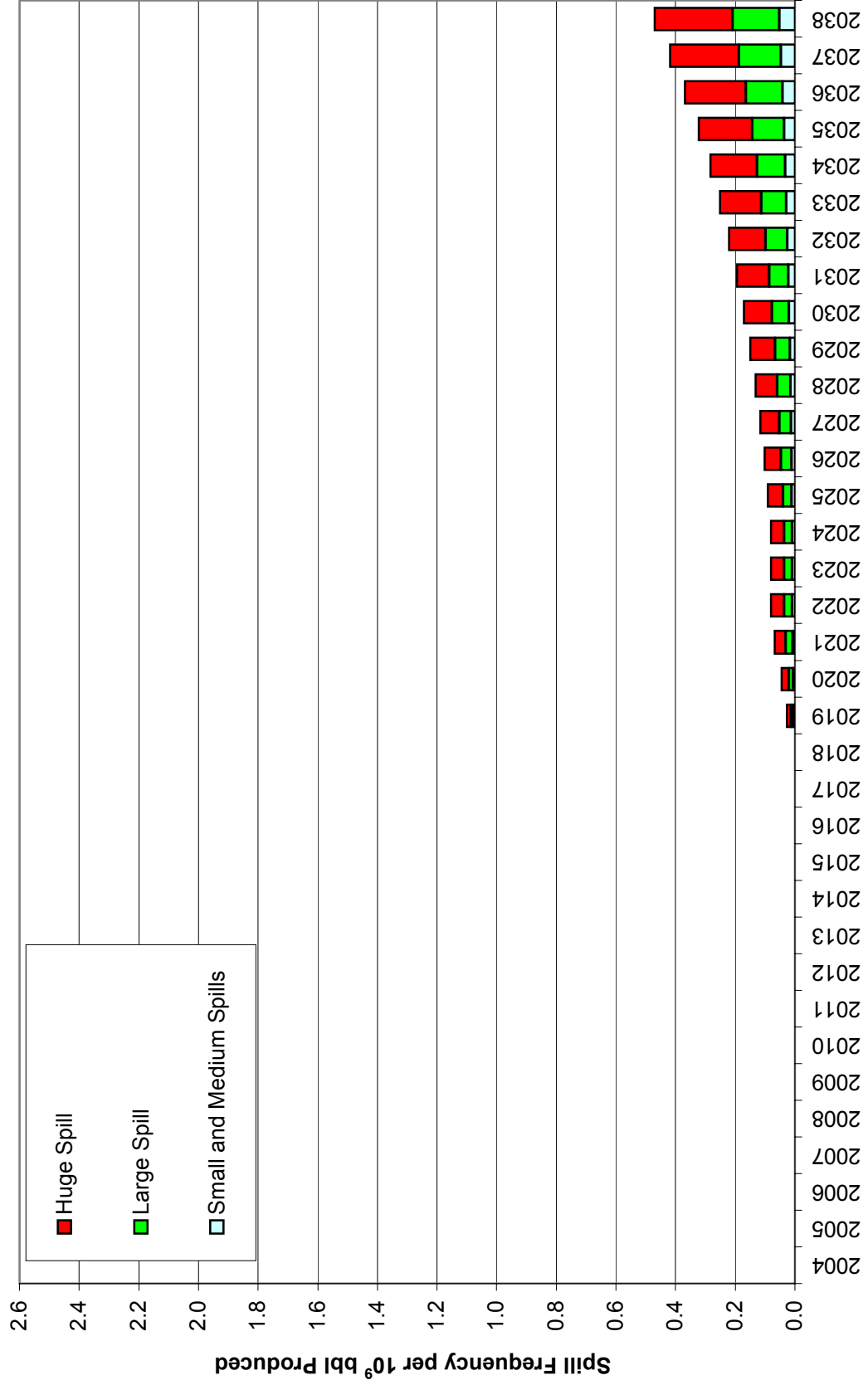
Beaufort Sea Sale 3 Spill Index - Platforms



Beaufort Sea Sale 3 Spill Frequency - Wells



Beaufort Sea Sale 3 Spill Frequency per 10⁹ bbl Produced - Wells



Beaufort Sea Sale 3 Spill Index - Wells

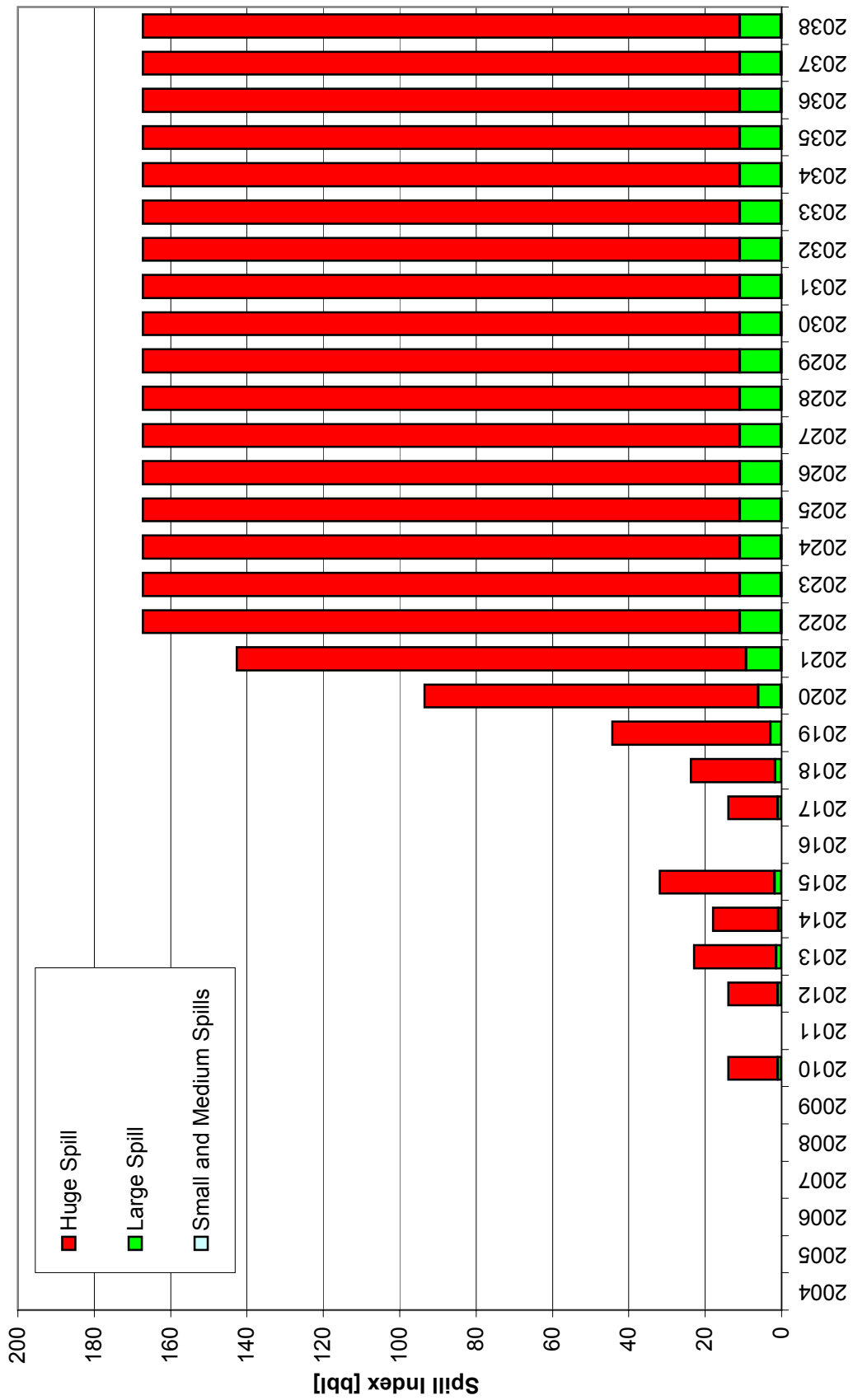
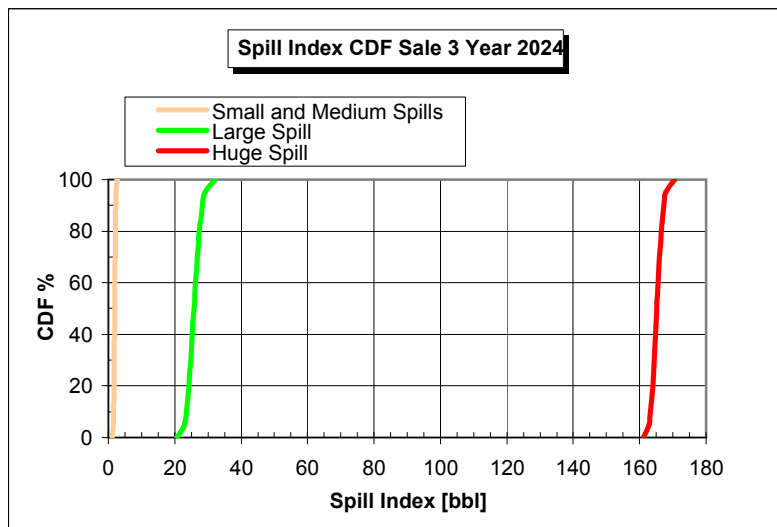
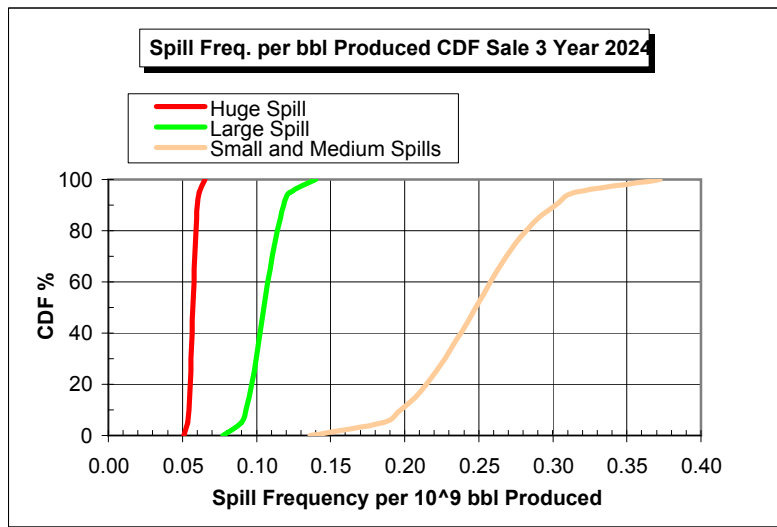
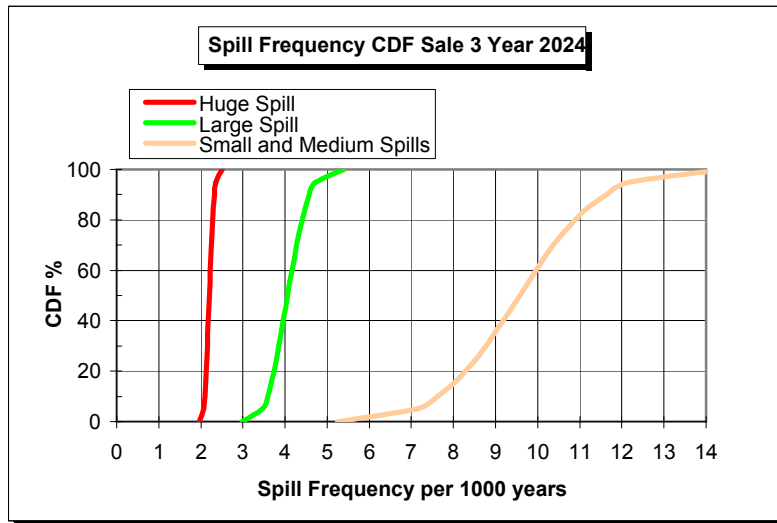


Figure 4.3.13



**Table 4.4.1
Arctic Spill Occurrence Beaufort Sea Sale All P/L**

Year	Water Depth	P/L Dis <10"										P/L Dis >= 10"									
		P/L [miles]		Small Spills		Medium Spills		Large Spills		Huge Spills		P/L [miles]		Small Spills		Medium Spills		Large Spills		Huge Spills	
		Cumm.	Average Spill [bbl] = 58	Frequency spills per 10 ⁶ km-year	Spill Index bbl	Average Spill [bbl] = 266	Frequency spills per 10 ⁶ km-year	Spill Index bbl	Average Spill [bbl] = 4436	Frequency spills per 10 ⁶ km-year	Spill Index bbl	Average Spill [bbl] = 14423	Frequency spills per 10 ⁶ km-year	Spill Index bbl	Cumm.	Average Spill [bbl] = 387	Frequency spills per 10 ⁶ km-year	Spill Index bbl	Average Spill [bbl] = 3932	Frequency spills per 10 ⁶ km-year	Spill Index bbl
2004	Shallow		1.880	3.298	2.636	0.710				1.367	3.095	2.714									
	Medium		1.697	2.973	2.636	0.710				1.170	2.765	2.714									
	Deep		1.540	2.696	1.015	0.254				0.992	2.479	2.479									
2005	Shallow		1.880	3.298	2.636	0.710				1.367	3.095	2.714									
	Medium		1.697	2.973	2.636	0.710				1.170	2.765	2.714									
	Deep		1.540	2.696	1.015	0.254				0.992	2.479	2.479									
2006	Shallow		1.880	3.298	2.636	0.710				1.367	3.095	2.714									
	Medium		1.697	2.973	2.636	0.710				1.170	2.765	2.714									
	Deep		1.540	2.696	1.015	0.254				0.992	2.479	2.479									
2007	Shallow		1.880	3.298	2.636	0.710				1.367	3.095	2.714									
	Medium		1.697	2.973	2.636	0.710				1.170	2.765	2.714									
	Deep		1.540	2.696	1.015	0.254				0.992	2.479	2.479									
2008	Shallow		1.880	3.298	2.636	0.710				1.367	3.095	2.714									
	Medium		1.697	2.973	2.636	0.710				1.170	2.765	2.714									
	Deep		1.540	2.696	1.015	0.254				0.992	2.479	2.479									
2009	Shallow		1.880	3.298	2.636	0.710				1.367	3.095	2.714									
	Medium		1.697	2.973	2.636	0.710				1.170	2.765	2.714									
	Deep		1.540	2.696	1.015	0.254				0.992	2.479	2.479									
2010	Shallow		1.880	3.298	2.636	0.710				1.367	3.095	2.714									
	Medium		1.697	2.973	2.636	0.710				1.170	2.765	2.714									
	Deep		1.540	2.696	1.015	0.254				0.992	2.479	2.479									
2011	Shallow		1.880	3.298	2.636	0.710				1.367	3.095	2.714									
	Medium		1.697	2.973	2.636	0.710				1.170	2.765	2.714									
	Deep		1.540	2.696	1.015	0.254				0.992	2.479	2.479									
2012	Shallow		1.880	3.298	2.636	0.710				1.367	3.095	2.714									
	Medium		1.697	2.973	2.636	0.710				1.170	2.765	2.714									
	Deep		1.540	2.696	1.015	0.254				0.992	2.479	2.479									
2013	Shallow		1.880	3.298	2.636	0.710				1.367	3.095	2.714									
	Medium		1.697	2.973	2.636	0.710				1.170	2.765	2.714									
	Deep		1.540	2.696	1.015	0.254				0.992	2.479	2.479									
2014	Shallow		1.880	3.298	2.636	0.710				1.367	3.095	2.714									
	Medium		1.697	2.973	2.636	0.710				1.170	2.765	2.714									
	Deep		1.540	2.696	1.015	0.254				0.992	2.479	2.479									
2015	Shallow		1.880	3.298	2.636	0.710				1.367	3.095	2.714									
	Medium		1.697	2.973	2.636	0.710				1.170	2.765	2.714									
	Deep		1.540	2.696	1.015	0.254				0.992	2.479	2.479									
2016	Shallow		1.880	3.298	2.636	0.710				1.367	3.095	2.714									
	Medium		1.697	2.973	2.636	0.710				1.170	2.765	2.714									
	Deep		1.540	2.696	1.015	0.254				0.992	2.479	2.479									
2017	Shallow		1.880	3.298	2.636	0.710				1.367	3.095	2.714									
	Medium		1.697	2.973	2.636	0.710				1.170	2.765	2.714									
	Deep		1.540	2.696	1.015	0.254				0.992	2.479	2.479									
2018	Shallow		1.880	3.298	2.636	0.710				1.367	3.095	2.714									
	Medium		1.697	2.973	2.636	0.710				1.170	2.765	2.714									
	Deep		1.540	2.696	1.015	0.254				0.992	2.479	2.479									
2019	Shallow		1.880	3.298	2.636	0.710				1.367	3.095	2.714									
	Medium		1.697	2.973	2.636	0.710				1.170	2.765	2.714									
	Deep		1.540	2.696	1.015	0.254				0.992	2.479	2.479									
2020	Shallow		1.880	3.298	2.636	0.710				1.367	3.095	2.714									
	Medium		1.697	2.973	2.636	0.710				1.170	2.765	2.714									
	Deep		1.540	2.696	1.015	0.254				0.992	2.479	2.479									
2021	Shallow		1.880	3.298	2.636	0.710				1.367	3.095	2.714									
	Medium		1.697	2.973	2.636	0.710				1.170	2.765	2.714									
	Deep		1.540	2.696	1.015	0.254				0.992	2.479	2.479									
Total	Shallow	10	1.880	3.298	2.636	0.710	10	1.367	3.095	2.714	3.095	2.714	3.095	2.714	3.095	2.714	3.095	2.714	3.095	2.714	3.095
	Medium	10	1.697	2.973	2.636	0.710	10	1.170	2.765	2.714	2.765	2.714	2.765	2.714	2.765	2.714	2.765	2.714	2.765	2.714	2.765
	Deep	10	1.540	2.696	1.015	0.254	10	0.992	2.479	2.479	2.479	2.479	2.479	2.479	2.479	2.479	2.479	2.479	2.479	2.479	2.479

**Table 4.4.1
Arctic Spill Occurrence Beaufort Sea Sale All P/L**

17706	
Spill	
Index	
bbl	21.56
	8.57
30.13	
21.56	
	8.57
30.13	
21.56	
	8.57
30.13	
18.48	
	8.57
27.05	
18.48	
	8.57
27.05	
15.40	
	8.57
23.97	
10.78	
	8.57
19.35	
10.78	
	8.57
19.35	
7.70	
	6.12
13.82	
7.70	
	6.12
13.82	
7.70	
	6.12
13.82	
7.70	
	6.12
13.82	
7.70	
	6.12
13.82	
4.62	
	3.67
8.29	
4.62	
	3.67
8.29	
4.62	
	3.67
8.29	

**Table 4.4.2
Arctic Spill Occurrence Beaufort Sea Sale All P/L Summary**

Year	Production [Mmbbl]	Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills				
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]		
2004																					
2005																					
2006																					
2007																					
2008																					
2009																					
2010	10.9	0.220	0.020	0.013	0.498	0.046	0.193	0.718	0.066	0.205	0.565	0.052	2.223	0.174	0.016	3.079	1.457	0.134	5.508		
2011	19.9	0.220	0.011	0.013	0.498	0.025	0.193	0.718	0.036	0.205	0.565	0.028	2.223	0.174	0.009	3.079	1.457	0.073	5.508		
2012	30.8	0.440	0.014	0.026	0.996	0.032	0.385	1.436	0.047	0.411	1.131	0.037	4.446	0.348	0.011	6.159	2.915	0.095	11.016		
2013	50.7	0.770	0.015	0.045	1.743	0.034	0.675	2.513	0.050	0.719	1.979	0.039	7.781	0.609	0.012	10.778	5.101	0.101	19.278		
2014	56.2	0.770	0.014	0.045	1.743	0.031	0.675	2.513	0.045	0.719	1.979	0.035	7.781	0.609	0.011	10.778	5.101	0.091	19.278		
2015	64.2	1.178	0.018	0.068	2.686	0.042	1.039	3.864	0.060	1.108	2.981	0.046	11.721	0.921	0.014	16.306	7.766	0.121	29.135		
2016	67.4	1.178	0.017	0.068	2.686	0.040	1.039	3.864	0.057	1.108	2.981	0.044	11.721	0.921	0.014	16.306	7.766	0.115	29.135		
2017	77.4	1.723	0.022	0.100	3.868	0.050	1.468	5.591	0.072	1.568	4.129	0.053	16.308	1.272	0.016	22.389	10.991	0.142	40.265		
2018	82.9	1.723	0.021	0.100	3.868	0.047	1.468	5.591	0.067	1.568	4.129	0.050	16.308	1.272	0.015	22.389	10.991	0.133	40.265		
2019	104.6	2.472	0.024	0.143	5.522	0.053	2.079	7.993	0.076	2.222	5.778	0.055	22.865	1.779	0.017	31.237	15.549	0.149	56.323		
2020	104.8	2.472	0.024	0.143	5.522	0.053	2.079	7.993	0.076	2.222	5.778	0.055	22.865	1.779	0.017	31.237	15.549	0.148	56.323		
2021	98.6	2.472	0.025	0.143	5.522	0.056	2.079	7.993	0.081	2.222	5.778	0.059	22.865	1.779	0.018	31.237	15.549	0.158	56.323		
2022	89.2	2.472	0.028	0.143	5.522	0.062	2.079	7.993	0.090	2.222	5.778	0.065	22.865	1.779	0.020	31.237	15.549	0.174	56.323		
2023	81.4	2.472	0.030	0.143	5.522	0.068	2.079	7.993	0.098	2.222	5.778	0.071	22.865	1.779	0.022	31.237	15.549	0.191	56.323		
2024	74.8	2.472	0.033	0.143	5.522	0.074	2.079	7.993	0.107	2.222	5.778	0.077	22.865	1.779	0.024	31.237	15.549	0.208	56.323		
2025	62.5	2.252	0.036	0.131	5.024	0.080	1.886	7.275	0.116	2.017	5.212	0.083	20.641	1.605	0.026	28.157	14.092	0.225	50.815		
2026	54.1	2.252	0.042	0.131	5.024	0.093	1.886	7.275	0.134	2.017	5.212	0.096	20.641	1.605	0.030	28.157	14.092	0.260	50.815		
2027	44.6	2.032	0.046	0.118	4.525	0.101	1.693	6.557	0.147	1.811	4.647	0.104	18.418	1.431	0.032	25.078	12.635	0.283	45.307		
2028	36.9	1.702	0.046	0.099	3.778	0.102	1.404	5.480	0.149	1.503	3.799	0.103	15.084	1.170	0.032	20.459	10.449	0.283	37.045		
2029	32.2	1.702	0.053	0.099	3.778	0.117	1.404	5.480	0.170	1.503	3.799	0.118	15.084	1.170	0.036	20.459	10.449	0.324	37.045		
2030	25.8	1.294	0.050	0.075	2.836	0.110	1.039	4.129	0.160	1.115	2.797	0.108	11.143	0.858	0.033	14.931	7.783	0.302	27.189		
2031	22.6	1.294	0.057	0.059	2.836	0.125	0.912	4.129	0.183	0.971	2.797	0.124	9.850	0.858	0.038	13.821	7.783	0.344	24.642		
2032	19.7	1.294	0.066	0.075	2.836	0.144	1.039	4.129	0.210	1.115	2.797	0.142	11.143	0.858	0.044	14.931	7.783	0.395	27.189		
2033	17.2	1.294	0.075	0.075	2.836	0.165	1.039	4.129	0.240	1.115	2.797	0.163	11.143	0.858	0.050	14.931	7.783	0.453	27.189		
2034	15.1	1.294	0.086	0.075	2.836	0.188	1.039	4.129	0.273	1.115	2.797	0.185	11.143	0.858	0.057	14.931	7.783	0.515	27.189		
2035	13.2	1.294	0.098	0.075	2.836	0.215	1.039	4.129	0.313	1.115	2.797	0.212	11.143	0.858	0.065	14.931	7.783	0.590	27.189		
2036	8.3	0.749	0.090	0.043	1.653	0.199	0.611	2.402	0.289	0.654	1.649	0.199	6.557	0.507	0.061	8.847	4.558	0.549	16.058		
2037	7.3	0.749	0.103	0.043	1.653	0.227	0.611	2.402	0.329	0.654	1.649	0.226	6.557	0.507	0.069	8.847	4.558	0.624	16.058		
2038	6.5	0.749	0.115	0.043	1.653	0.254	0.611	2.402	0.370	0.654	1.649	0.254	6.557	0.507	0.078	8.847	4.558	0.701	16.058		

**Table 4.4.3
Arctic Spill Occurrence Beaufort Sea Sale All Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2005	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2006	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2007	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2008	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2009	Shallow	1	3	0.964	0.289	0.05	0.192	0.058	0.35
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total	1	3		0.289	0.05		0.058	0.35
2010	Shallow	1	13	0.964	1.254	0.20	0.192	0.250	1.53
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total	1	13		1.254	0.20		0.250	1.53
2011	Shallow	2	26	0.964	2.508	0.40	0.192	0.500	3.06
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total	2	26		2.508	0.40		0.500	3.06
2012	Shallow	3	39	0.964	3.761	0.59	0.192	0.750	4.60
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total	3	39		3.761	0.59		0.750	4.60
2013	Shallow	3	59	0.964	5.690	0.90	0.192	1.134	6.95
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total	3	59		5.690	0.90		1.134	6.95
2014	Shallow	3	69	0.964	6.655	1.05	0.192	1.327	8.13
	Medium	1	3	1.044	0.313	0.05	0.206	0.062	0.38
	Deep			1.163			0.227		
	Total	4	72		6.968	1.10		1.389	8.51
2015	Shallow	3	69	0.964	6.655	1.05	0.192	1.327	8.13
	Medium	1	13	1.044	1.357	0.21	0.206	0.268	1.64
	Deep			1.163			0.227		
	Total	4	82		8.012	1.27		1.595	9.78
2016	Shallow	3	69	0.964	6.655	1.05	0.192	1.327	8.13
	Medium	2	26	1.044	2.714	0.43	0.206	0.536	3.29
	Deep			1.163			0.227		
	Total	5	95		9.369	1.48		1.863	11.42
2017	Shallow	3	69	0.964	6.655	1.05	0.192	1.327	8.13
	Medium	3	39	1.044	4.072	0.64	0.206	0.805	4.93
	Deep			1.163			0.227		
	Total	6	108		10.726	1.69		2.131	13.07

**Table 4.4.3
Arctic Spill Occurrence Beaufort Sea Sale All Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow	3	69	0.964	6.655	1.05	0.192	1.327	8.13
	Medium	4	63	1.044	6.577	1.04	0.206	1.300	7.97
	Deep			1.163			0.227		
	Total	7	132		13.232	2.09		2.627	16.10
2019	Shallow	3	69	0.964	6.655	1.05	0.192	1.327	8.13
	Medium	5	87	1.044	9.083	1.44	0.206	1.795	11.00
	Deep			1.163			0.227		
	Total	8	156		15.738	2.49		3.122	19.14
2020	Shallow	3	69	0.964	6.655	1.05	0.192	1.327	8.13
	Medium	5	107	1.044	11.171	1.77	0.206	2.208	13.53
	Deep			1.163			0.227		
	Total	8	176		17.826	2.82		3.534	21.67
2021	Shallow	3	69	0.964	6.655	1.05	0.192	1.327	8.13
	Medium	5	127	1.044	13.259	2.09	0.206	2.620	16.06
	Deep			1.163			0.227		
	Total	8	196		19.914	3.15		3.947	24.20
2022	Shallow	3	69	0.964	6.655	1.05	0.192	1.327	8.13
	Medium	5	137	1.044	14.303	2.26	0.206	2.827	17.33
	Deep			1.163			0.227		
	Total	8	206		20.958	3.31		4.153	25.46
2023	Shallow	3	69	0.964	6.655	1.05	0.192	1.327	8.13
	Medium	5	137	1.044	14.303	2.26	0.206	2.827	17.33
	Deep			1.163			0.227		
	Total	8	206		20.958	3.31		4.153	25.46
2024	Shallow	3	69	0.964	6.655	1.05	0.192	1.327	8.13
	Medium	5	137	1.044	14.303	2.26	0.206	2.827	17.33
	Deep			1.163			0.227		
	Total	8	206		20.958	3.31		4.153	25.46
2025	Shallow	2	46	0.964	4.436	0.70	0.192	0.884	5.42
	Medium	5	137	1.044	14.303	2.26	0.206	2.827	17.33
	Deep			1.163			0.227		
	Total	7	183		18.739	2.96		3.711	22.75
2026	Shallow	2	46	0.964	4.436	0.70	0.192	0.884	5.42
	Medium	5	137	1.044	14.303	2.26	0.206	2.827	17.33
	Deep			1.163			0.227		
	Total	7	183		18.739	2.96		3.711	22.75
2027	Shallow	1	23	0.964	2.218	0.35	0.192	0.442	2.71
	Medium	5	137	1.044	14.303	2.26	0.206	2.827	17.33
	Deep			1.163			0.227		
	Total	6	160		16.521	2.61		3.269	20.04
2028	Shallow			0.964			0.192		
	Medium	5	137	1.044	14.303	2.26	0.206	2.827	17.33
	Deep			1.163			0.227		
	Total	5	137		14.303	2.26		2.827	17.33
2029	Shallow			0.964			0.192		
	Medium	5	137	1.044	14.303	2.26	0.206	2.827	17.33
	Deep			1.163			0.227		
	Total	5	137		14.303	2.26		2.827	17.33
2030	Shallow			0.964			0.192		
	Medium	4	114	1.044	11.902	1.88	0.206	2.352	14.42
	Deep			1.163			0.227		
	Total	4	114		11.902	1.88		2.352	14.42
2031	Shallow			0.964			0.192		
	Medium	4	114	1.044	11.902	1.88	0.206	2.352	14.42
	Deep			1.163			0.227		
	Total	4	114		11.902	1.88		2.352	14.42

**Table 4.4.3
Arctic Spill Occurrence Beaufort Sea Sale All Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow			0.964			0.192		
	Medium	4	114	1.044	11.902	1.88	0.206	2.352	14.42
	Deep			1.163			0.227		
	Total	4	114		11.902	1.88		2.352	14.42
2033	Shallow			0.964			0.192		
	Medium	4	114	1.044	11.902	1.88	0.206	2.352	14.42
	Deep			1.163			0.227		
	Total	4	114		11.902	1.88		2.352	14.42
2034	Shallow			0.964			0.192		
	Medium	4	114	1.044	11.902	1.88	0.206	2.352	14.42
	Deep			1.163			0.227		
	Total	4	114		11.902	1.88		2.352	14.42
2035	Shallow			0.964			0.192		
	Medium	4	114	1.044	11.902	1.88	0.206	2.352	14.42
	Deep			1.163			0.227		
	Total	4	114		11.902	1.88		2.352	14.42
2036	Shallow			0.964			0.192		
	Medium	2	68	1.044	7.099	1.12	0.206	1.403	8.60
	Deep			1.163			0.227		
	Total	2	68		7.099	1.12		1.403	8.60
2037	Shallow			0.964			0.192		
	Medium	2	68	1.044	7.099	1.12	0.206	1.403	8.60
	Deep			1.163			0.227		
	Total	2	68		7.099	1.12		1.403	8.60
2038	Shallow			0.964			0.192		
	Medium	2	68	1.044	7.099	1.12	0.206	1.403	8.60
	Deep			1.163			0.227		
	Total	2	68		7.099	1.12		1.403	8.60

**Table 4.4.4
Arctic Spill Occurrence Beaufort Sea Sale All Platforms Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]
2004										
2005										
2006										
2007										
2008										
2009		0.289		0.046	0.058		0.354	0.347		0.399
2010	10.9	1.254	0.115	0.198	0.250	0.023	1.532	1.504	0.138	1.730
2011	19.9	2.508	0.126	0.396	0.500	0.025	3.065	3.007	0.151	3.461
2012	30.8	3.761	0.122	0.594	0.750	0.024	4.597	4.511	0.146	5.191
2013	50.7	5.690	0.112	0.899	1.134	0.022	6.954	6.825	0.135	7.853
2014	56.2	6.968	0.124	1.101	1.389	0.025	8.512	8.357	0.149	9.613
2015	64.2	8.012	0.125	1.266	1.595	0.025	9.777	9.607	0.150	11.043
2016	67.4	9.369	0.139	1.480	1.863	0.028	11.421	11.232	0.167	12.902
2017	77.4	10.726	0.139	1.695	2.131	0.028	13.065	12.858	0.166	14.760
2018	82.9	13.232	0.160	2.091	2.627	0.032	16.101	15.859	0.191	18.192
2019	104.6	15.738	0.150	2.487	3.122	0.030	19.136	18.859	0.180	21.623
2020	104.8	17.826	0.170	2.816	3.534	0.034	21.666	21.360	0.204	24.482
2021	98.6	19.914	0.202	3.146	3.947	0.040	24.195	23.861	0.242	27.342
2022	89.2	20.958	0.235	3.311	4.153	0.047	25.460	25.111	0.282	28.771
2023	81.4	20.958	0.257	3.311	4.153	0.051	25.460	25.111	0.308	28.771
2024	74.8	20.958	0.280	3.311	4.153	0.056	25.460	25.111	0.336	28.771
2025	62.5	18.739	0.300	2.961	3.711	0.059	22.749	22.451	0.359	25.710
2026	54.1	18.739	0.346	2.961	3.711	0.069	22.749	22.451	0.415	25.710
2027	44.6	16.521	0.370	2.610	3.269	0.073	20.038	19.790	0.444	22.649
2028	36.9	14.303	0.388	2.260	2.827	0.077	17.327	17.130	0.464	19.587
2029	32.2	14.303	0.444	2.260	2.827	0.088	17.327	17.130	0.532	19.587
2030	25.8	11.902	0.461	1.880	2.352	0.091	14.418	14.254	0.552	16.299
2031	22.6	11.902	0.527	1.880	2.352	0.104	14.418	14.254	0.631	16.299
2032	19.7	11.902	0.604	1.880	2.352	0.119	14.418	14.254	0.724	16.299
2033	17.2	11.902	0.692	1.880	2.352	0.137	14.418	14.254	0.829	16.299
2034	15.1	11.902	0.788	1.880	2.352	0.156	14.418	14.254	0.944	16.299
2035	13.2	11.902	0.902	1.880	2.352	0.178	14.418	14.254	1.080	16.299
2036	8.3	7.099	0.855	1.122	1.403	0.169	8.600	8.502	1.024	9.722
2037	7.3	7.099	0.973	1.122	1.403	0.192	8.600	8.502	1.165	9.722
2038	6.5	7.099	1.092	1.122	1.403	0.216	8.600	8.502	1.308	9.722

**Table 4.4.5
Arctic Spill Occurrence Beaufort Sea Sale All Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2009	Shallow	3	0.500	0.015	0.01	3.500	0.105	0.47	1.500	0.045	0.90	1.000	0.030	6.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	3		0.015	0.01		0.105	0.47		0.045	0.90		0.030	6.00
2010	Shallow	13	0.500	0.065	0.03	3.500	0.455	2.05	1.500	0.195	3.90	1.000	0.130	26.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	13		0.065	0.03		0.455	2.05		0.195	3.90		0.130	26.00
2011	Shallow	26	0.500	0.130	0.07	3.500	0.910	4.10	1.500	0.390	7.80	1.000	0.260	52.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	26		0.130	0.07		0.910	4.10		0.390	7.80		0.260	52.00
2012	Shallow	39	0.500	0.195	0.10	3.500	1.365	6.14	1.500	0.585	11.70	1.000	0.390	78.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	39		0.195	0.10		1.365	6.14		0.585	11.70		0.390	78.00
2013	Shallow	59	0.500	0.295	0.15	3.500	2.065	9.29	1.500	0.885	17.70	1.000	0.590	118.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	59		0.295	0.15		2.065	9.29		0.885	17.70		0.590	118.00
2014	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	3	0.500	0.015	0.01	3.500	0.105	0.47	1.500	0.045	0.90	1.000	0.030	6.00
	Deep		0.500			3.500			1.500			1.000		
	Total	72		0.360	0.18		2.520	11.34		1.080	21.60		0.720	144.00
2015	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	13	0.500	0.065	0.03	3.500	0.455	2.05	1.500	0.195	3.90	1.000	0.130	26.00
	Deep		0.500			3.500			1.500			1.000		
	Total	82		0.410	0.21		2.870	12.92		1.230	24.60		0.820	164.00
2016	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	26	0.500	0.130	0.07	3.500	0.910	4.10	1.500	0.390	7.80	1.000	0.260	52.00
	Deep		0.500			3.500			1.500			1.000		
	Total	95		0.475	0.24		3.325	14.96		1.425	28.50		0.950	190.00
2017	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	39	0.500	0.195	0.10	3.500	1.365	6.14	1.500	0.585	11.70	1.000	0.390	78.00
	Deep		0.500			3.500			1.500			1.000		
	Total	108		0.540	0.27		3.780	17.01		1.620	32.40		1.080	216.00

**Table 4.4.5
Arctic Spill Occurrence Beaufort Sea Sale All Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	63	0.500	0.315	0.16	3.500	2.205	9.92	1.500	0.945	18.90	1.000	0.630	126.00
	Deep		0.500			3.500			1.500			1.000		
	Total	132		0.660	0.33		4.620	20.79		1.980	39.60		1.320	264.00
2019	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	87	0.500	0.435	0.22	3.500	3.045	13.70	1.500	1.305	26.10	1.000	0.870	174.00
	Deep		0.500			3.500			1.500			1.000		
	Total	156		0.780	0.39		5.460	24.57		2.340	46.80		1.560	312.00
2020	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	107	0.500	0.535	0.27	3.500	3.745	16.85	1.500	1.605	32.10	1.000	1.070	214.00
	Deep		0.500			3.500			1.500			1.000		
	Total	176		0.880	0.44		6.160	27.72		2.640	52.80		1.760	352.00
2021	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	127	0.500	0.635	0.32	3.500	4.445	20.00	1.500	1.905	38.10	1.000	1.270	254.00
	Deep		0.500			3.500			1.500			1.000		
	Total	196		0.980	0.49		6.860	30.87		2.940	58.80		1.960	392.00
2022	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	206		1.030	0.52		7.210	32.45		3.090	61.80		2.060	412.00
2023	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	206		1.030	0.52		7.210	32.45		3.090	61.80		2.060	412.00
2024	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	206		1.030	0.52		7.210	32.45		3.090	61.80		2.060	412.00
2025	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	183		0.915	0.46		6.405	28.82		2.745	54.90		1.830	366.00
2026	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	183		0.915	0.46		6.405	28.82		2.745	54.90		1.830	366.00
2027	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	160		0.800	0.40		5.600	25.20		2.400	48.00		1.600	320.00
2028	Shallow		0.500			3.500			1.500			1.000		
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	137		0.685	0.34		4.795	21.58		2.055	41.10		1.370	274.00
2029	Shallow		0.500			3.500			1.500			1.000		
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	137		0.685	0.34		4.795	21.58		2.055	41.10		1.370	274.00
2030	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00
2031	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00

**Table 4.4.5
Arctic Spill Occurrence Beaufort Sea Sale All Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00
2033	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00
2034	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00
2035	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00
2036	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2037	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2038	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00

Table 4.4.6

Arctic Spill Occurrence Beaufort Sea Sale All Production Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009		0.015		0.008	0.045		0.473	0.075		6.900	0.135		7.380
2010	10.9	0.065	0.006	0.033	0.195	0.018	2.048	0.325	0.030	29.900	0.585	0.054	31.980
2011	19.9	0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
2012	30.8	0.195	0.006	0.098	0.585	0.019	6.143	0.975	0.032	89.700	1.755	0.057	95.940
2013	50.7	0.295	0.006	0.148	0.885	0.017	9.293	1.475	0.029	135.700	2.655	0.052	145.140
2014	56.2	0.360	0.006	0.180	1.080	0.019	11.340	1.800	0.032	165.600	3.240	0.058	177.120
2015	64.2	0.410	0.006	0.205	1.230	0.019	12.915	2.050	0.032	188.600	3.690	0.057	201.720
2016	67.4	0.475	0.007	0.238	1.425	0.021	14.963	2.375	0.035	218.500	4.275	0.063	233.700
2017	77.4	0.540	0.007	0.270	1.620	0.021	17.010	2.700	0.035	248.400	4.860	0.063	265.680
2018	82.9	0.660	0.008	0.330	1.980	0.024	20.790	3.300	0.040	303.600	5.940	0.072	324.720
2019	104.6	0.780	0.007	0.390	2.340	0.022	24.570	3.900	0.037	358.800	7.020	0.067	383.760
2020	104.8	0.880	0.008	0.440	2.640	0.025	27.720	4.400	0.042	404.800	7.920	0.076	432.960
2021	98.6	0.980	0.010	0.490	2.940	0.030	30.870	4.900	0.050	450.800	8.820	0.089	482.160
2022	89.2	1.030	0.012	0.515	3.090	0.035	32.445	5.150	0.058	473.800	9.270	0.104	506.760
2023	81.4	1.030	0.013	0.515	3.090	0.038	32.445	5.150	0.063	473.800	9.270	0.114	506.760
2024	74.8	1.030	0.014	0.515	3.090	0.041	32.445	5.150	0.069	473.800	9.270	0.124	506.760
2025	62.5	0.915	0.015	0.458	2.745	0.044	28.823	4.575	0.073	420.900	8.235	0.132	450.180
2026	54.1	0.915	0.017	0.458	2.745	0.051	28.823	4.575	0.085	420.900	8.235	0.152	450.180
2027	44.6	0.800	0.018	0.400	2.400	0.054	25.200	4.000	0.090	368.000	7.200	0.161	393.600
2028	36.9	0.685	0.019	0.343	2.055	0.056	21.578	3.425	0.093	315.100	6.165	0.167	337.020
2029	32.2	0.685	0.021	0.343	2.055	0.064	21.578	3.425	0.106	315.100	6.165	0.191	337.020
2030	25.8	0.570	0.022	0.285	1.710	0.066	17.955	2.850	0.110	262.200	5.130	0.199	280.440
2031	22.6	0.570	0.025	0.285	1.710	0.076	17.955	2.850	0.126	262.200	5.130	0.227	280.440
2032	19.7	0.570	0.029	0.285	1.710	0.087	17.955	2.850	0.145	262.200	5.130	0.260	280.440
2033	17.2	0.570	0.033	0.285	1.710	0.099	17.955	2.850	0.166	262.200	5.130	0.298	280.440
2034	15.1	0.570	0.038	0.285	1.710	0.113	17.955	2.850	0.189	262.200	5.130	0.340	280.440
2035	13.2	0.570	0.043	0.285	1.710	0.130	17.955	2.850	0.216	262.200	5.130	0.389	280.440
2036	8.3	0.340	0.041	0.170	1.020	0.123	10.710	1.700	0.205	156.400	3.060	0.369	167.280
2037	7.3	0.340	0.047	0.170	1.020	0.140	10.710	1.700	0.233	156.400	3.060	0.419	167.280
2038	6.5	0.340	0.052	0.170	1.020	0.157	10.710	1.700	0.262	156.400	3.060	0.471	167.280

**Table 4.4.7
Arctic Spill Occurrence Beaufort Sea Sale All Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2005	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2006	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2007	Shallow	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2008	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2010	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2011	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2012	Shallow		3.160			22.110			9.500			5.500		
	Medium	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	3		0.095	0.05		0.663	2.98		0.285	5.70		0.165	33.00
2013	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2014	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2015	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2016	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2017	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00

**Table 4.4.7
Arctic Spill Occurrence Beaufort Sea Sale All Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2019	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2020	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2021	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2022	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2023	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2024	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2025	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2026	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2027	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2028	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2029	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2030	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2031	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

**Table 4.4.7
Arctic Spill Occurrence Beaufort Sea Sale All Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2033	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2034	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2035	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2036	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2037	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2038	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.4.8

Arctic Spill Occurrence Beaufort Sea Sale All Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]
2004		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2005		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2006		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2007		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2008		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2009		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2010	10.9	0.063	0.006	0.032	0.190	0.017	1.990	0.300	0.028	25.800	0.553	0.051	27.822
2011	19.9												
2012	30.8	0.095	0.003	0.047	0.285	0.009	2.985	0.450	0.015	38.700	0.830	0.027	41.732
2013	50.7	0.063	0.001	0.032	0.190	0.004	1.990	0.300	0.006	25.800	0.553	0.011	27.822
2014	56.2												
2015	64.2	0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.004	13.911
2016	67.4												
2017	77.4	0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.004	13.911
2018	82.9	0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.003	13.911
2019	104.6												
2020	104.8												
2021	98.6												
2022	89.2												
2023	81.4												
2024	74.8												
2025	62.5												
2026	54.1												
2027	44.6												
2028	36.9												
2029	32.2												
2030	25.8												
2031	22.6												
2032	19.7												
2033	17.2												
2034	15.1												
2035	13.2												
2036	8.3												
2037	7.3												
2038	6.5												

**Table 4.4.9
Arctic Spill Occurrence Beaufort Sea Sale All Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2009	Shallow	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2011	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2012	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2013	Shallow		1.300			9.080			3.900			3.900		
	Medium	3	1.300	0.039	0.02	9.080	0.272	1.23	3.900	0.117	2.34	3.900	0.117	23.40
	Deep		1.300			9.080			3.900			3.900		
	Total	3		0.039	0.02		0.272	1.23		0.117	2.34		0.117	23.40
2014	Shallow		1.300			9.080			3.900			3.900		
	Medium	4	1.300	0.052	0.03	9.080	0.363	1.63	3.900	0.156	3.12	3.900	0.156	31.20
	Deep		1.300			9.080			3.900			3.900		
	Total	4		0.052	0.03		0.363	1.63		0.156	3.12		0.156	31.20
2015	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2016	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2017	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.4.9
Arctic Spill Occurrence Beaufort Sea Sale All Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] = 500		Spill Index bbl	Average Spill [bbl] = 4500		Spill Index bbl	Average Spill [bbl] = 20000		Spill Index bbl	Average Spill [bbl] = 200000		Spill Index bbl
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2019	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2020	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2021	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2022	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2023	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2024	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2025	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2026	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2027	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2028	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2029	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2030	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2031	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.4.9
Arctic Spill Occurrence Beaufort Sea Sale All Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2033	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2034	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2035	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2036	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2037	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2038	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.4.10

Arctic Spill Occurrence Beaufort Sea Sale All Development Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004													
2005													
2006		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2007													
2008		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2009		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2010	10.9	0.026	0.002	0.013	0.078	0.007	0.817	0.156	0.014	17.160	0.260	0.024	17.990
2011	19.9												
2012	30.8												
2013	50.7	0.039	0.001	0.020	0.117	0.002	1.226	0.234	0.005	25.740	0.390	0.008	26.985
2014	56.2	0.052	0.001	0.026	0.156	0.003	1.634	0.312	0.006	34.320	0.520	0.009	35.980
2015	64.2	0.026	0.000	0.013	0.078	0.001	0.817	0.156	0.002	17.160	0.260	0.004	17.990
2016	67.4												
2017	77.4												
2018	82.9												
2019	104.6												
2020	104.8												
2021	98.6												
2022	89.2												
2023	81.4												
2024	74.8												
2025	62.5												
2026	54.1												
2027	44.6												
2028	36.9												
2029	32.2												
2030	25.8												
2031	22.6												
2032	19.7												
2033	17.2												
2034	15.1												
2035	13.2												
2036	8.3												
2037	7.3												
2038	6.5												

**Table 4.4.11
Arctic Spill Occurrence Beaufort Sea Sale All Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills			
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	
2004	Pipeline														
	Platforms														
	Production Wells														
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911	
	Development Wells														
	Total		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911	
2005	Pipeline														
	Platforms														
	Production Wells														
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911	
	Development Wells														
	Total		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911	
2006	Pipeline														
	Platforms														
	Production Wells														
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911	
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990	
	Total		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901	
2007	Pipeline														
	Platforms														
	Production Wells														
	Exploration Wells		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822	
	Development Wells														
	Total		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822	
2008	Pipeline														
	Platforms														
	Production Wells														
	Exploration Wells		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822	
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990	
	Total		0.089		0.045	0.268		2.807	0.456		42.960	0.813		45.812	
2009	Pipeline														
	Platforms		0.289		0.046	0.058		0.354			0.347		0.399		
	Production Wells		0.015		0.008	0.045		0.473	0.075		6.900	0.135		7.380	
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911	
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990	
	Total		0.362		0.082	0.276		2.638	0.381		36.960	1.019		39.680	
2010	Pipeline	10.9	0.718	0.066	0.205	0.565	0.052	2.223	0.174	0.016	3.079	1.457	0.134	5.508	
	Platforms		1.254	0.115	0.198	0.250	0.023	1.532				1.504	0.138	1.730	
	Production Wells		0.065	0.006	0.033	0.195	0.018	2.048	0.325	0.030	29.900	0.585	0.054	31.980	
	Exploration Wells		0.063	0.006	0.032	0.190	0.017	1.990	0.300	0.028	25.800	0.553	0.051	27.822	
	Development Wells		0.026	0.002	0.013	0.078	0.007	0.817	0.156	0.014	17.160	0.260	0.024	17.990	
	Total		2.126	0.195	0.481	1.278	0.117	8.610	0.955	0.088	75.939	4.359	0.400	85.030	
2011	Pipeline	19.9	0.718	0.036	0.205	0.565	0.028	2.223	0.174	0.009	3.079	1.457	0.073	5.508	
	Platforms		2.508	0.126	0.396	0.500	0.025	3.065				3.007	0.151	3.461	
	Production Wells		0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960	
	Exploration Wells														
	Development Wells														
	Total		3.356	0.169	0.667	1.455	0.073	9.383	0.824	0.041	62.879	5.635	0.283	72.929	
2012	Pipeline	30.8	1.436	0.047	0.411	1.131	0.037	4.446	0.348	0.011	6.159	2.915	0.095	11.016	
	Platforms		3.761	0.122	0.594	0.750	0.024	4.597				4.511	0.146	5.191	
	Production Wells		0.195	0.006	0.098	0.585	0.019	6.143	0.975	0.032	89.700	1.755	0.057	95.940	
	Exploration Wells		0.095	0.003	0.047	0.285	0.009	2.985	0.450	0.015	38.700	0.830	0.027	41.732	
	Development Wells														
	Total		5.487	0.178	1.150	2.751	0.089	18.170	1.773	0.058	134.559	10.011	0.325	153.879	
2013	Pipeline	50.7	2.513	0.050	0.719	1.979	0.039	7.781	0.609	0.012	10.778	5.101	0.101	19.278	
	Platforms		5.690	0.112	0.899	1.134	0.022	6.954				6.825	0.135	7.853	
	Production Wells		0.295	0.006	0.148	0.885	0.017	9.293	1.475	0.029	135.700	2.655	0.052	145.140	
	Exploration Wells		0.063	0.001	0.032	0.190	0.004	1.990	0.300	0.006	25.800	0.553	0.011	27.822	
	Development Wells		0.039	0.001	0.020	0.117	0.002	1.226	0.234	0.005	25.740	0.390	0.008	26.985	
	Total		8.600	0.170	1.817	4.305	0.085	27.243	2.618	0.052	198.018	15.524	0.306	227.078	

**Table 4.4.11
Arctic Spill Occurrence Beaufort Sea Sale All Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills			
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	
2014	Pipeline	56.2	2.513	0.045	0.719	1.979	0.035	7.781	0.609	0.011	10.778	5.101	0.091	19.278	
	Platforms		6.968	0.124	1.101	1.389	0.025	8.512				8.357	0.149	9.613	
	Production Wells		0.360	0.006	0.180	1.080	0.019	11.340	1.800	0.032	165.600	3.240	0.058	177.120	
	Exploration Wells														
	Development Wells		0.052	0.001	0.026	0.156	0.003	1.634	0.312	0.006	34.320	0.520	0.009	35.980	
	Total		9.893	0.176	2.026	4.604	0.082	29.268	2.721	0.048	210.698	17.217	0.306	241.992	
2015	Pipeline	64.2	3.864	0.060	1.108	2.981	0.046	11.721	0.921	0.014	16.306	7.766	0.121	29.135	
	Platforms		8.012	0.125	1.266	1.595	0.025	9.777				9.607	0.150	11.043	
	Production Wells		0.410	0.006	0.205	1.230	0.019	12.915	2.050	0.032	188.600	3.690	0.057	201.720	
	Exploration Wells		0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.004	13.911	
	Development Wells		0.026	0.000	0.013	0.078	0.001	0.817	0.156	0.002	17.160	0.260	0.004	17.990	
	Total		12.344	0.192	2.607	5.979	0.093	36.225	3.277	0.051	234.966	21.599	0.336	273.799	
2016	Pipeline	67.4	3.864	0.057	1.108	2.981	0.044	11.721	0.921	0.014	16.306	7.766	0.115	29.135	
	Platforms		9.369	0.139	1.480	1.863	0.028	11.421				11.232	0.167	12.902	
	Production Wells		0.475	0.007	0.238	1.425	0.021	14.963	2.375	0.035	218.500	4.275	0.063	233.700	
	Exploration Wells														
	Development Wells														
	Total		13.708	0.203	2.826	6.269	0.093	38.105	3.296	0.049	234.806	23.273	0.345	275.737	
2017	Pipeline	77.4	5.591	0.072	1.568	4.129	0.053	16.308	1.272	0.016	22.389	10.991	0.142	40.265	
	Platforms		10.726	0.139	1.695	2.131	0.028	13.065				12.858	0.166	14.760	
	Production Wells		0.540	0.007	0.270	1.620	0.021	17.010	2.700	0.035	248.400	4.860	0.063	265.680	
	Exploration Wells		0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.004	13.911	
	Development Wells														
	Total		16.889	0.218	3.548	7.975	0.103	47.378	4.122	0.053	283.689	28.986	0.374	334.616	
2018	Pipeline	82.9	5.591	0.067	1.568	4.129	0.050	16.308	1.272	0.015	22.389	10.991	0.133	40.265	
	Platforms		13.232	0.160	2.091	2.627	0.032	16.101				15.859	0.191	18.192	
	Production Wells		0.660	0.008	0.330	1.980	0.024	20.790	3.300	0.040	303.600	5.940	0.072	324.720	
	Exploration Wells		0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.003	13.911	
	Development Wells														
	Total		19.514	0.235	4.004	8.830	0.107	54.194	4.722	0.057	338.889	33.067	0.399	397.087	
2019	Pipeline	104.6	7.993	0.076	2.222	5.778	0.055	22.865	1.779	0.017	31.237	15.549	0.149	56.323	
	Platforms		15.738	0.150	2.487	3.122	0.030	19.136				18.859	0.180	21.623	
	Production Wells		0.780	0.007	0.390	2.340	0.022	24.570	3.900	0.037	358.800	7.020	0.067	383.760	
	Exploration Wells														
	Development Wells														
	Total		24.511	0.234	5.099	11.239	0.107	66.571	5.679	0.054	390.037	41.429	0.396	461.706	
2020	Pipeline	104.8	7.993	0.076	2.222	5.778	0.055	22.865	1.779	0.017	31.237	15.549	0.148	56.323	
	Platforms		17.826	0.170	2.816	3.534	0.034	21.666				21.360	0.204	24.482	
	Production Wells		0.880	0.008	0.440	2.640	0.025	27.720	4.400	0.042	404.800	7.920	0.076	432.960	
	Exploration Wells														
	Development Wells														
	Total		26.699	0.255	5.479	11.952	0.114	72.250	6.179	0.059	436.037	44.829	0.428	513.766	
2021	Pipeline	98.6	7.993	0.081	2.222	5.778	0.059	22.865	1.779	0.018	31.237	15.549	0.158	56.323	
	Platforms		19.914	0.202	3.146	3.947	0.040	24.195				23.861	0.242	27.342	
	Production Wells		0.980	0.010	0.490	2.940	0.030	30.870	4.900	0.050	450.800	8.820	0.089	482.160	
	Exploration Wells														
	Development Wells														
	Total		28.887	0.293	5.859	12.665	0.128	77.930	6.679	0.068	482.037	48.230	0.489	565.825	
2022	Pipeline	89.2	7.993	0.090	2.222	5.778	0.065	22.865	1.779	0.020	31.237	15.549	0.174	56.323	
	Platforms		20.958	0.235	3.311	4.153	0.047	25.460				25.111	0.282	28.771	
	Production Wells		1.030	0.012	0.515	3.090	0.035	32.445	5.150	0.058	473.800	9.270	0.104	506.760	
	Exploration Wells														
	Development Wells														
	Total		29.981	0.336	6.049	13.021	0.146	80.770	6.929	0.078	505.037	49.930	0.560	591.855	
2023	Pipeline	81.4	7.993	0.098	2.222	5.778	0.071	22.865	1.779	0.022	31.237	15.549	0.191	56.323	
	Platforms		20.958	0.257	3.311	4.153	0.051	25.460				25.111	0.308	28.771	
	Production Wells		1.030	0.013	0.515	3.090	0.038	32.445	5.150	0.063	473.800	9.270	0.114	506.760	
	Exploration Wells														
	Development Wells														
	Total		29.981	0.368	6.049	13.021	0.160	80.770	6.929	0.085	505.037	49.930	0.613	591.855	

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Arctic Spill Occurrence Beaufort Sea Sale All Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2024	Pipeline	74.8	7.993	0.107	2.222	5.778	0.077	22.865	1.779	0.024	31.237	15.549	0.208	56.323
	Platforms		20.958	0.280	3.311	4.153	0.056	25.460				25.111	0.336	28.771
	Production Wells		1.030	0.014	0.515	3.090	0.041	32.445	5.150	0.069	473.800	9.270	0.124	506.760
	Exploration Wells													
	Development Wells													
	Total		29.981	0.401	6.049	13.021	0.174	80.770	6.929	0.093	505.037	49.930	0.668	591.855
2025	Pipeline	62.5	7.275	0.116	2.017	5.212	0.083	20.641	1.605	0.026	28.157	14.092	0.225	50.815
	Platforms		18.739	0.300	2.961	3.711	0.059	22.749				22.451	0.359	25.710
	Production Wells		0.915	0.015	0.458	2.745	0.044	28.823	4.575	0.073	420.900	8.235	0.132	450.180
	Exploration Wells													
	Development Wells													
	Total		26.930	0.431	5.435	11.668	0.187	72.213	6.180	0.099	449.057	44.778	0.716	526.705
2026	Pipeline	54.1	7.275	0.134	2.017	5.212	0.096	20.641	1.605	0.030	28.157	14.092	0.260	50.815
	Platforms		18.739	0.346	2.961	3.711	0.069	22.749				22.451	0.415	25.710
	Production Wells		0.915	0.017	0.458	2.745	0.051	28.823	4.575	0.085	420.900	8.235	0.152	450.180
	Exploration Wells													
	Development Wells													
	Total		26.930	0.498	5.435	11.668	0.216	72.213	6.180	0.114	449.057	44.778	0.828	526.705
2027	Pipeline	44.6	6.557	0.147	1.811	4.647	0.104	18.418	1.431	0.032	25.078	12.635	0.283	45.307
	Platforms		16.521	0.370	2.610	3.269	0.073	20.038				19.790	0.444	22.649
	Production Wells		0.800	0.018	0.400	2.400	0.054	25.200	4.000	0.090	368.000	7.200	0.161	393.600
	Exploration Wells													
	Development Wells													
	Total		23.878	0.535	4.822	10.316	0.231	63.656	5.431	0.122	393.078	39.625	0.888	461.556
2028	Pipeline	36.9	5.480	0.149	1.503	3.799	0.103	15.084	1.170	0.032	20.459	10.449	0.283	37.045
	Platforms		14.303	0.388	2.260	2.827	0.077	17.327				17.130	0.464	19.587
	Production Wells		0.685	0.019	0.343	2.055	0.056	21.578	3.425	0.093	315.100	6.165	0.167	337.020
	Exploration Wells													
	Development Wells													
	Total		20.468	0.555	4.105	8.680	0.235	53.988	4.595	0.125	335.559	33.743	0.914	393.653
2029	Pipeline	32.2	5.480	0.170	1.503	3.799	0.118	15.084	1.170	0.036	20.459	10.449	0.324	37.045
	Platforms		14.303	0.444	2.260	2.827	0.088	17.327				17.130	0.532	19.587
	Production Wells		0.685	0.021	0.343	2.055	0.064	21.578	3.425	0.106	315.100	6.165	0.191	337.020
	Exploration Wells													
	Development Wells													
	Total		20.468	0.636	4.105	8.680	0.270	53.988	4.595	0.143	335.559	33.743	1.048	393.653
2030	Pipeline	25.8	4.129	0.160	1.115	2.797	0.108	11.143	0.858	0.033	14.931	7.783	0.302	27.189
	Platforms		11.902	0.461	1.880	2.352	0.091	14.418				14.254	0.552	16.299
	Production Wells		0.570	0.022	0.285	1.710	0.066	17.955	2.850	0.110	262.200	5.130	0.199	280.440
	Exploration Wells													
	Development Wells													
	Total		16.601	0.643	3.280	6.859	0.266	43.517	3.708	0.144	277.131	27.167	1.053	323.927
2031	Pipeline	22.6	4.129	0.183	0.971	2.797	0.124	9.850	0.858	0.038	13.821	7.783	0.344	24.642
	Platforms		11.902	0.527	1.880	2.352	0.104	14.418				14.254	0.631	16.299
	Production Wells		0.570	0.025	0.285	1.710	0.076	17.955	2.850	0.126	262.200	5.130	0.227	280.440
	Exploration Wells													
	Development Wells													
	Total		16.601	0.735	3.137	6.859	0.303	42.223	3.708	0.164	276.021	27.167	1.202	321.381
2032	Pipeline	19.7	4.129	0.210	1.115	2.797	0.142	11.143	0.858	0.044	14.931	7.783	0.395	27.189
	Platforms		11.902	0.604	1.880	2.352	0.119	14.418				14.254	0.724	16.299
	Production Wells		0.570	0.029	0.285	1.710	0.087	17.955	2.850	0.145	262.200	5.130	0.260	280.440
	Exploration Wells													
	Development Wells													
	Total		16.601	0.843	3.280	6.859	0.348	43.517	3.708	0.188	277.131	27.167	1.379	323.927
2033	Pipeline	17.2	4.129	0.240	1.115	2.797	0.163	11.143	0.858	0.050	14.931	7.783	0.453	27.189
	Platforms		11.902	0.692	1.880	2.352	0.137	14.418				14.254	0.829	16.299
	Production Wells		0.570	0.033	0.285	1.710	0.099	17.955	2.850	0.166	262.200	5.130	0.298	280.440
	Exploration Wells													
	Development Wells													
	Total		16.601	0.965	3.280	6.859	0.399	43.517	3.708	0.216	277.131	27.167	1.579	323.927

**Table 4.4.11
Arctic Spill Occurrence Beaufort Sea Sale All Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills			
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	
2034	Pipeline	15.1	4.129	0.273	1.115	2.797	0.185	11.143	0.858	0.057	14.931	7.783	0.515	27.189	
	Platforms		11.902	0.788	1.880	2.352	0.156	14.418				14.254	0.944	16.299	
	Production Wells		0.570	0.038	0.285	1.710	0.113	17.955	2.850	0.189	262.200	5.130	0.340	280.440	
	Exploration Wells														
	Development Wells														
	Total		16.601	1.099	3.280	6.859	0.454	43.517	3.708	0.246	277.131	27.167	1.799	323.927	
2035	Pipeline	13.2	4.129	0.313	1.115	2.797	0.212	11.143	0.858	0.065	14.931	7.783	0.590	27.189	
	Platforms		11.902	0.902	1.880	2.352	0.178	14.418				14.254	1.080	16.299	
	Production Wells		0.570	0.043	0.285	1.710	0.130	17.955	2.850	0.216	262.200	5.130	0.389	280.440	
	Exploration Wells														
	Development Wells														
	Total		16.601	1.258	3.280	6.859	0.520	43.517	3.708	0.281	277.131	27.167	2.058	323.927	
2036	Pipeline	8.3	2.402	0.289	0.654	1.649	0.199	6.557	0.507	0.061	8.847	4.558	0.549	16.058	
	Platforms		7.099	0.855	1.122	1.403	0.169	8.600				8.502	1.024	9.722	
	Production Wells		0.340	0.041	0.170	1.020	0.123	10.710	1.700	0.205	156.400	3.060	0.369	167.280	
	Exploration Wells														
	Development Wells														
	Total		9.842	1.186	1.946	4.072	0.491	25.867	2.207	0.266	165.247	16.120	1.942	193.061	
2037	Pipeline	7.3	2.402	0.329	0.654	1.649	0.226	6.557	0.507	0.069	8.847	4.558	0.624	16.058	
	Platforms		7.099	0.973	1.122	1.403	0.192	8.600				8.502	1.165	9.722	
	Production Wells		0.340	0.047	0.170	1.020	0.140	10.710	1.700	0.233	156.400	3.060	0.419	167.280	
	Exploration Wells														
	Development Wells														
	Total		9.842	1.348	1.946	4.072	0.558	25.867	2.207	0.302	165.247	16.120	2.208	193.061	
2038	Pipeline	6.5	2.402	0.370	0.654	1.649	0.254	6.557	0.507	0.078	8.847	4.558	0.701	16.058	
	Platforms		7.099	1.092	1.122	1.403	0.216	8.600				8.502	1.308	9.722	
	Production Wells		0.340	0.052	0.170	1.020	0.157	10.710	1.700	0.262	156.400	3.060	0.471	167.280	
	Exploration Wells														
	Development Wells														
	Total		9.842	1.514	1.946	4.072	0.626	25.867	2.207	0.340	165.247	16.120	2.480	193.061	

**Table 4.4.12
Arctic Spill Occurrence Beaufort Sea Sale All Annual Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2005		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2006		0.06		0.029	0.17		1.812	0.306		30.06	0.537		31.901
2007		0.06		0.032	0.19		1.990	0.300		25.80	0.553		27.822
2008		0.09		0.045	0.27		2.807	0.456		42.96	0.813		45.812
2009		0.36		0.082	0.28		2.638	0.381		36.96	1.019		39.680
2010	10.9	2.13	0.195	0.481	1.28	0.117	8.610	0.955	0.088	75.94	4.359	0.400	85.030
2011	19.9	3.36	0.169	0.667	1.46	0.073	9.383	0.824	0.041	62.88	5.635	0.283	72.929
2012	30.8	5.49	0.178	1.150	2.75	0.089	18.170	1.773	0.058	134.56	10.011	0.325	153.879
2013	50.7	8.60	0.170	1.817	4.31	0.085	27.243	2.618	0.052	198.02	15.524	0.306	227.078
2014	56.2	9.89	0.176	2.026	4.60	0.082	29.268	2.721	0.048	210.70	17.217	0.306	241.992
2015	64.2	12.34	0.192	2.607	5.98	0.093	36.225	3.277	0.051	234.97	21.599	0.336	273.799
2016	67.4	13.71	0.203	2.826	6.27	0.093	38.105	3.296	0.049	234.81	23.273	0.345	275.737
2017	77.4	16.89	0.218	3.548	7.98	0.103	47.378	4.122	0.053	283.69	28.986	0.374	334.616
2018	82.9	19.51	0.235	4.004	8.83	0.107	54.194	4.722	0.057	338.89	33.067	0.399	397.087
2019	104.6	24.51	0.234	5.099	11.24	0.107	66.571	5.679	0.054	390.04	41.429	0.396	461.706
2020	104.8	26.70	0.255	5.479	11.95	0.114	72.250	6.179	0.059	436.04	44.829	0.428	513.766
2021	98.6	28.89	0.293	5.859	12.66	0.128	77.930	6.679	0.068	482.04	48.230	0.489	565.825
2022	89.2	29.98	0.336	6.049	13.02	0.146	80.770	6.929	0.078	505.04	49.930	0.560	591.855
2023	81.4	29.98	0.368	6.049	13.02	0.160	80.770	6.929	0.085	505.04	49.930	0.613	591.855
2024	74.8	29.98	0.401	6.049	13.02	0.174	80.770	6.929	0.093	505.04	49.930	0.668	591.855
2025	62.5	26.93	0.431	5.435	11.67	0.187	72.213	6.180	0.099	449.06	44.778	0.716	526.705
2026	54.1	26.93	0.498	5.435	11.67	0.216	72.213	6.180	0.114	449.06	44.778	0.828	526.705
2027	44.6	23.88	0.535	4.822	10.32	0.231	63.656	5.431	0.122	393.08	39.625	0.888	461.556
2028	36.9	20.47	0.555	4.105	8.68	0.235	53.988	4.595	0.125	335.56	33.743	0.914	393.653
2029	32.2	20.47	0.636	4.105	8.68	0.270	53.988	4.595	0.143	335.56	33.743	1.048	393.653
2030	25.8	16.60	0.643	3.280	6.86	0.266	43.517	3.708	0.144	277.13	27.167	1.053	323.927
2031	22.6	16.60	0.735	3.137	6.86	0.303	42.223	3.708	0.164	276.02	27.167	1.202	321.381
2032	19.7	16.60	0.843	3.280	6.86	0.348	43.517	3.708	0.188	277.13	27.167	1.379	323.927
2033	17.2	16.60	0.965	3.280	6.86	0.399	43.517	3.708	0.216	277.13	27.167	1.579	323.927
2034	15.1	16.60	1.099	3.280	6.86	0.454	43.517	3.708	0.246	277.13	27.167	1.799	323.927
2035	13.2	16.60	1.258	3.280	6.86	0.520	43.517	3.708	0.281	277.13	27.167	2.058	323.927
2036	8.3	9.84	1.186	1.946	4.07	0.491	25.867	2.207	0.266	165.25	16.120	1.942	193.061
2037	7.3	9.84	1.348	1.946	4.07	0.558	25.867	2.207	0.302	165.25	16.120	2.208	193.061
2038	6.5	9.84	1.514	1.946	4.07	0.626	25.867	2.207	0.340	165.25	16.120	2.480	193.061

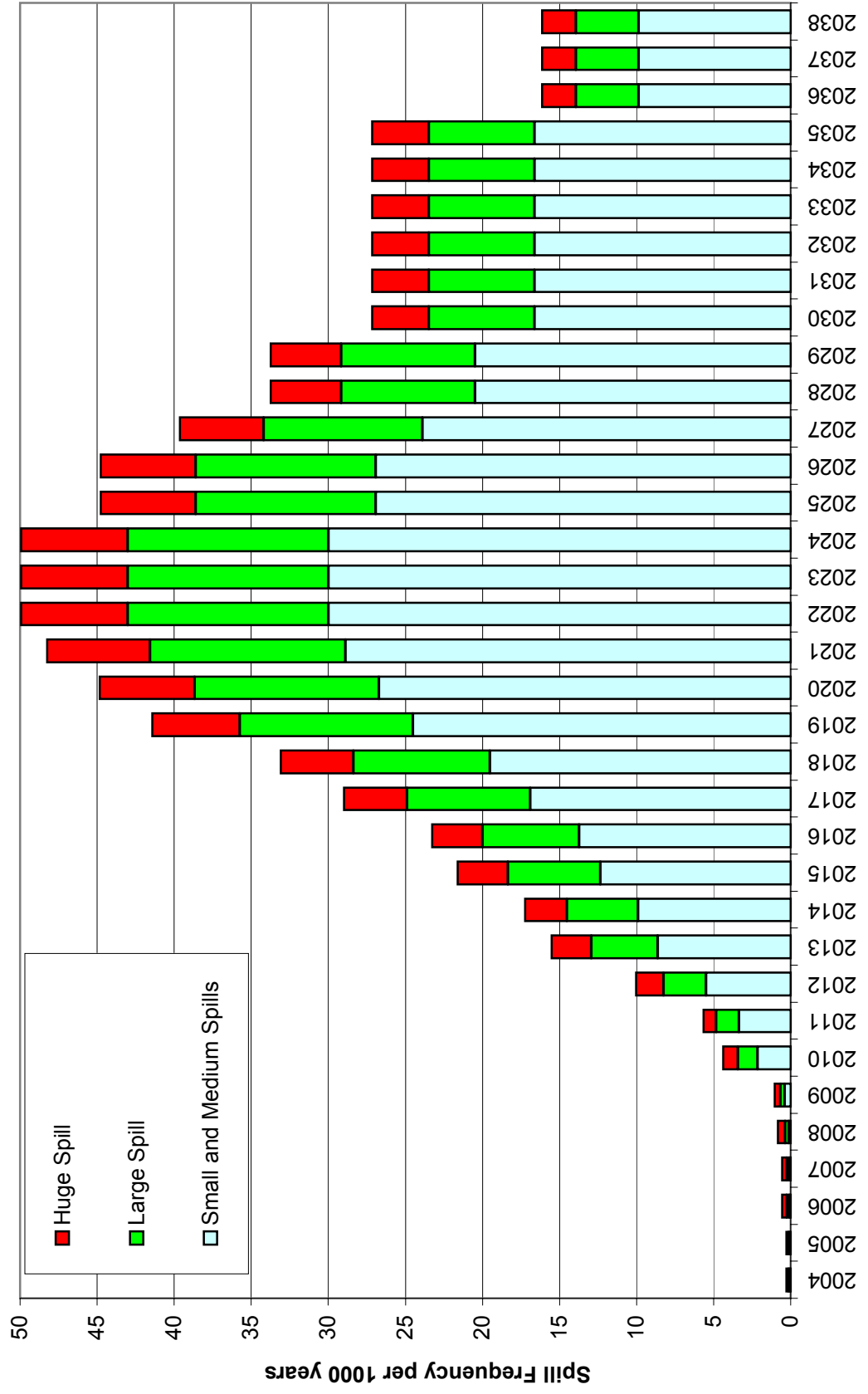
**Table 4.4.13
Arctic Spill Occurrence Beaufort Sea Sale All Wells Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]
2004		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2005		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2006		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901
2007		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2008		0.089		0.045	0.268		2.807	0.456		42.960	0.813		45.812
2009		0.073		0.036	0.218		2.285	0.381		36.960	0.672		39.281
2010	10.9	0.154	0.014	0.077	0.463	0.042	4.855	0.781	0.072	72.860	1.398	0.128	77.792
2011	19.9	0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
2012	30.8	0.290	0.009	0.145	0.870	0.028	9.127	1.425	0.046	128.400	2.585	0.084	137.672
2013	50.7	0.397	0.008	0.199	1.192	0.024	12.508	2.009	0.040	187.240	3.598	0.071	199.947
2014	56.2	0.412	0.007	0.206	1.236	0.022	12.974	2.112	0.038	199.920	3.760	0.067	213.100
2015	64.2	0.468	0.007	0.234	1.403	0.022	14.727	2.356	0.037	218.660	4.227	0.066	233.621
2016	67.4	0.475	0.007	0.238	1.425	0.021	14.963	2.375	0.035	218.500	4.275	0.063	233.700
2017	77.4	0.572	0.007	0.286	1.715	0.022	18.005	2.850	0.037	261.300	5.137	0.066	279.591
2018	82.9	0.692	0.008	0.346	2.075	0.025	21.785	3.450	0.042	316.500	6.217	0.075	338.631
2019	104.6	0.780	0.007	0.390	2.340	0.022	24.570	3.900	0.037	358.800	7.020	0.067	383.760
2020	104.8	0.880	0.008	0.440	2.640	0.025	27.720	4.400	0.042	404.800	7.920	0.076	432.960
2021	98.6	0.980	0.010	0.490	2.940	0.030	30.870	4.900	0.050	450.800	8.820	0.089	482.160
2022	89.2	1.030	0.012	0.515	3.090	0.035	32.445	5.150	0.058	473.800	9.270	0.104	506.760
2023	81.4	1.030	0.013	0.515	3.090	0.038	32.445	5.150	0.063	473.800	9.270	0.114	506.760
2024	74.8	1.030	0.014	0.515	3.090	0.041	32.445	5.150	0.069	473.800	9.270	0.124	506.760
2025	62.5	0.915	0.015	0.458	2.745	0.044	28.823	4.575	0.073	420.900	8.235	0.132	450.180
2026	54.1	0.915	0.017	0.458	2.745	0.051	28.823	4.575	0.085	420.900	8.235	0.152	450.180
2027	44.6	0.800	0.018	0.400	2.400	0.054	25.200	4.000	0.090	368.000	7.200	0.161	393.600
2028	36.9	0.685	0.019	0.343	2.055	0.056	21.578	3.425	0.093	315.100	6.165	0.167	337.020
2029	32.2	0.685	0.021	0.343	2.055	0.064	21.578	3.425	0.106	315.100	6.165	0.191	337.020
2030	25.8	0.570	0.022	0.285	1.710	0.066	17.955	2.850	0.110	262.200	5.130	0.199	280.440
2031	22.6	0.570	0.025	0.285	1.710	0.076	17.955	2.850	0.126	262.200	5.130	0.227	280.440
2032	19.7	0.570	0.029	0.285	1.710	0.087	17.955	2.850	0.145	262.200	5.130	0.260	280.440
2033	17.2	0.570	0.033	0.285	1.710	0.099	17.955	2.850	0.166	262.200	5.130	0.298	280.440
2034	15.1	0.570	0.038	0.285	1.710	0.113	17.955	2.850	0.189	262.200	5.130	0.340	280.440
2035	13.2	0.570	0.043	0.285	1.710	0.130	17.955	2.850	0.216	262.200	5.130	0.389	280.440
2036	8.3	0.340	0.041	0.170	1.020	0.123	10.710	1.700	0.205	156.400	3.060	0.369	167.280
2037	7.3	0.340	0.047	0.170	1.020	0.140	10.710	1.700	0.233	156.400	3.060	0.419	167.280
2038	6.5	0.340	0.052	0.170	1.020	0.157	10.710	1.700	0.262	156.400	3.060	0.471	167.280

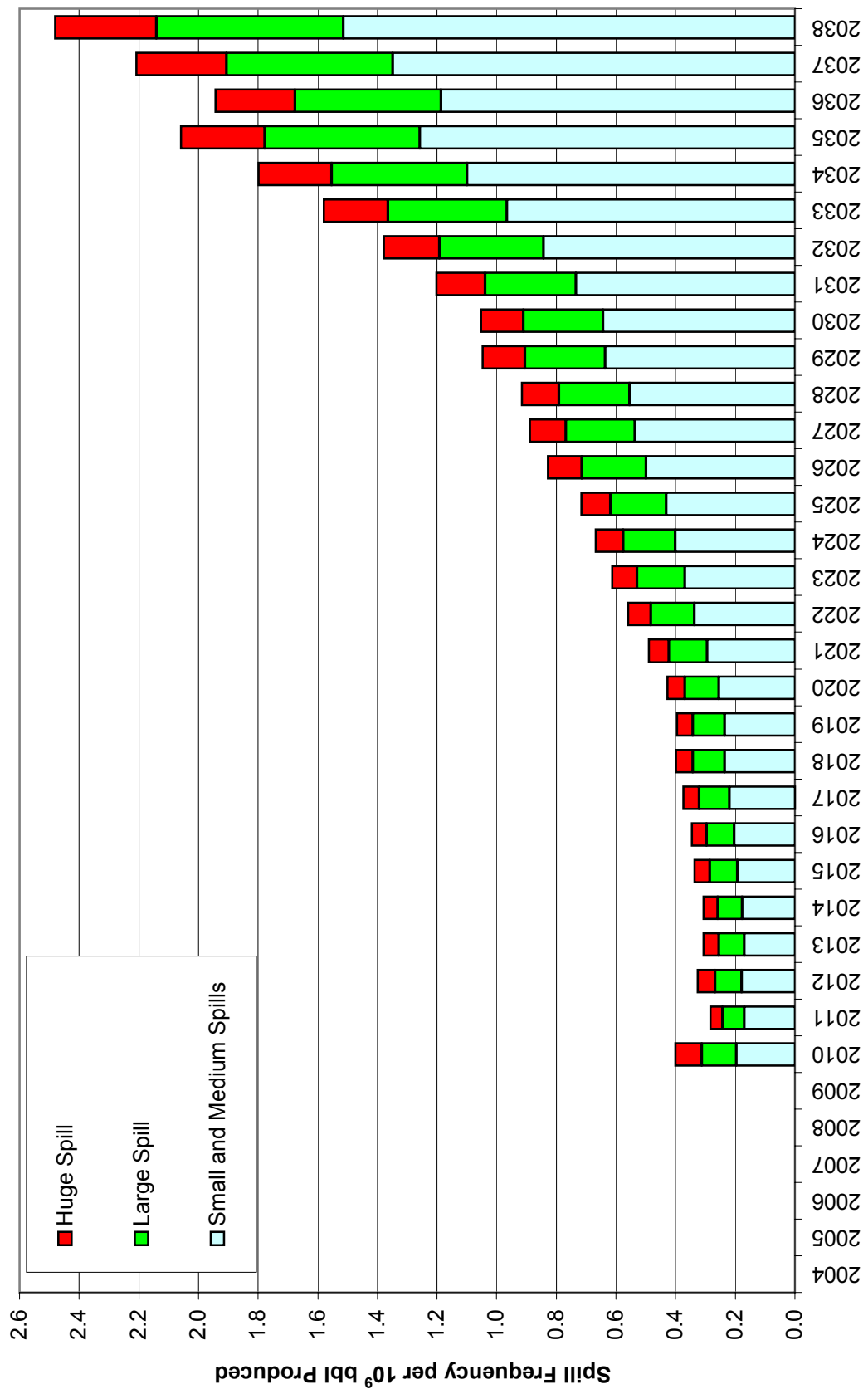
**Table 4.4.14
Beaufort Sea Sale All Sales 2024 - Monte Carlo Results**

SALE All	Small and Medium Spills			Large Spill			Huge Spill		
Year 2024	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
Mean =	29.17	0.390	5.96	13.02	0.174	80.77	6.93	0.093	505.04
Std Deviation =	3.34	0.045	0.57	1.35	0.018	5.77	0.36	0.005	6.31
Variance =	11.18	0.002	0.32	1.81	0.000	33.33	0.13	0.000	39.79
Skewness =	0.06	0.060	0.07	0.34	0.336	0.27	0.36	0.358	0.36
Kurtosis =	2.83	2.829	2.87	2.74	2.739	2.78	2.61	2.607	2.60
Mode =	26.51	0.354	5.66	11.40	0.152	82.18	6.71	0.091	495.14
Minimum =	17.63	0.236	3.95	9.57	0.128	64.64	6.03	0.081	489.05
5% Perc =	23.71	0.317	5.03	10.99	0.147	71.88	6.40	0.086	495.77
10% Perc =	24.93	0.333	5.23	11.37	0.152	73.51	6.49	0.087	497.23
15% Perc =	25.63	0.343	5.36	11.63	0.155	74.77	6.55	0.088	498.40
20% Perc =	26.25	0.351	5.46	11.83	0.158	75.73	6.61	0.088	499.37
25% Perc =	26.74	0.358	5.57	12.03	0.161	76.60	6.66	0.089	500.23
30% Perc =	27.30	0.365	5.65	12.22	0.163	77.45	6.71	0.090	501.12
35% Perc =	27.77	0.371	5.72	12.41	0.166	78.23	6.76	0.090	501.96
40% Perc =	28.24	0.378	5.80	12.58	0.168	78.93	6.80	0.091	502.80
45% Perc =	28.70	0.384	5.88	12.74	0.170	79.69	6.85	0.092	503.59
50% Perc =	29.19	0.390	5.95	12.89	0.172	80.39	6.89	0.092	504.44
55% Perc =	29.62	0.396	6.02	13.08	0.175	81.16	6.94	0.093	505.17
60% Perc =	30.06	0.402	6.09	13.28	0.177	81.95	6.99	0.093	506.15
65% Perc =	30.48	0.407	6.17	13.47	0.180	82.73	7.05	0.094	507.20
70% Perc =	30.94	0.414	6.25	13.70	0.183	83.67	7.11	0.095	508.25
75% Perc =	31.46	0.421	6.35	13.93	0.186	84.61	7.18	0.096	509.45
80% Perc =	32.05	0.428	6.45	14.18	0.190	85.73	7.25	0.097	510.74
85% Perc =	32.64	0.436	6.55	14.47	0.193	86.93	7.32	0.098	512.04
90% Perc =	33.46	0.447	6.70	14.87	0.199	88.61	7.43	0.099	513.88
95% Perc =	34.66	0.463	6.90	15.45	0.207	91.04	7.57	0.101	516.24
Maximum =	40.96	0.548	8.15	17.65	0.236	100.90	8.12	0.108	525.86

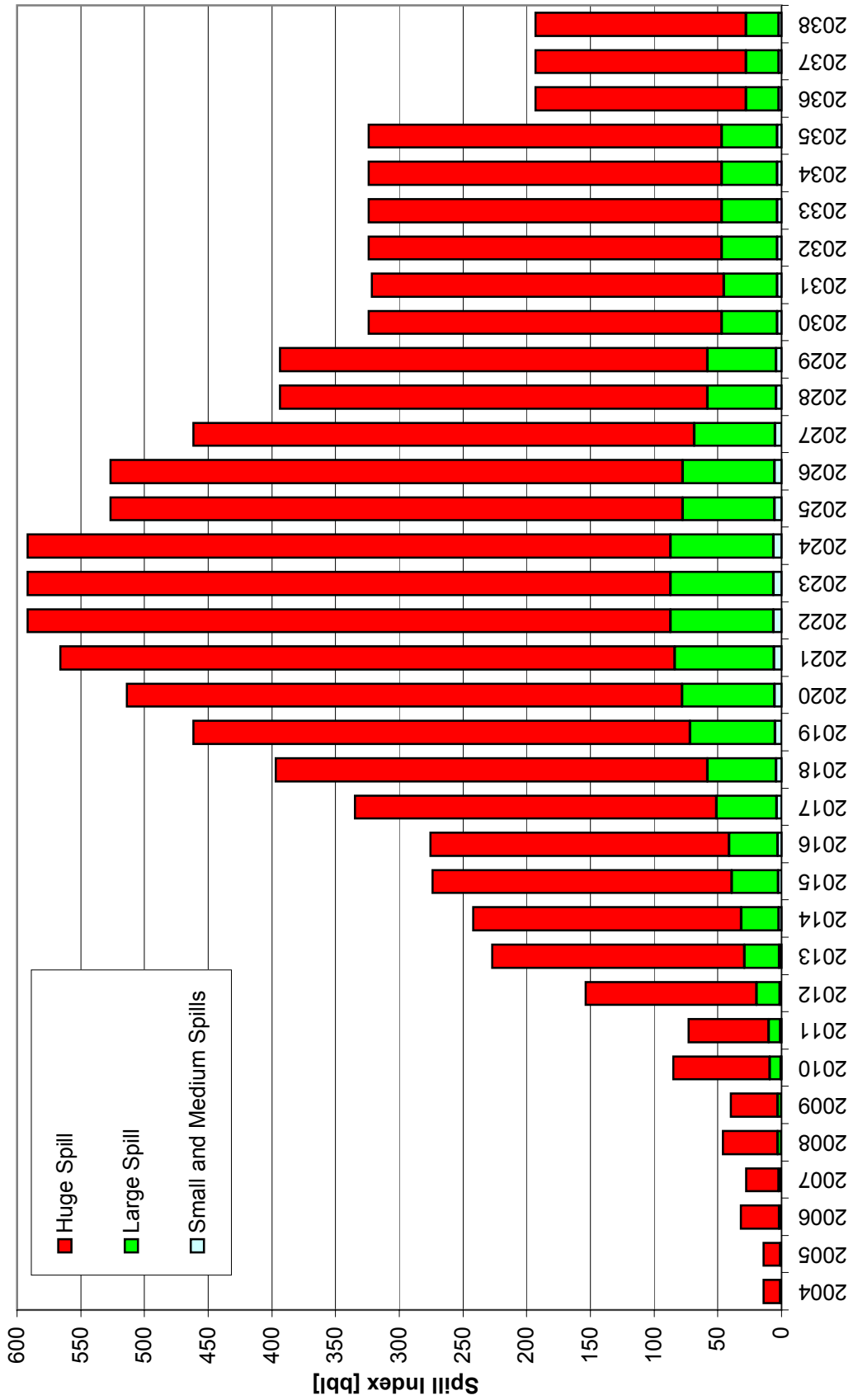
Beaufort Sea Sale All Spill Frequency



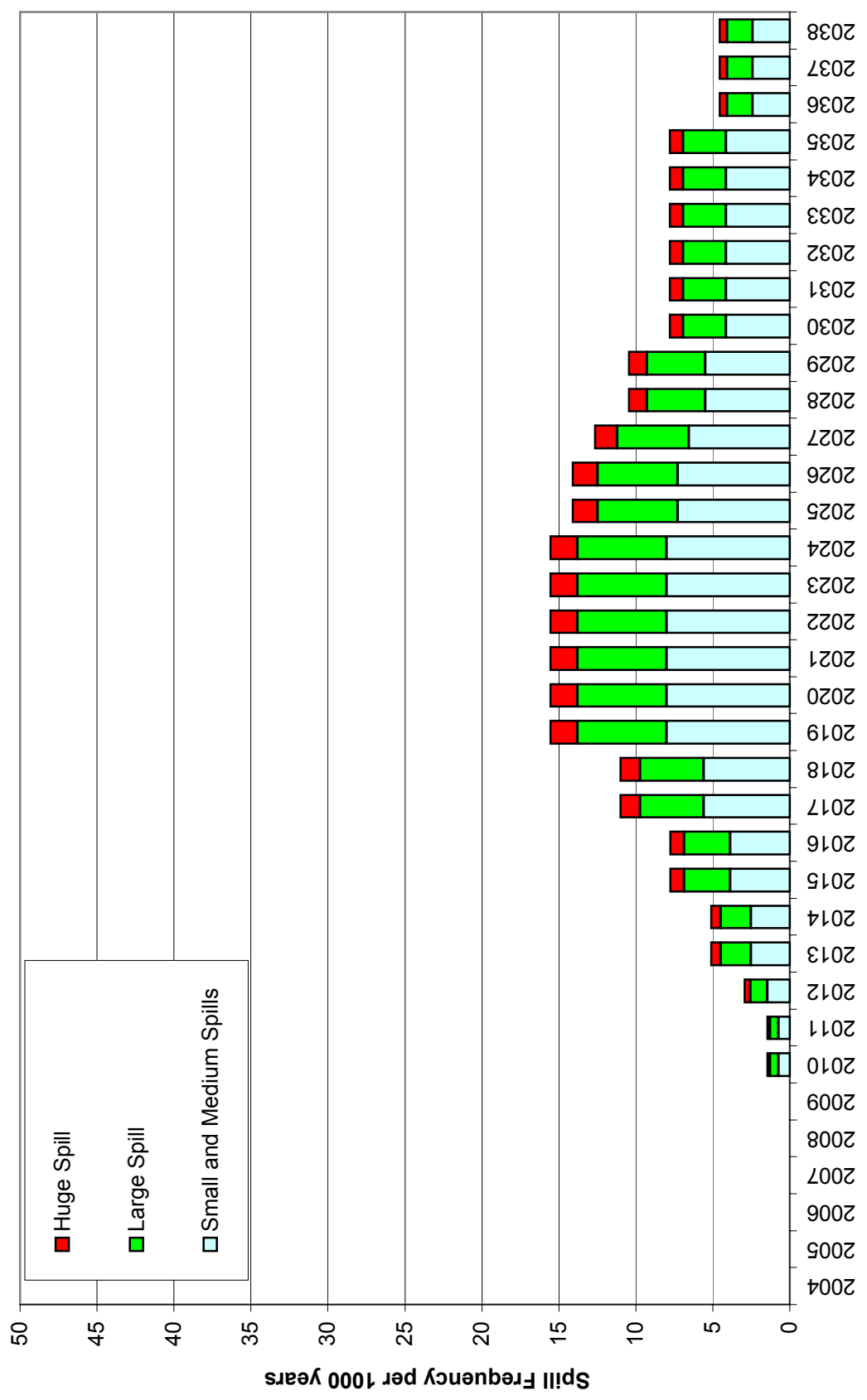
Beaufort Sea Sale All Spill Frequency per 10⁹ bbl Produced



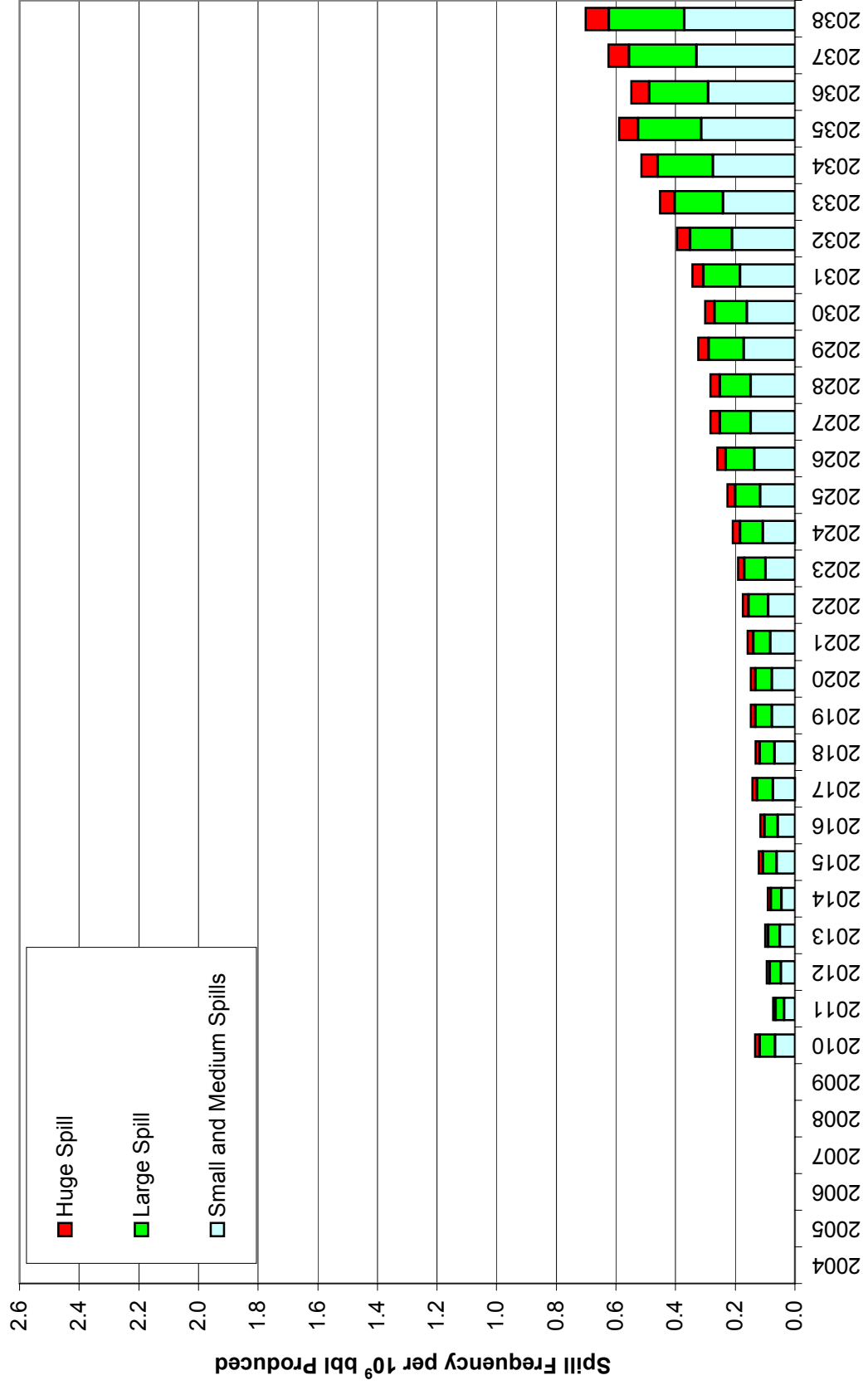
Beaufort Sea Sale All Spill Index



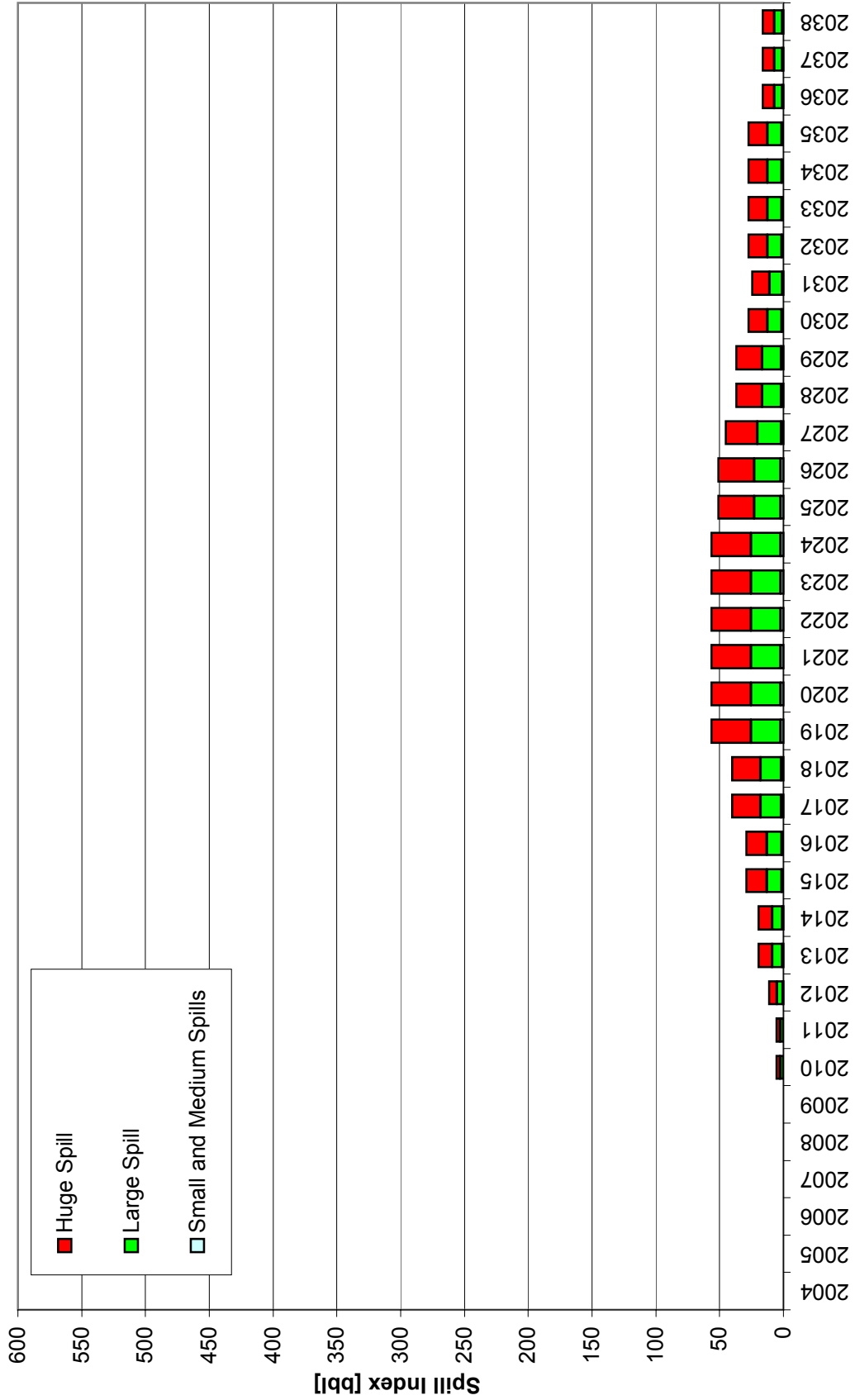
Beaufort Sea Sale All Spill Frequency - P/L



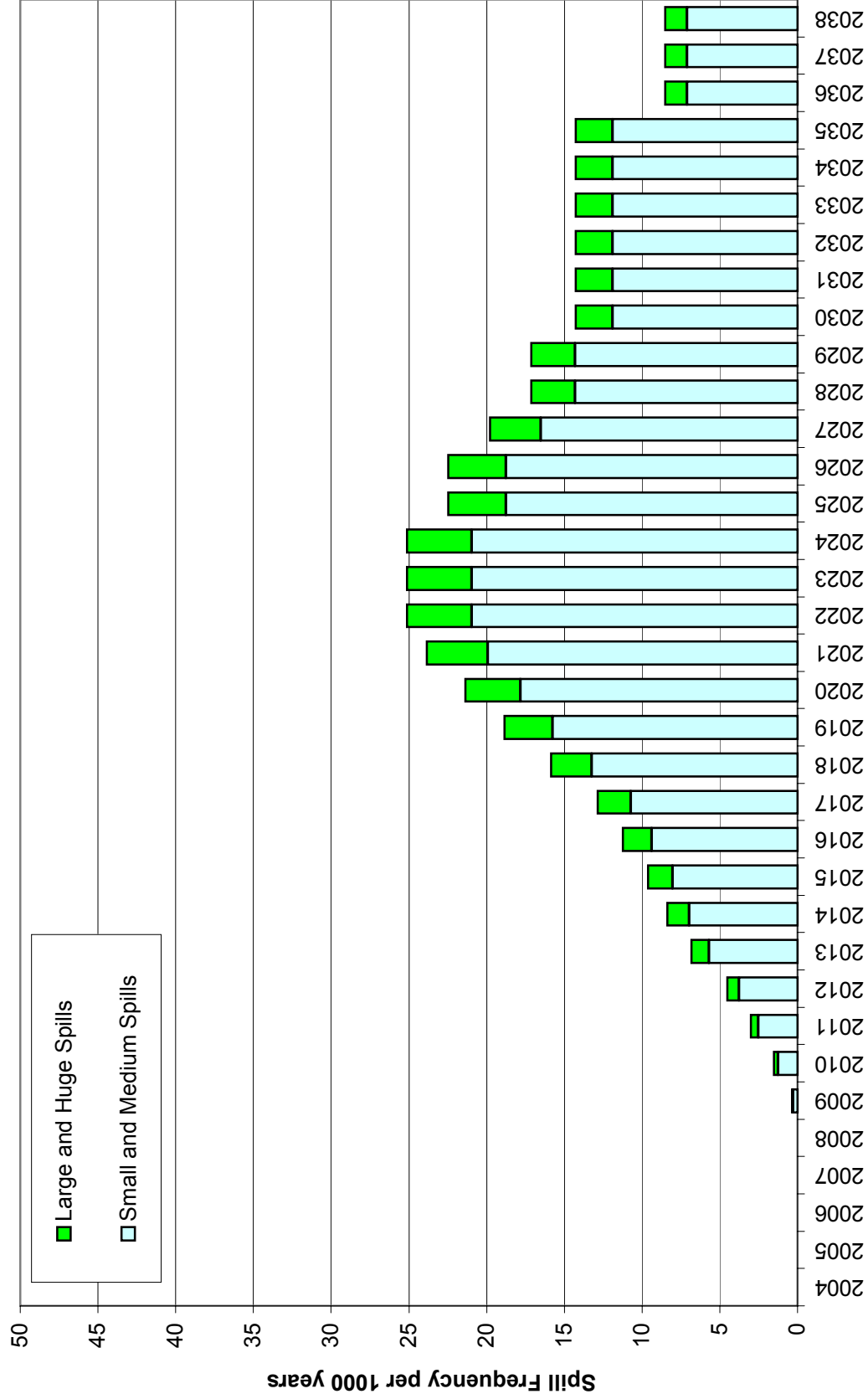
Beaufort Sea Sale All Spill Frequency per 10⁹ bbl Produced - P/L



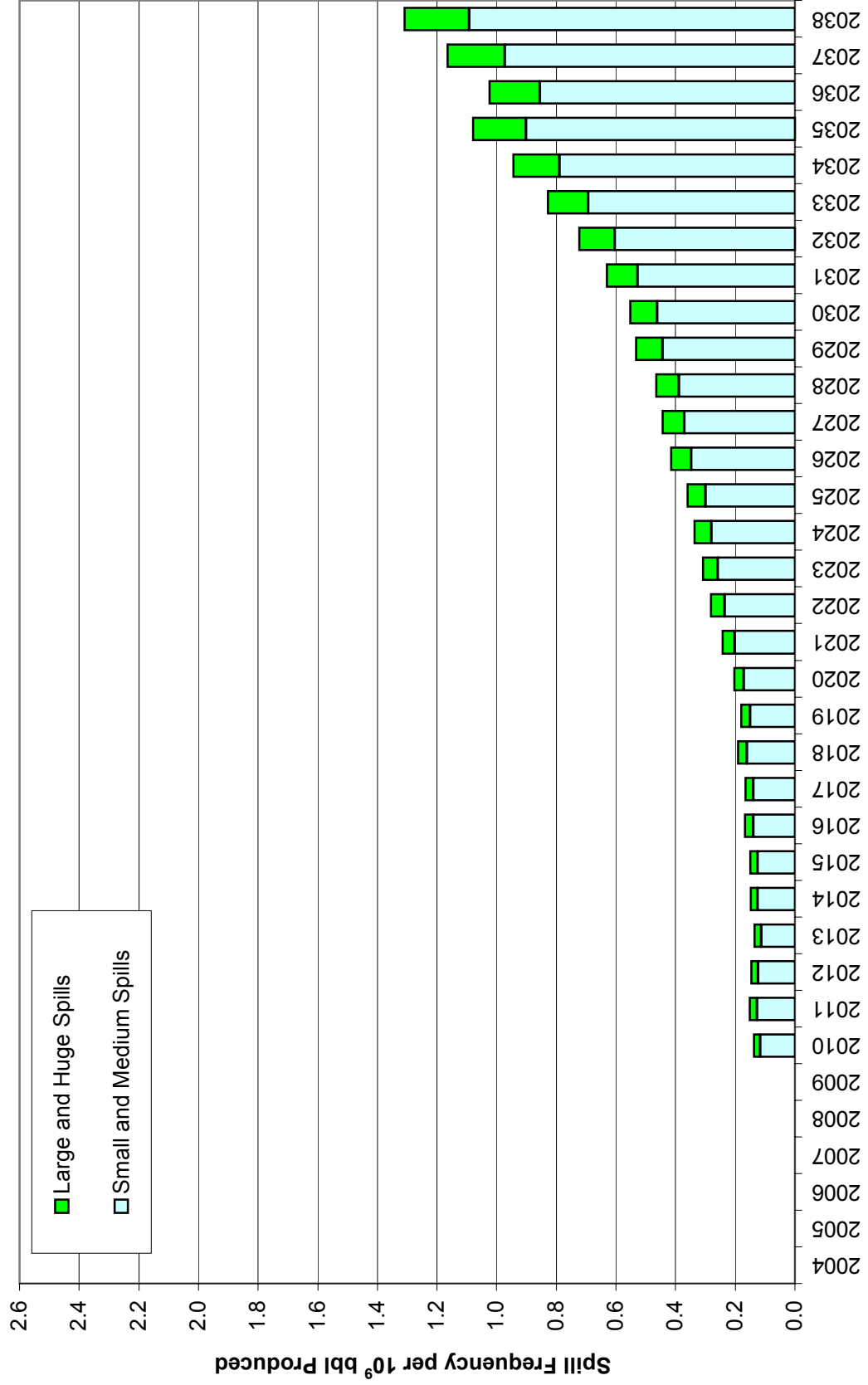
Beaufort Sea Sale All Spill Index - P/L



Beaufort Sea Sale All Spill Frequency - Platforms



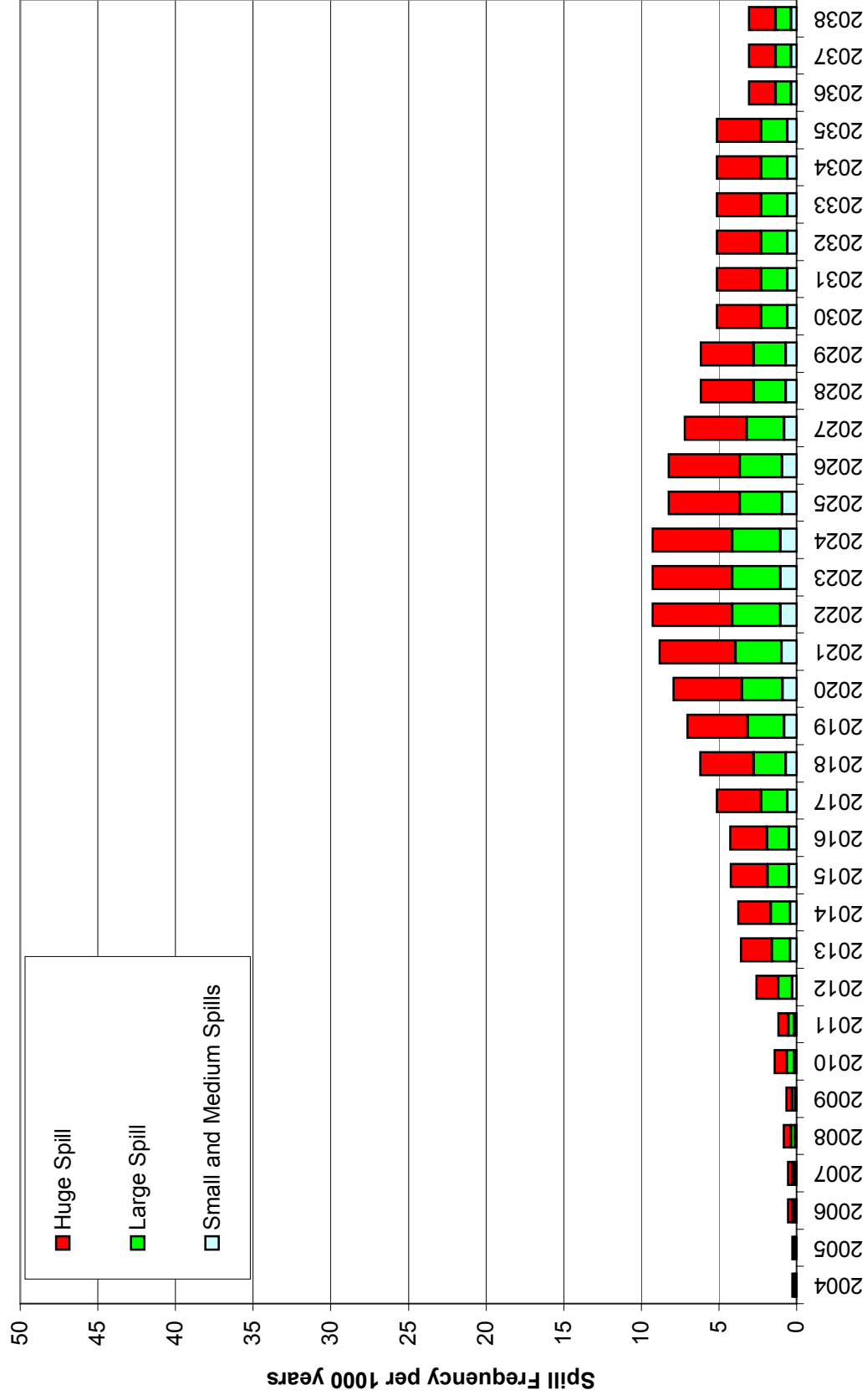
Beaufort Sea Sale All Spill Frequency per 10⁹ bbl Produced - Platforms



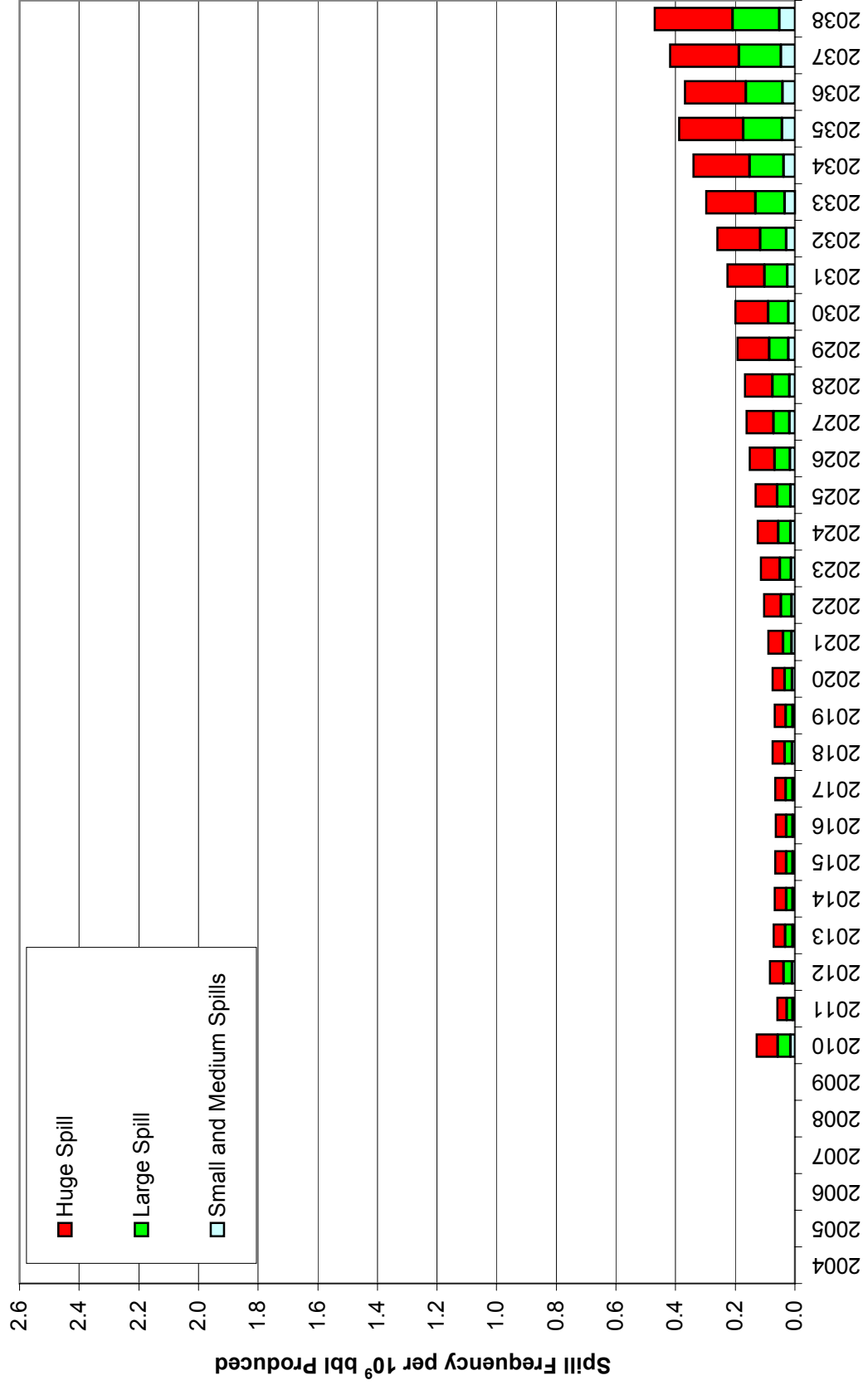
Beaufort Sea Sale All Spill Index - Platforms



Beaufort Sea Sale All Spill Frequency - Wells



Beaufort Sea Sale All Spill Frequency per 10⁹ bbl Produced - Wells



Beaufort Sea Sale All Spill Index - Wells

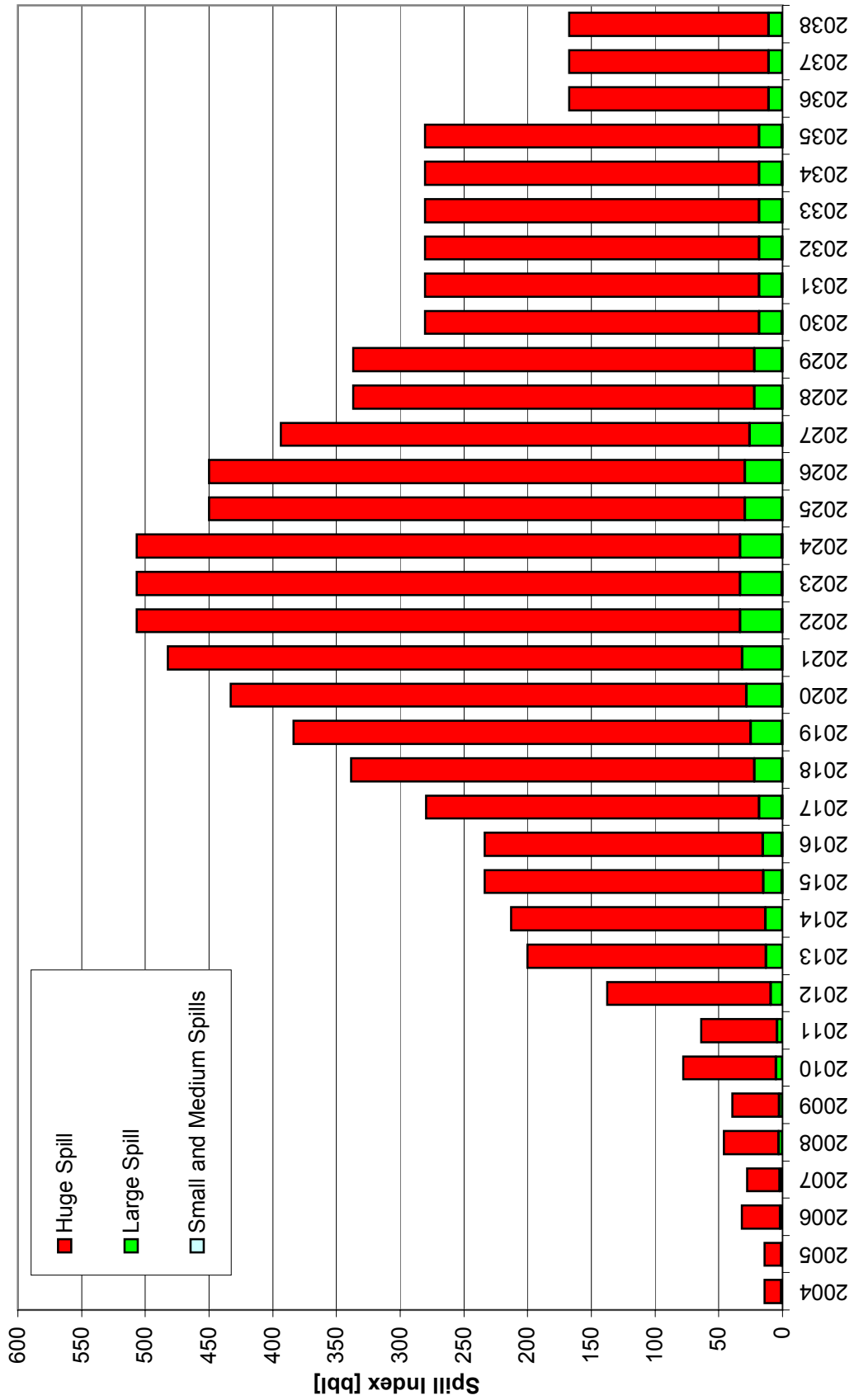


Figure 4.4.13

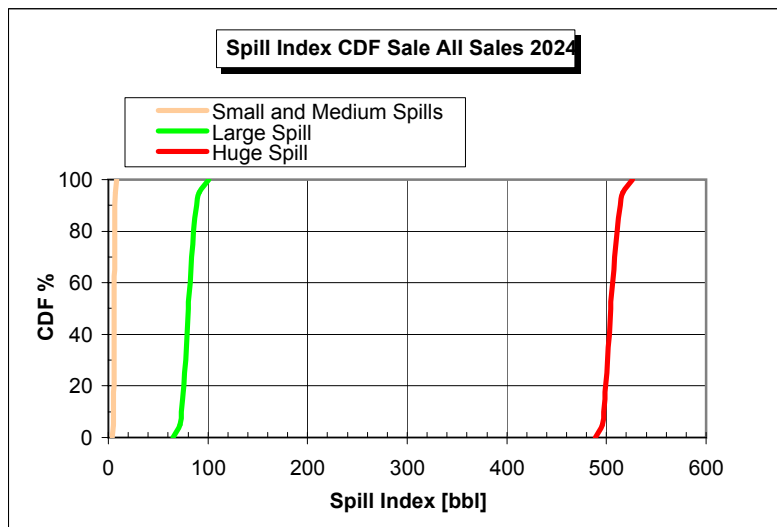
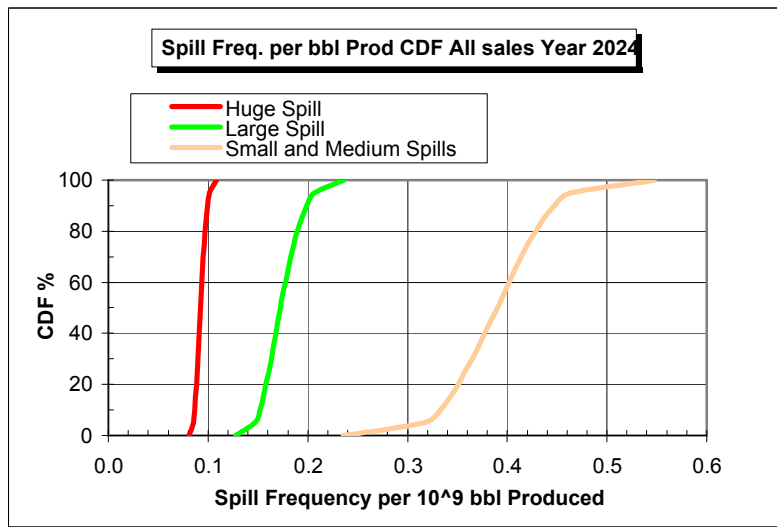
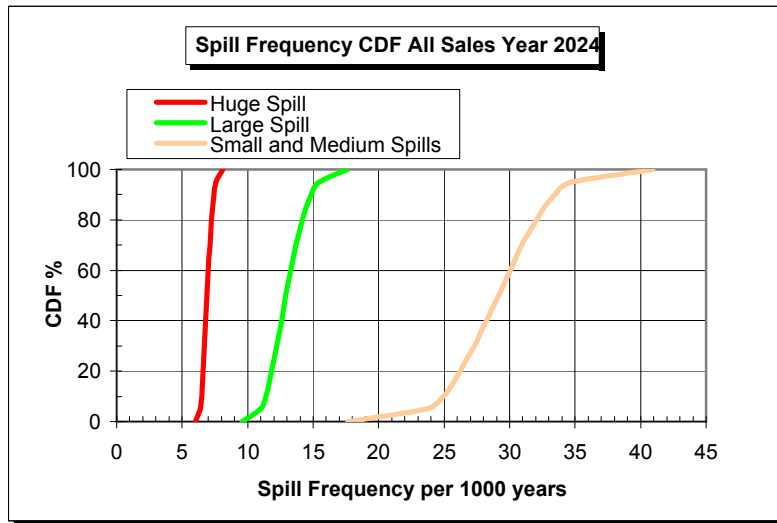
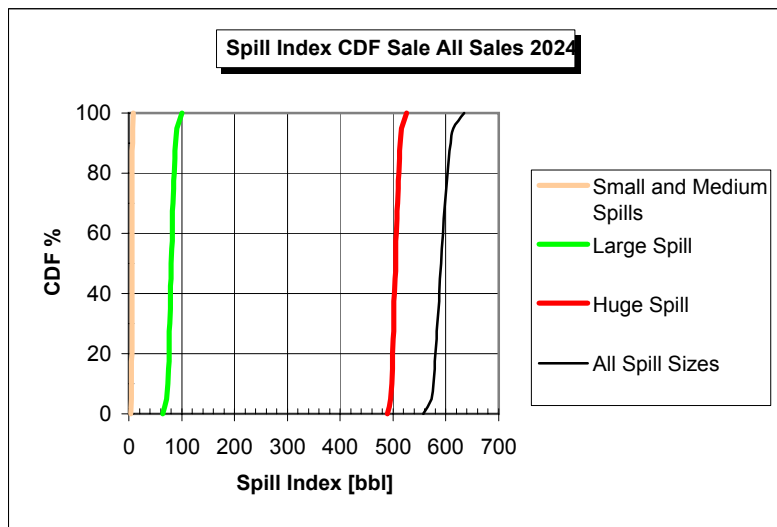
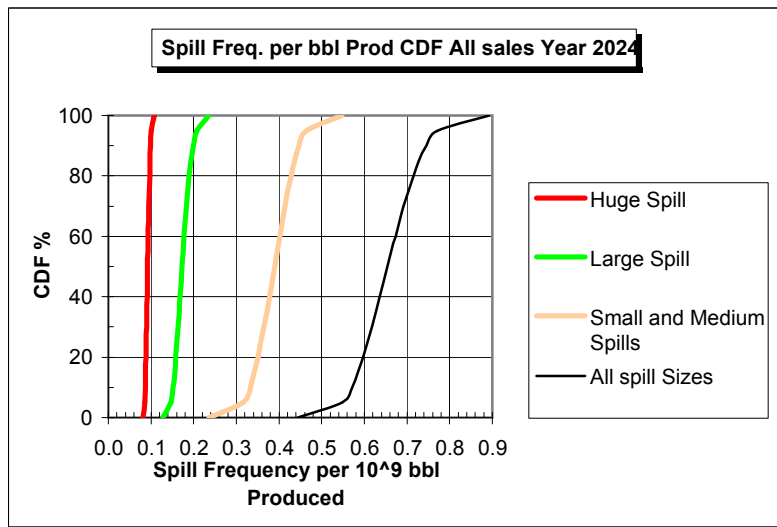
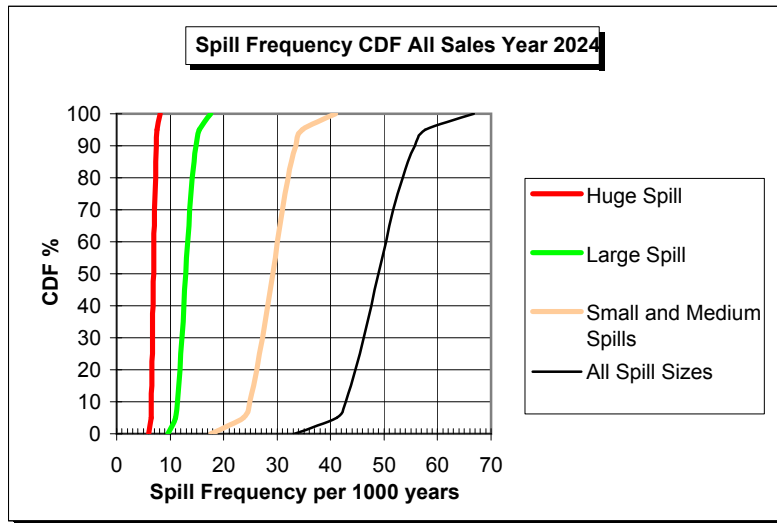


Figure 4.4.13A



**Table 4.4.1
Non Artic Spill Occurrence Beaufort Sea Sale All P/L**

17705	
Spill	
Index	
bbl	
35.93	
17.96	
53.89	
35.93	
17.96	
53.89	
35.93	
17.96	
53.89	
30.79	
17.96	
48.76	
30.79	
17.96	
48.76	
25.66	
17.96	
43.63	
17.96	
35.93	
17.96	
35.93	
12.83	
12.83	
25.66	
12.83	
12.83	
25.66	
12.83	
12.83	
25.66	
12.83	
12.83	
25.66	
7.70	
7.70	
15.40	
7.70	
7.70	
15.40	
7.70	
7.70	
15.40	

**Table 4.4A.2
Non Arctic Spill Occurrence Beaufort Sea Sale All P/L Summary**

Year	Production [Mmbbl]	Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills			
		Frequency Spills per 10 ³ years	10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ³ bbl Produced	Spill Index [bbl]	
2004																				
2005																				
2006																				
2007																				
2008																				
2009																				
2010	10.9	0.290	0.027	0.017	0.725	0.066	0.280	1.015	0.093	0.297	0.870	0.080	3.419	0.290	0.027	5.132	2.174	0.199	8.849	
2011	19.9	0.290	0.015	0.017	0.725	0.036	0.280	1.015	0.051	0.297	0.870	0.044	3.419	0.290	0.015	5.132	2.174	0.109	8.849	
2012	30.8	0.580	0.019	0.034	1.449	0.047	0.561	2.029	0.066	0.595	1.739	0.056	6.839	0.580	0.019	10.265	4.348	0.141	17.698	
2013	50.7	1.015	0.020	0.059	2.536	0.050	0.982	3.551	0.070	1.040	3.044	0.060	11.968	1.015	0.020	17.963	7.609	0.150	30.972	
2014	56.2	1.015	0.018	0.059	2.536	0.045	0.982	3.551	0.063	1.040	3.044	0.054	11.968	1.015	0.018	17.963	7.609	0.135	30.972	
2015	64.2	1.594	0.025	0.092	3.986	0.062	1.543	5.580	0.087	1.635	4.783	0.075	18.807	1.594	0.025	28.228	11.958	0.186	48.670	
2016	67.4	1.594	0.024	0.092	3.986	0.059	1.543	5.580	0.083	1.635	4.783	0.071	18.807	1.594	0.024	28.228	11.958	0.177	48.670	
2017	77.4	2.399	0.031	0.139	5.829	0.075	2.208	8.229	0.106	2.347	6.748	0.087	26.645	2.230	0.029	39.305	17.207	0.222	68.297	
2018	82.9	2.399	0.029	0.139	5.829	0.070	2.208	8.229	0.099	2.347	6.748	0.081	26.645	2.230	0.027	39.305	17.207	0.208	68.297	
2019	104.6	3.494	0.033	0.203	8.398	0.080	3.155	11.892	0.114	3.357	9.582	0.092	37.902	3.156	0.030	55.514	24.630	0.235	96.773	
2020	104.8	3.494	0.033	0.203	8.398	0.080	3.155	11.892	0.113	3.357	9.582	0.091	37.902	3.156	0.030	55.514	24.630	0.235	96.773	
2021	98.6	3.494	0.035	0.203	8.398	0.085	3.155	11.892	0.121	3.357	9.582	0.097	37.902	3.156	0.032	55.514	24.630	0.250	96.773	
2022	89.2	3.494	0.039	0.203	8.398	0.094	3.155	11.892	0.133	3.357	9.582	0.107	37.902	3.156	0.035	55.514	24.630	0.276	96.773	
2023	81.4	3.494	0.043	0.203	8.398	0.103	3.155	11.892	0.146	3.357	9.582	0.118	37.902	3.156	0.039	55.514	24.630	0.303	96.773	
2024	74.8	3.494	0.047	0.203	8.398	0.112	3.155	11.892	0.159	3.357	9.582	0.128	37.902	3.156	0.042	55.514	24.630	0.329	96.773	
2025	62.5	3.204	0.051	0.186	7.673	0.123	2.874	10.877	0.174	3.060	8.712	0.139	34.483	2.866	0.046	50.381	22.456	0.359	87.924	
2026	54.1	3.204	0.059	0.186	7.673	0.142	2.874	10.877	0.201	3.060	8.712	0.161	34.483	2.866	0.053	50.381	22.456	0.415	87.924	
2027	44.6	2.914	0.065	0.169	6.948	0.156	2.594	9.863	0.221	2.763	7.842	0.176	31.063	2.577	0.058	45.249	20.282	0.455	79.075	
2028	36.9	2.480	0.067	0.144	5.861	0.159	2.173	8.341	0.226	2.317	6.538	0.177	25.934	2.142	0.058	37.551	17.020	0.461	65.801	
2029	32.2	2.480	0.077	0.144	5.861	0.182	2.173	8.341	0.259	2.317	6.538	0.203	25.934	2.142	0.067	37.551	17.020	0.529	65.801	
2030	25.8	1.900	0.074	0.110	4.412	0.171	1.612	6.312	0.245	1.722	4.799	0.186	19.095	1.562	0.061	27.286	12.672	0.491	48.103	
2031	22.6	1.900	0.084	0.084	4.412	0.195	1.402	6.312	0.279	1.486	4.799	0.212	17.097	1.562	0.069	25.662	12.672	0.561	44.245	
2032	19.7	1.900	0.096	0.110	4.412	0.224	1.612	6.312	0.320	1.722	4.799	0.244	19.095	1.562	0.079	27.286	12.672	0.643	48.103	
2033	17.2	1.900	0.110	0.110	4.412	0.256	1.612	6.312	0.367	1.722	4.799	0.279	19.095	1.562	0.091	27.286	12.672	0.737	48.103	
2034	15.1	1.900	0.126	0.110	4.412	0.292	1.612	6.312	0.418	1.722	4.799	0.318	19.095	1.562	0.103	27.286	12.672	0.839	48.103	
2035	13.2	1.900	0.144	0.110	4.412	0.334	1.612	6.312	0.478	1.722	4.799	0.364	19.095	1.562	0.118	27.286	12.672	0.960	48.103	
2036	8.3	1.095	0.132	0.064	2.568	0.309	0.946	3.663	0.441	1.010	2.834	0.341	11.257	0.926	0.112	16.209	7.423	0.894	28.476	
2037	7.3	1.095	0.150	0.064	2.568	0.352	0.946	3.663	0.502	1.010	2.834	0.388	11.257	0.926	0.127	16.209	7.423	1.017	28.476	
2038	6.5	1.095	0.168	0.064	2.568	0.395	0.946	3.663	0.564	1.010	2.834	0.436	11.257	0.926	0.142	16.209	7.423	1.142	28.476	

**Table 4.4A.3
Non Arctic Spill Occurrence Beaufort Sea Sale All Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep			1.504			0.251		
	Total								
2005	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep			1.504			0.251		
	Total								
2006	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep			1.504			0.251		
	Total								
2007	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep			1.504			0.251		
	Total								
2008	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep			1.504			0.251		
	Total								
2009	Shallow	1	3	1.504	0.451	0.07	0.251	0.075	0.46
	Medium			1.504			0.251		
	Deep			1.504			0.251		
	Total	1	3		0.451	0.07		0.075	0.46
2010	Shallow	1	13	1.504	1.955	0.31	0.251	0.326	2.00
	Medium			1.504			0.251		
	Deep			1.504			0.251		
	Total	1	13		1.955	0.31		0.326	2.00
2011	Shallow	2	26	1.504	3.909	0.62	0.251	0.652	3.99
	Medium			1.504			0.251		
	Deep			1.504			0.251		
	Total	2	26		3.909	0.62		0.652	3.99
2012	Shallow	3	39	1.504	5.864	0.93	0.251	0.977	5.99
	Medium			1.504			0.251		
	Deep			1.504			0.251		
	Total	3	39		5.864	0.93		0.977	5.99
2013	Shallow	3	59	1.504	8.871	1.40	0.251	1.479	9.06
	Medium			1.504			0.251		
	Deep			1.504			0.251		
	Total	3	59		8.871	1.40		1.479	9.06
2014	Shallow	3	69	1.504	10.375	1.64	0.251	1.729	10.60
	Medium	1	3	1.504	0.451	0.07	0.251	0.075	0.46
	Deep			1.504			0.251		
	Total	4	72		10.826	1.71		1.804	11.06
2015	Shallow	3	69	1.504	10.375	1.64	0.251	1.729	10.60
	Medium	1	13	1.504	1.955	0.31	0.251	0.326	2.00
	Deep			1.504			0.251		
	Total	4	82		12.329	1.95		2.055	12.60
2016	Shallow	3	69	1.504	10.375	1.64	0.251	1.729	10.60
	Medium	2	26	1.504	3.909	0.62	0.251	0.652	3.99
	Deep			1.504			0.251		
	Total	5	95		14.284	2.26		2.381	14.59
2017	Shallow	3	69	1.504	10.375	1.64	0.251	1.729	10.60
	Medium	3	39	1.504	5.864	0.93	0.251	0.977	5.99
	Deep			1.504			0.251		
	Total	6	108		16.239	2.57		2.706	16.59

**Table 4.4A.3
Non Arctic Spill Occurrence Beaufort Sea Sale All Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow	3	69	1.504	10.375	1.64	0.251	1.729	10.60
	Medium	4	63	1.504	9.473	1.50	0.251	1.579	9.68
	Deep			1.504			0.251		
	Total	7	132		19.847	3.14		3.308	20.28
2019	Shallow	3	69	1.504	10.375	1.64	0.251	1.729	10.60
	Medium	5	87	1.504	13.081	2.07	0.251	2.180	13.36
	Deep			1.504			0.251		
	Total	8	156		23.456	3.71		3.909	23.96
2020	Shallow	3	69	1.504	10.375	1.64	0.251	1.729	10.60
	Medium	5	107	1.504	16.088	2.54	0.251	2.681	16.44
	Deep			1.504			0.251		
	Total	8	176		26.463	4.18		4.411	27.04
2021	Shallow	3	69	1.504	10.375	1.64	0.251	1.729	10.60
	Medium	5	127	1.504	19.096	3.02	0.251	3.183	19.51
	Deep			1.504			0.251		
	Total	8	196		29.470	4.66		4.912	30.11
2022	Shallow	3	69	1.504	10.375	1.64	0.251	1.729	10.60
	Medium	5	137	1.504	20.599	3.25	0.251	3.433	21.05
	Deep			1.504			0.251		
	Total	8	206		30.974	4.89		5.162	31.64
2023	Shallow	3	69	1.504	10.375	1.64	0.251	1.729	10.60
	Medium	5	137	1.504	20.599	3.25	0.251	3.433	21.05
	Deep			1.504			0.251		
	Total	8	206		30.974	4.89		5.162	31.64
2024	Shallow	3	69	1.504	10.375	1.64	0.251	1.729	10.60
	Medium	5	137	1.504	20.599	3.25	0.251	3.433	21.05
	Deep			1.504			0.251		
	Total	8	206		30.974	4.89		5.162	31.64
2025	Shallow	2	46	1.504	6.916	1.09	0.251	1.153	7.07
	Medium	5	137	1.504	20.599	3.25	0.251	3.433	21.05
	Deep			1.504			0.251		
	Total	7	183		27.516	4.35		4.586	28.11
2026	Shallow	2	46	1.504	6.916	1.09	0.251	1.153	7.07
	Medium	5	137	1.504	20.599	3.25	0.251	3.433	21.05
	Deep			1.504			0.251		
	Total	7	183		27.516	4.35		4.586	28.11
2027	Shallow	1	23	1.504	3.458	0.55	0.251	0.576	3.53
	Medium	5	137	1.504	20.599	3.25	0.251	3.433	21.05
	Deep			1.504			0.251		
	Total	6	160		24.057	3.80		4.010	24.58
2028	Shallow			1.504			0.251		
	Medium	5	137	1.504	20.599	3.25	0.251	3.433	21.05
	Deep			1.504			0.251		
	Total	5	137		20.599	3.25		3.433	21.05
2029	Shallow			1.504			0.251		
	Medium	5	137	1.504	20.599	3.25	0.251	3.433	21.05
	Deep			1.504			0.251		
	Total	5	137		20.599	3.25		3.433	21.05
2030	Shallow			1.504			0.251		
	Medium	4	114	1.504	17.141	2.71	0.251	2.857	17.51
	Deep			1.504			0.251		
	Total	4	114		17.141	2.71		2.857	17.51
2031	Shallow			1.504			0.251		
	Medium	4	114	1.504	17.141	2.71	0.251	2.857	17.51
	Deep			1.504			0.251		
	Total	4	114		17.141	2.71		2.857	17.51

**Table 4.4A.3
Non Arctic Spill Occurrence Beaufort Sea Sale All Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		Average Spill [bbl] =			
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow			1.504			0.251		
	Medium	4	114	1.504	17.141	2.71	0.251	2.857	17.51
	Deep			1.504			0.251		
	Total	4	114		17.141	2.71		2.857	17.51
2033	Shallow			1.504			0.251		
	Medium	4	114	1.504	17.141	2.71	0.251	2.857	17.51
	Deep			1.504			0.251		
	Total	4	114		17.141	2.71		2.857	17.51
2034	Shallow			1.504			0.251		
	Medium	4	114	1.504	17.141	2.71	0.251	2.857	17.51
	Deep			1.504			0.251		
	Total	4	114		17.141	2.71		2.857	17.51
2035	Shallow			1.504			0.251		
	Medium	4	114	1.504	17.141	2.71	0.251	2.857	17.51
	Deep			1.504			0.251		
	Total	4	114		17.141	2.71		2.857	17.51
2036	Shallow			1.504			0.251		
	Medium	2	68	1.504	10.224	1.62	0.251	1.704	10.45
	Deep			1.504			0.251		
	Total	2	68		10.224	1.62		1.704	10.45
2037	Shallow			1.504			0.251		
	Medium	2	68	1.504	10.224	1.62	0.251	1.704	10.45
	Deep			1.504			0.251		
	Total	2	68		10.224	1.62		1.704	10.45
2038	Shallow			1.504			0.251		
	Medium	2	68	1.504	10.224	1.62	0.251	1.704	10.45
	Deep			1.504			0.251		
	Total	2	68		10.224	1.62		1.704	10.45

**Table 4.4A.4
Non Arctic Spill Occurrence Beaufort Sea Sale All Platforms Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]
2004										
2005										
2006										
2007										
2008										
2009		0.451		0.071	0.075		0.461	0.526		0.532
2010	10.9	1.955	0.179	0.309	0.326	0.030	1.997	2.280	0.209	2.306
2011	19.9	3.909	0.196	0.618	0.652	0.033	3.994	4.561	0.229	4.612
2012	30.8	5.864	0.190	0.927	0.977	0.032	5.991	6.841	0.222	6.918
2013	50.7	8.871	0.175	1.402	1.479	0.029	9.063	10.350	0.204	10.465
2014	56.2	10.826	0.193	1.710	1.804	0.032	11.060	12.630	0.225	12.771
2015	64.2	12.329	0.192	1.948	2.055	0.032	12.597	14.384	0.224	14.545
2016	67.4	14.284	0.212	2.257	2.381	0.035	14.594	16.665	0.247	16.850
2017	77.4	16.239	0.210	2.566	2.706	0.035	16.591	18.945	0.245	19.156
2018	82.9	19.847	0.239	3.136	3.308	0.040	20.277	23.155	0.279	23.413
2019	104.6	23.456	0.224	3.706	3.909	0.037	23.964	27.365	0.262	27.670
2020	104.8	26.463	0.253	4.181	4.411	0.042	27.036	30.874	0.295	31.218
2021	98.6	29.470	0.299	4.656	4.912	0.050	30.109	34.382	0.349	34.765
2022	89.2	30.974	0.347	4.894	5.162	0.058	31.645	36.136	0.405	36.539
2023	81.4	30.974	0.381	4.894	5.162	0.063	31.645	36.136	0.444	36.539
2024	74.8	30.974	0.414	4.894	5.162	0.069	31.645	36.136	0.483	36.539
2025	62.5	27.516	0.440	4.347	4.586	0.073	28.112	32.102	0.514	32.459
2026	54.1	27.516	0.509	4.347	4.586	0.085	28.112	32.102	0.593	32.459
2027	44.6	24.057	0.539	3.801	4.010	0.090	24.579	28.067	0.629	28.380
2028	36.9	20.599	0.558	3.255	3.433	0.093	21.045	24.032	0.651	24.300
2029	32.2	20.599	0.640	3.255	3.433	0.107	21.045	24.032	0.746	24.300
2030	25.8	17.141	0.664	2.708	2.857	0.111	17.512	19.998	0.775	20.220
2031	22.6	17.141	0.758	2.708	2.857	0.126	17.512	19.998	0.885	20.220
2032	19.7	17.141	0.870	2.708	2.857	0.145	17.512	19.998	1.015	20.220
2033	17.2	17.141	0.997	2.708	2.857	0.166	17.512	19.998	1.163	20.220
2034	15.1	17.141	1.135	2.708	2.857	0.189	17.512	19.998	1.324	20.220
2035	13.2	17.141	1.299	2.708	2.857	0.216	17.512	19.998	1.515	20.220
2036	8.3	10.224	1.232	1.615	1.704	0.205	10.446	11.928	1.437	12.061
2037	7.3	10.224	1.401	1.615	1.704	0.233	10.446	11.928	1.634	12.061
2038	6.5	10.224	1.573	1.615	1.704	0.262	10.446	11.928	1.835	12.061

**Table 4.4A.5
Non Arctic Spill Occurrence Beaufort Sea Sale All Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2009	Shallow	3	0.500	0.015	0.01	3.500	0.105	0.47	1.500	0.045	0.90	1.000	0.030	6.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	3		0.015	0.01		0.105	0.47		0.045	0.90		0.030	6.00
2010	Shallow	13	0.500	0.065	0.03	3.500	0.455	2.05	1.500	0.195	3.90	1.000	0.130	26.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	13		0.065	0.03		0.455	2.05		0.195	3.90		0.130	26.00
2011	Shallow	26	0.500	0.130	0.07	3.500	0.910	4.10	1.500	0.390	7.80	1.000	0.260	52.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	26		0.130	0.07		0.910	4.10		0.390	7.80		0.260	52.00
2012	Shallow	39	0.500	0.195	0.10	3.500	1.365	6.14	1.500	0.585	11.70	1.000	0.390	78.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	39		0.195	0.10		1.365	6.14		0.585	11.70		0.390	78.00
2013	Shallow	59	0.500	0.295	0.15	3.500	2.065	9.29	1.500	0.885	17.70	1.000	0.590	118.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	59		0.295	0.15		2.065	9.29		0.885	17.70		0.590	118.00
2014	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	3	0.500	0.015	0.01	3.500	0.105	0.47	1.500	0.045	0.90	1.000	0.030	6.00
	Deep		0.500			3.500			1.500			1.000		
	Total	72		0.360	0.18		2.520	11.34		1.080	21.60		0.720	144.00
2015	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	13	0.500	0.065	0.03	3.500	0.455	2.05	1.500	0.195	3.90	1.000	0.130	26.00
	Deep		0.500			3.500			1.500			1.000		
	Total	82		0.410	0.21		2.870	12.92		1.230	24.60		0.820	164.00
2016	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	26	0.500	0.130	0.07	3.500	0.910	4.10	1.500	0.390	7.80	1.000	0.260	52.00
	Deep		0.500			3.500			1.500			1.000		
	Total	95		0.475	0.24		3.325	14.96		1.425	28.50		0.950	190.00
2017	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	39	0.500	0.195	0.10	3.500	1.365	6.14	1.500	0.585	11.70	1.000	0.390	78.00
	Deep		0.500			3.500			1.500			1.000		
	Total	108		0.540	0.27		3.780	17.01		1.620	32.40		1.080	216.00

**Table 4.4A.5
Non Arctic Spill Occurrence Beaufort Sea Sale All Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	63	0.500	0.315	0.16	3.500	2.205	9.92	1.500	0.945	18.90	1.000	0.630	126.00
	Deep		0.500			3.500			1.500			1.000		
	Total	132		0.660	0.33		4.620	20.79		1.980	39.60		1.320	264.00
2019	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	87	0.500	0.435	0.22	3.500	3.045	13.70	1.500	1.305	26.10	1.000	0.870	174.00
	Deep		0.500			3.500			1.500			1.000		
	Total	156		0.780	0.39		5.460	24.57		2.340	46.80		1.560	312.00
2020	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	107	0.500	0.535	0.27	3.500	3.745	16.85	1.500	1.605	32.10	1.000	1.070	214.00
	Deep		0.500			3.500			1.500			1.000		
	Total	176		0.880	0.44		6.160	27.72		2.640	52.80		1.760	352.00
2021	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	127	0.500	0.635	0.32	3.500	4.445	20.00	1.500	1.905	38.10	1.000	1.270	254.00
	Deep		0.500			3.500			1.500			1.000		
	Total	196		0.980	0.49		6.860	30.87		2.940	58.80		1.960	392.00
2022	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	206		1.030	0.52		7.210	32.45		3.090	61.80		2.060	412.00
2023	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	206		1.030	0.52		7.210	32.45		3.090	61.80		2.060	412.00
2024	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	206		1.030	0.52		7.210	32.45		3.090	61.80		2.060	412.00
2025	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	183		0.915	0.46		6.405	28.82		2.745	54.90		1.830	366.00
2026	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	183		0.915	0.46		6.405	28.82		2.745	54.90		1.830	366.00
2027	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	160		0.800	0.40		5.600	25.20		2.400	48.00		1.600	320.00
2028	Shallow		0.500			3.500			1.500			1.000		
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	137		0.685	0.34		4.795	21.58		2.055	41.10		1.370	274.00
2029	Shallow		0.500			3.500			1.500			1.000		
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	137		0.685	0.34		4.795	21.58		2.055	41.10		1.370	274.00
2030	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00
2031	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00

**Table 4.4A.5
Non Arctic Spill Occurrence Beaufort Sea Sale All Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00
2033	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00
2034	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00
2035	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00
2036	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2037	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2038	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00

Table 4.4A.6

Non Arctic Spill Occurrence Beaufort Sea Sale All Production Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009		0.015		0.008	0.045		0.473	0.075		6.900	0.135		7.380
2010	10.9	0.065	0.006	0.033	0.195	0.018	2.048	0.325	0.030	29.900	0.585	0.054	31.980
2011	19.9	0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
2012	30.8	0.195	0.006	0.098	0.585	0.019	6.143	0.975	0.032	89.700	1.755	0.057	95.940
2013	50.7	0.295	0.006	0.148	0.885	0.017	9.293	1.475	0.029	135.700	2.655	0.052	145.140
2014	56.2	0.360	0.006	0.180	1.080	0.019	11.340	1.800	0.032	165.600	3.240	0.058	177.120
2015	64.2	0.410	0.006	0.205	1.230	0.019	12.915	2.050	0.032	188.600	3.690	0.057	201.720
2016	67.4	0.475	0.007	0.238	1.425	0.021	14.963	2.375	0.035	218.500	4.275	0.063	233.700
2017	77.4	0.540	0.007	0.270	1.620	0.021	17.010	2.700	0.035	248.400	4.860	0.063	265.680
2018	82.9	0.660	0.008	0.330	1.980	0.024	20.790	3.300	0.040	303.600	5.940	0.072	324.720
2019	104.6	0.780	0.007	0.390	2.340	0.022	24.570	3.900	0.037	358.800	7.020	0.067	383.760
2020	104.8	0.880	0.008	0.440	2.640	0.025	27.720	4.400	0.042	404.800	7.920	0.076	432.960
2021	98.6	0.980	0.010	0.490	2.940	0.030	30.870	4.900	0.050	450.800	8.820	0.089	482.160
2022	89.2	1.030	0.012	0.515	3.090	0.035	32.445	5.150	0.058	473.800	9.270	0.104	506.760
2023	81.4	1.030	0.013	0.515	3.090	0.038	32.445	5.150	0.063	473.800	9.270	0.114	506.760
2024	74.8	1.030	0.014	0.515	3.090	0.041	32.445	5.150	0.069	473.800	9.270	0.124	506.760
2025	62.5	0.915	0.015	0.458	2.745	0.044	28.823	4.575	0.073	420.900	8.235	0.132	450.180
2026	54.1	0.915	0.017	0.458	2.745	0.051	28.823	4.575	0.085	420.900	8.235	0.152	450.180
2027	44.6	0.800	0.018	0.400	2.400	0.054	25.200	4.000	0.090	368.000	7.200	0.161	393.600
2028	36.9	0.685	0.019	0.343	2.055	0.056	21.578	3.425	0.093	315.100	6.165	0.167	337.020
2029	32.2	0.685	0.021	0.343	2.055	0.064	21.578	3.425	0.106	315.100	6.165	0.191	337.020
2030	25.8	0.570	0.022	0.285	1.710	0.066	17.955	2.850	0.110	262.200	5.130	0.199	280.440
2031	22.6	0.570	0.025	0.285	1.710	0.076	17.955	2.850	0.126	262.200	5.130	0.227	280.440
2032	19.7	0.570	0.029	0.285	1.710	0.087	17.955	2.850	0.145	262.200	5.130	0.260	280.440
2033	17.2	0.570	0.033	0.285	1.710	0.099	17.955	2.850	0.166	262.200	5.130	0.298	280.440
2034	15.1	0.570	0.038	0.285	1.710	0.113	17.955	2.850	0.189	262.200	5.130	0.340	280.440
2035	13.2	0.570	0.043	0.285	1.710	0.130	17.955	2.850	0.216	262.200	5.130	0.389	280.440
2036	8.3	0.340	0.041	0.170	1.020	0.123	10.710	1.700	0.205	156.400	3.060	0.369	167.280
2037	7.3	0.340	0.047	0.170	1.020	0.140	10.710	1.700	0.233	156.400	3.060	0.419	167.280
2038	6.5	0.340	0.052	0.170	1.020	0.157	10.710	1.700	0.262	156.400	3.060	0.471	167.280

**Table 4.4A.7
Non Arctic Spill Occurrence Beaufort Sea Sale All Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2005	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2006	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2007	Shallow	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2008	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2010	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2011	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2012	Shallow		3.160			22.110			9.500			5.500		
	Medium	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	3		0.095	0.05		0.663	2.98		0.285	5.70		0.165	33.00
2013	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2014	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2015	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2016	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2017	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00

**Table 4.4A.7
Non Arctic Spill Occurrence Beaufort Sea Sale All Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2019	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2020	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2021	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2022	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2023	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2024	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2025	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2026	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2027	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2028	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2029	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2030	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2031	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

**Table 4.4A.7
Non Arctic Spill Occurrence Beaufort Sea Sale All Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2033	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2034	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2035	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2036	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2037	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2038	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.4A.8

Non Arctic Spill Occurrence Beaufort Sea Sale All Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]
2004		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2005		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2006		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2007		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2008		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2009		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2010	10.9	0.063	0.006	0.032	0.190	0.017	1.990	0.300	0.028	25.800	0.553	0.051	27.822
2011	19.9												
2012	30.8	0.095	0.003	0.047	0.285	0.009	2.985	0.450	0.015	38.700	0.830	0.027	41.732
2013	50.7	0.063	0.001	0.032	0.190	0.004	1.990	0.300	0.006	25.800	0.553	0.011	27.822
2014	56.2												
2015	64.2	0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.004	13.911
2016	67.4												
2017	77.4	0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.004	13.911
2018	82.9	0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.003	13.911
2019	104.6												
2020	104.8												
2021	98.6												
2022	89.2												
2023	81.4												
2024	74.8												
2025	62.5												
2026	54.1												
2027	44.6												
2028	36.9												
2029	32.2												
2030	25.8												
2031	22.6												
2032	19.7												
2033	17.2												
2034	15.1												
2035	13.2												
2036	8.3												
2037	7.3												
2038	6.5												

**Table 4.4A.9
Non Arctic Spill Occurrence Beaufort Sea Sale All Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2009	Shallow	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2011	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2012	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2013	Shallow		1.300			9.080			3.900			3.900		
	Medium	3	1.300	0.039	0.02	9.080	0.272	1.23	3.900	0.117	2.34	3.900	0.117	23.40
	Deep		1.300			9.080			3.900			3.900		
	Total	3		0.039	0.02		0.272	1.23		0.117	2.34		0.117	23.40
2014	Shallow		1.300			9.080			3.900			3.900		
	Medium	4	1.300	0.052	0.03	9.080	0.363	1.63	3.900	0.156	3.12	3.900	0.156	31.20
	Deep		1.300			9.080			3.900			3.900		
	Total	4		0.052	0.03		0.363	1.63		0.156	3.12		0.156	31.20
2015	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2016	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2017	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.4A.9
Non Arctic Spill Occurrence Beaufort Sea Sale All Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] = 500		Spill Index bbl	Average Spill [bbl] = 4500		Spill Index bbl	Average Spill [bbl] = 20000		Spill Index bbl	Average Spill [bbl] = 200000		Spill Index bbl
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2019	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2020	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2021	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2022	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2023	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2024	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2025	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2026	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2027	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2028	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2029	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2030	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2031	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.4A.9
Non Arctic Spill Occurrence Beaufort Sea Sale All Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2033	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2034	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2035	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2036	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2037	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2038	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.4A.10

Non Arctic Spill Occurrence Beaufort Sea Sale All Development Wells

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004													
2005													
2006		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2007													
2008		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2009		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2010	10.9	0.026	0.002	0.013	0.078	0.007	0.817	0.156	0.014	17.160	0.260	0.024	17.990
2011	19.9												
2012	30.8												
2013	50.7	0.039	0.001	0.020	0.117	0.002	1.226	0.234	0.005	25.740	0.390	0.008	26.985
2014	56.2	0.052	0.001	0.026	0.156	0.003	1.634	0.312	0.006	34.320	0.520	0.009	35.980
2015	64.2	0.026	0.000	0.013	0.078	0.001	0.817	0.156	0.002	17.160	0.260	0.004	17.990
2016	67.4												
2017	77.4												
2018	82.9												
2019	104.6												
2020	104.8												
2021	98.6												
2022	89.2												
2023	81.4												
2024	74.8												
2025	62.5												
2026	54.1												
2027	44.6												
2028	36.9												
2029	32.2												
2030	25.8												
2031	22.6												
2032	19.7												
2033	17.2												
2034	15.1												
2035	13.2												
2036	8.3												
2037	7.3												
2038	6.5												

**Table 4.4A.11
Non Artic Spill Occurrence Beaufort Sea Sale All Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
	Total		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2005	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
	Total		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2006	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
	Total		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901
2007	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
	Development Wells													
	Total		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2008	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
	Total		0.089		0.045	0.268		2.807	0.456		42.960	0.813		45.812
2009	Pipeline													
	Platforms		0.451		0.071	0.075		0.461			0.526		0.532	
	Production Wells		0.015		0.008	0.045		0.473	0.075		6.900	0.135		7.380
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
	Total		0.524		0.108	0.293		2.745	0.381		36.960	1.198		39.813
2010	Pipeline	10.9	1.015	0.093	0.297	0.870	0.080	3.419	0.290	0.027	5.132	2.174	0.199	8.849
	Platforms		1.955	0.179	0.309	0.326	0.030	1.997				2.280	0.209	2.306
	Production Wells		0.065	0.006	0.033	0.195	0.018	2.048	0.325	0.030	29.900	0.585	0.054	31.980
	Exploration Wells		0.063	0.006	0.032	0.190	0.017	1.990	0.300	0.028	25.800	0.553	0.051	27.822
	Development Wells		0.026	0.002	0.013	0.078	0.007	0.817	0.156	0.014	17.160	0.260	0.024	17.990
	Total		3.123	0.287	0.683	1.658	0.152	10.271	1.071	0.098	77.992	5.853	0.537	88.947
2011	Pipeline	19.9	1.015	0.051	0.297	0.870	0.044	3.419	0.290	0.015	5.132	2.174	0.109	8.849
	Platforms		3.909	0.196	0.618	0.652	0.033	3.994				4.561	0.229	4.612
	Production Wells		0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
	Exploration Wells													
	Development Wells													
	Total		5.054	0.254	0.980	1.911	0.096	11.508	0.940	0.047	64.932	7.905	0.397	77.421
2012	Pipeline	30.8	2.029	0.066	0.595	1.739	0.056	6.839	0.580	0.019	10.265	4.348	0.141	17.698
	Platforms		5.864	0.190	0.927	0.977	0.032	5.991				6.841	0.222	6.918
	Production Wells		0.195	0.006	0.098	0.585	0.019	6.143	0.975	0.032	89.700	1.755	0.057	95.940
	Exploration Wells		0.095	0.003	0.047	0.285	0.009	2.985	0.450	0.015	38.700	0.830	0.027	41.732
	Development Wells													
	Total		8.183	0.266	1.666	3.587	0.116	21.957	2.005	0.065	138.665	13.774	0.447	162.288
2013	Pipeline	50.7	3.551	0.070	1.040	3.044	0.060	11.968	1.015	0.020	17.963	7.609	0.150	30.972
	Platforms		8.871	0.175	1.402	1.479	0.029	9.063				10.350	0.204	10.465
	Production Wells		0.295	0.006	0.148	0.885	0.017	9.293	1.475	0.029	135.700	2.655	0.052	145.140
	Exploration Wells		0.063	0.001	0.032	0.190	0.004	1.990	0.300	0.006	25.800	0.553	0.011	27.822
	Development Wells		0.039	0.001	0.020	0.117	0.002	1.226	0.234	0.005	25.740	0.390	0.008	26.985
	Total		12.819	0.253	2.641	5.714	0.113	33.540	3.024	0.060	205.203	21.557	0.425	241.384

**Table 4.4A.11
Non Artic Spill Occurrence Beaufort Sea Sale All Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills			
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	
2014	Pipeline	56.2	3.551	0.063	1.040	3.044	0.054	11.968	1.015	0.018	17.963	7.609	0.135	30.972	
	Platforms		10.826	0.193	1.710	1.804	0.032	11.060				12.630	0.225	12.771	
	Production Wells		0.360	0.006	0.180	1.080	0.019	11.340	1.800	0.032	165.600	3.240	0.058	177.120	
	Exploration Wells														
	Development Wells		0.052	0.001	0.026	0.156	0.003	1.634	0.312	0.006	34.320	0.520	0.009	35.980	
	Total		14.789	0.263	2.957	6.084	0.108	36.003	3.127	0.056	217.883	24.000	0.427	256.843	
2015	Pipeline	64.2	5.580	0.087	1.635	4.783	0.075	18.807	1.594	0.025	28.228	11.958	0.186	48.670	
	Platforms		12.329	0.192	1.948	2.055	0.032	12.597				14.384	0.224	14.545	
	Production Wells		0.410	0.006	0.205	1.230	0.019	12.915	2.050	0.032	188.600	3.690	0.057	201.720	
	Exploration Wells		0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.004	13.911	
	Development Wells		0.026	0.000	0.013	0.078	0.001	0.817	0.156	0.002	17.160	0.260	0.004	17.990	
	Total		18.377	0.286	3.817	8.241	0.128	46.131	3.950	0.062	246.888	30.569	0.476	296.835	
2016	Pipeline	67.4	5.580	0.083	1.635	4.783	0.071	18.807	1.594	0.024	28.228	11.958	0.177	48.670	
	Platforms		14.284	0.212	2.257	2.381	0.035	14.594				16.665	0.247	16.850	
	Production Wells		0.475	0.007	0.238	1.425	0.021	14.963	2.375	0.035	218.500	4.275	0.063	233.700	
	Exploration Wells														
	Development Wells														
	Total		20.339	0.302	4.129	8.589	0.127	48.363	3.969	0.059	246.728	32.897	0.488	299.220	
2017	Pipeline	77.4	8.229	0.106	2.347	6.748	0.087	26.645	2.230	0.029	39.305	17.207	0.222	68.297	
	Platforms		16.239	0.210	2.566	2.706	0.035	16.591				18.945	0.245	19.156	
	Production Wells		0.540	0.007	0.270	1.620	0.021	17.010	2.700	0.035	248.400	4.860	0.063	265.680	
	Exploration Wells		0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.004	13.911	
	Development Wells														
	Total		25.039	0.324	5.199	11.169	0.144	61.240	5.080	0.066	300.605	41.288	0.533	367.044	
2018	Pipeline	82.9	8.229	0.099	2.347	6.748	0.081	26.645	2.230	0.027	39.305	17.207	0.208	68.297	
	Platforms		19.847	0.239	3.136	3.308	0.040	20.277				23.155	0.279	23.413	
	Production Wells		0.660	0.008	0.330	1.980	0.024	20.790	3.300	0.040	303.600	5.940	0.072	324.720	
	Exploration Wells		0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.003	13.911	
	Development Wells														
	Total		28.768	0.347	5.829	12.130	0.146	68.707	5.680	0.069	355.805	46.578	0.562	430.341	
2019	Pipeline	104.6	11.892	0.114	3.357	9.582	0.092	37.902	3.156	0.030	55.514	24.630	0.235	96.773	
	Platforms		23.456	0.224	3.706	3.909	0.037	23.964				27.365	0.262	27.670	
	Production Wells		0.780	0.007	0.390	2.340	0.022	24.570	3.900	0.037	358.800	7.020	0.067	383.760	
	Exploration Wells														
	Development Wells														
	Total		36.128	0.345	7.453	15.831	0.151	86.436	7.056	0.067	414.314	59.015	0.564	508.203	
2020	Pipeline	104.8	11.892	0.113	3.357	9.582	0.091	37.902	3.156	0.030	55.514	24.630	0.235	96.773	
	Platforms		26.463	0.253	4.181	4.411	0.042	27.036				30.874	0.295	31.218	
	Production Wells		0.880	0.008	0.440	2.640	0.025	27.720	4.400	0.042	404.800	7.920	0.076	432.960	
	Exploration Wells														
	Development Wells														
	Total		39.235	0.374	7.978	16.632	0.159	92.659	7.556	0.072	460.314	63.423	0.605	560.951	
2021	Pipeline	98.6	11.892	0.121	3.357	9.582	0.097	37.902	3.156	0.032	55.514	24.630	0.250	96.773	
	Platforms		29.470	0.299	4.656	4.912	0.050	30.109				34.382	0.349	34.765	
	Production Wells		0.980	0.010	0.490	2.940	0.030	30.870	4.900	0.050	450.800	8.820	0.089	482.160	
	Exploration Wells														
	Development Wells														
	Total		42.342	0.429	8.503	17.433	0.177	98.881	8.056	0.082	506.314	67.832	0.688	613.698	
2022	Pipeline	89.2	11.892	0.133	3.357	9.582	0.107	37.902	3.156	0.035	55.514	24.630	0.276	96.773	
	Platforms		30.974	0.347	4.894	5.162	0.058	31.645				36.136	0.405	36.539	
	Production Wells		1.030	0.012	0.515	3.090	0.035	32.445	5.150	0.058	473.800	9.270	0.104	506.760	
	Exploration Wells														
	Development Wells														
	Total		43.896	0.492	8.766	17.834	0.200	101.992	8.306	0.093	529.314	70.036	0.785	640.072	
2023	Pipeline	81.4	11.892	0.146	3.357	9.582	0.118	37.902	3.156	0.039	55.514	24.630	0.303	96.773	
	Platforms		30.974	0.381	4.894	5.162	0.063	31.645				36.136	0.444	36.539	
	Production Wells		1.030	0.013	0.515	3.090	0.038	32.445	5.150	0.063	473.800	9.270	0.114	506.760	
	Exploration Wells														
	Development Wells														
	Total		43.896	0.539	8.766	17.834	0.219	101.992	8.306	0.102	529.314	70.036	0.860	640.072	

**Table 4.4A.11
Non Artic Spill Occurrence Beaufort Sea Sale All Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2024	Pipeline	74.8	11.892	0.159	3.357	9.582	0.128	37.902	3.156	0.042	55.514	24.630	0.329	96.773
	Platforms		30.974	0.414	4.894	5.162	0.069	31.645				36.136	0.483	36.539
	Production Wells		1.030	0.014	0.515	3.090	0.041	32.445	5.150	0.069	473.800	9.270	0.124	506.760
	Exploration Wells													
	Development Wells													
Total			43.896	0.587	8.766	17.834	0.238	101.992	8.306	0.111	529.314	70.036	0.936	640.072
2025	Pipeline	62.5	10.877	0.174	3.060	8.712	0.139	34.483	2.866	0.046	50.381	22.456	0.359	87.924
	Platforms		27.516	0.440	4.347	4.586	0.073	28.112				32.102	0.514	32.459
	Production Wells		0.915	0.015	0.458	2.745	0.044	28.823	4.575	0.073	420.900	8.235	0.132	450.180
	Exploration Wells													
	Development Wells													
Total			39.308	0.629	7.865	16.043	0.257	91.417	7.441	0.119	471.281	62.792	1.005	570.563
2026	Pipeline	54.1	10.877	0.201	3.060	8.712	0.161	34.483	2.866	0.053	50.381	22.456	0.415	87.924
	Platforms		27.516	0.509	4.347	4.586	0.085	28.112				32.102	0.593	32.459
	Production Wells		0.915	0.017	0.458	2.745	0.051	28.823	4.575	0.085	420.900	8.235	0.152	450.180
	Exploration Wells													
	Development Wells													
Total			39.308	0.727	7.865	16.043	0.297	91.417	7.441	0.138	471.281	62.792	1.161	570.563
2027	Pipeline	44.6	9.863	0.221	2.763	7.842	0.176	31.063	2.577	0.058	45.249	20.282	0.455	79.075
	Platforms		24.057	0.539	3.801	4.010	0.090	24.579				28.067	0.629	28.380
	Production Wells		0.800	0.018	0.400	2.400	0.054	25.200	4.000	0.090	368.000	7.200	0.161	393.600
	Exploration Wells													
	Development Wells													
Total			34.720	0.778	6.964	14.252	0.320	80.842	6.577	0.147	413.249	55.549	1.245	501.055
2028	Pipeline	36.9	8.341	0.226	2.317	6.538	0.177	25.934	2.142	0.058	37.551	17.020	0.461	65.801
	Platforms		20.599	0.558	3.255	3.433	0.093	21.045				24.032	0.651	24.300
	Production Wells		0.685	0.019	0.343	2.055	0.056	21.578	3.425	0.093	315.100	6.165	0.167	337.020
	Exploration Wells													
	Development Wells													
Total			29.625	0.803	5.914	12.026	0.326	68.557	5.567	0.151	352.651	47.218	1.280	427.122
2029	Pipeline	32.2	8.341	0.259	2.317	6.538	0.203	25.934	2.142	0.067	37.551	17.020	0.529	65.801
	Platforms		20.599	0.640	3.255	3.433	0.107	21.045				24.032	0.746	24.300
	Production Wells		0.685	0.021	0.343	2.055	0.064	21.578	3.425	0.106	315.100	6.165	0.191	337.020
	Exploration Wells													
	Development Wells													
Total			29.625	0.920	5.914	12.026	0.373	68.557	5.567	0.173	352.651	47.218	1.466	427.122
2030	Pipeline	25.8	6.312	0.245	1.722	4.799	0.186	19.095	1.562	0.061	27.286	12.672	0.491	48.103
	Platforms		17.141	0.664	2.708	2.857	0.111	17.512				19.998	0.775	20.220
	Production Wells		0.570	0.022	0.285	1.710	0.066	17.955	2.850	0.110	262.200	5.130	0.199	280.440
	Exploration Wells													
	Development Wells													
Total			24.022	0.931	4.715	9.365	0.363	54.562	4.412	0.171	289.486	37.800	1.465	348.764
2031	Pipeline	22.6	6.312	0.279	1.486	4.799	0.212	17.097	1.562	0.069	25.662	12.672	0.561	44.245
	Platforms		17.141	0.758	2.708	2.857	0.126	17.512				19.998	0.885	20.220
	Production Wells		0.570	0.025	0.285	1.710	0.076	17.955	2.850	0.126	262.200	5.130	0.227	280.440
	Exploration Wells													
	Development Wells													
Total			24.022	1.063	4.480	9.365	0.414	52.564	4.412	0.195	287.862	37.800	1.673	344.906
2032	Pipeline	19.7	6.312	0.320	1.722	4.799	0.244	19.095	1.562	0.079	27.286	12.672	0.643	48.103
	Platforms		17.141	0.870	2.708	2.857	0.145	17.512				19.998	1.015	20.220
	Production Wells		0.570	0.029	0.285	1.710	0.087	17.955	2.850	0.145	262.200	5.130	0.260	280.440
	Exploration Wells													
	Development Wells													
Total			24.022	1.219	4.715	9.365	0.475	54.562	4.412	0.224	289.486	37.800	1.919	348.764
2033	Pipeline	17.2	6.312	0.367	1.722	4.799	0.279	19.095	1.562	0.091	27.286	12.672	0.737	48.103
	Platforms		17.141	0.997	2.708	2.857	0.166	17.512				19.998	1.163	20.220
	Production Wells		0.570	0.033	0.285	1.710	0.099	17.955	2.850	0.166	262.200	5.130	0.298	280.440
	Exploration Wells													
	Development Wells													
Total			24.022	1.397	4.715	9.365	0.545	54.562	4.412	0.257	289.486	37.800	2.198	348.764

**Table 4.4A.11
Non Artic Spill Occurrence Beaufort Sea Sale All Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2034	Pipeline	15.1	6.312	0.418	1.722	4.799	0.318	19.095	1.562	0.103	27.286	12.672	0.839	48.103
	Platforms		17.141	1.135	2.708	2.857	0.189	17.512				19.998	1.324	20.220
	Production Wells		0.570	0.038	0.285	1.710	0.113	17.955	2.850	0.189	262.200	5.130	0.340	280.440
	Exploration Wells													
	Development Wells													
	Total		24.022	1.591	4.715	9.365	0.620	54.562	4.412	0.292	289.486	37.800	2.503	348.764
2035	Pipeline	13.2	6.312	0.478	1.722	4.799	0.364	19.095	1.562	0.118	27.286	12.672	0.960	48.103
	Platforms		17.141	1.299	2.708	2.857	0.216	17.512				19.998	1.515	20.220
	Production Wells		0.570	0.043	0.285	1.710	0.130	17.955	2.850	0.216	262.200	5.130	0.389	280.440
	Exploration Wells													
	Development Wells													
	Total		24.022	1.820	4.715	9.365	0.710	54.562	4.412	0.334	289.486	37.800	2.864	348.764
2036	Pipeline	8.3	3.663	0.441	1.010	2.834	0.341	11.257	0.926	0.112	16.209	7.423	0.894	28.476
	Platforms		10.224	1.232	1.615	1.704	0.205	10.446				11.928	1.437	12.061
	Production Wells		0.340	0.041	0.170	1.020	0.123	10.710	1.700	0.205	156.400	3.060	0.369	167.280
	Exploration Wells													
	Development Wells													
	Total		14.227	1.714	2.795	5.558	0.670	32.413	2.626	0.316	172.609	22.412	2.700	207.818
2037	Pipeline	7.3	3.663	0.502	1.010	2.834	0.388	11.257	0.926	0.127	16.209	7.423	1.017	28.476
	Platforms		10.224	1.401	1.615	1.704	0.233	10.446				11.928	1.634	12.061
	Production Wells		0.340	0.047	0.170	1.020	0.140	10.710	1.700	0.233	156.400	3.060	0.419	167.280
	Exploration Wells													
	Development Wells													
	Total		14.227	1.949	2.795	5.558	0.761	32.413	2.626	0.360	172.609	22.412	3.070	207.818
2038	Pipeline	6.5	3.663	0.564	1.010	2.834	0.436	11.257	0.926	0.142	16.209	7.423	1.142	28.476
	Platforms		10.224	1.573	1.615	1.704	0.262	10.446				11.928	1.835	12.061
	Production Wells		0.340	0.052	0.170	1.020	0.157	10.710	1.700	0.262	156.400	3.060	0.471	167.280
	Exploration Wells													
	Development Wells													
	Total		14.227	2.189	2.795	5.558	0.855	32.413	2.626	0.404	172.609	22.412	3.448	207.818

Table 4.4A.12

Non Arctic Spill Occurrence Beaufort Sea Sale All Annual Summary

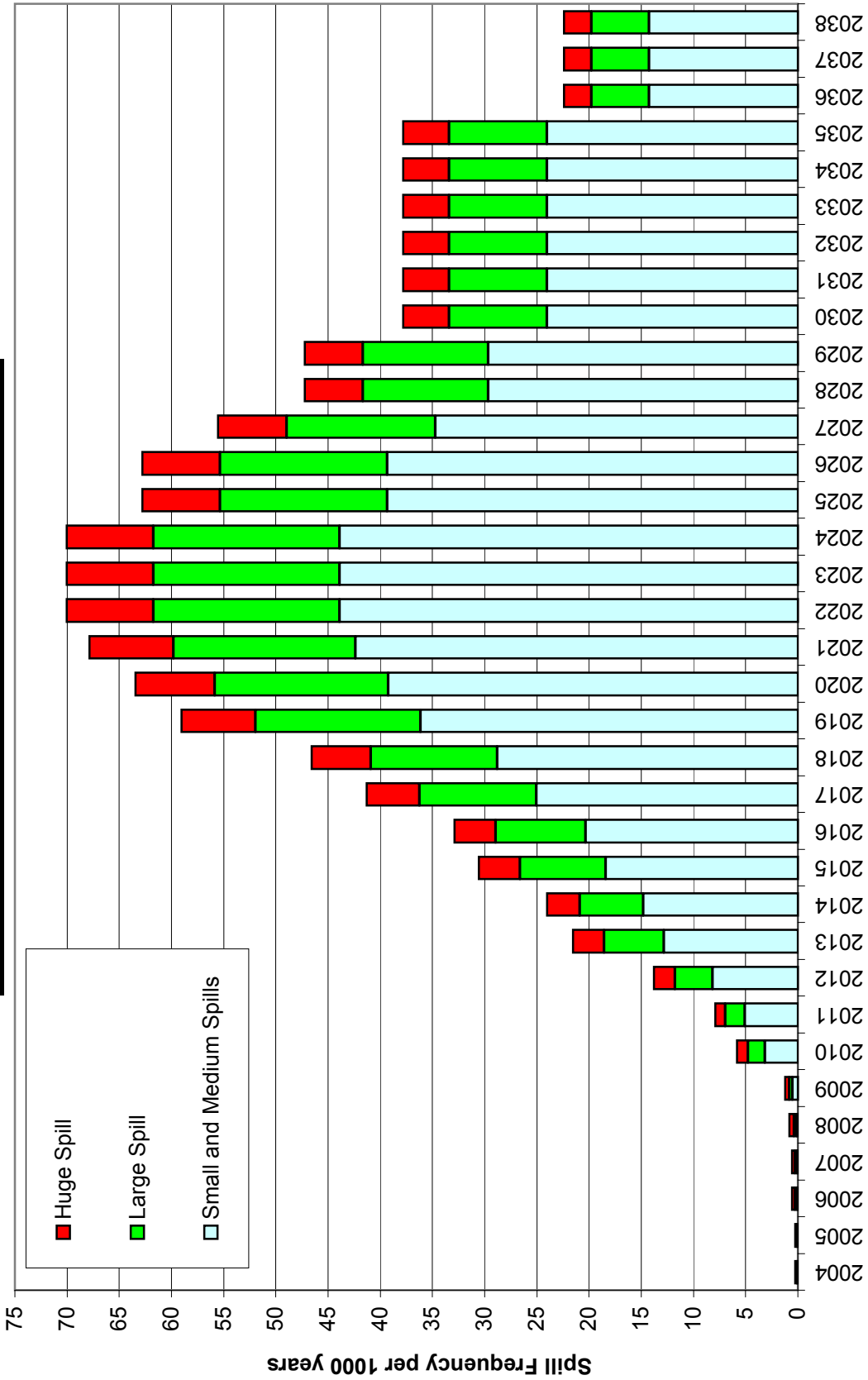
Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2005		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2006		0.06		0.029	0.17		1.812	0.306		30.06	0.537		31.901
2007		0.06		0.032	0.19		1.990	0.300		25.80	0.553		27.822
2008		0.09		0.045	0.27		2.807	0.456		42.96	0.813		45.812
2009		0.52		0.108	0.29		2.745	0.381		36.96	1.198		39.813
2010	10.9	3.12	0.287	0.683	1.66	0.152	10.271	1.071	0.098	77.99	5.853	0.537	88.947
2011	19.9	5.05	0.254	0.980	1.91	0.096	11.508	0.940	0.047	64.93	7.905	0.397	77.421
2012	30.8	8.18	0.266	1.666	3.59	0.116	21.957	2.005	0.065	138.66	13.774	0.447	162.288
2013	50.7	12.82	0.253	2.641	5.71	0.113	33.540	3.024	0.060	205.20	21.557	0.425	241.384
2014	56.2	14.79	0.263	2.957	6.08	0.108	36.003	3.127	0.056	217.88	24.000	0.427	256.843
2015	64.2	18.38	0.286	3.817	8.24	0.128	46.131	3.950	0.062	246.89	30.569	0.476	296.835
2016	67.4	20.34	0.302	4.129	8.59	0.127	48.363	3.969	0.059	246.73	32.897	0.488	299.220
2017	77.4	25.04	0.324	5.199	11.17	0.144	61.240	5.080	0.066	300.60	41.288	0.533	367.044
2018	82.9	28.77	0.347	5.829	12.13	0.146	68.707	5.680	0.069	355.80	46.578	0.562	430.341
2019	104.6	36.13	0.345	7.453	15.83	0.151	86.436	7.056	0.067	414.31	59.015	0.564	508.203
2020	104.8	39.23	0.374	7.978	16.63	0.159	92.659	7.556	0.072	460.31	63.423	0.605	560.951
2021	98.6	42.34	0.429	8.503	17.43	0.177	98.881	8.056	0.082	506.31	67.832	0.688	613.698
2022	89.2	43.90	0.492	8.766	17.83	0.200	101.992	8.306	0.093	529.31	70.036	0.785	640.072
2023	81.4	43.90	0.539	8.766	17.83	0.219	101.992	8.306	0.102	529.31	70.036	0.860	640.072
2024	74.8	43.90	0.587	8.766	17.83	0.238	101.992	8.306	0.111	529.31	70.036	0.936	640.072
2025	62.5	39.31	0.629	7.865	16.04	0.257	91.417	7.441	0.119	471.28	62.792	1.005	570.563
2026	54.1	39.31	0.727	7.865	16.04	0.297	91.417	7.441	0.138	471.28	62.792	1.161	570.563
2027	44.6	34.72	0.778	6.964	14.25	0.320	80.842	6.577	0.147	413.25	55.549	1.245	501.055
2028	36.9	29.62	0.803	5.914	12.03	0.326	68.557	5.567	0.151	352.65	47.218	1.280	427.122
2029	32.2	29.62	0.920	5.914	12.03	0.373	68.557	5.567	0.173	352.65	47.218	1.466	427.122
2030	25.8	24.02	0.931	4.715	9.37	0.363	54.562	4.412	0.171	289.49	37.800	1.465	348.764
2031	22.6	24.02	1.063	4.480	9.37	0.414	52.564	4.412	0.195	287.86	37.800	1.673	344.906
2032	19.7	24.02	1.219	4.715	9.37	0.475	54.562	4.412	0.224	289.49	37.800	1.919	348.764
2033	17.2	24.02	1.397	4.715	9.37	0.545	54.562	4.412	0.257	289.49	37.800	2.198	348.764
2034	15.1	24.02	1.591	4.715	9.37	0.620	54.562	4.412	0.292	289.49	37.800	2.503	348.764
2035	13.2	24.02	1.820	4.715	9.37	0.710	54.562	4.412	0.334	289.49	37.800	2.864	348.764
2036	8.3	14.23	1.714	2.795	5.56	0.670	32.413	2.626	0.316	172.61	22.412	2.700	207.818
2037	7.3	14.23	1.949	2.795	5.56	0.761	32.413	2.626	0.360	172.61	22.412	3.070	207.818
2038	6.5	14.23	2.189	2.795	5.56	0.855	32.413	2.626	0.404	172.61	22.412	3.448	207.818

Table 4.4A.13

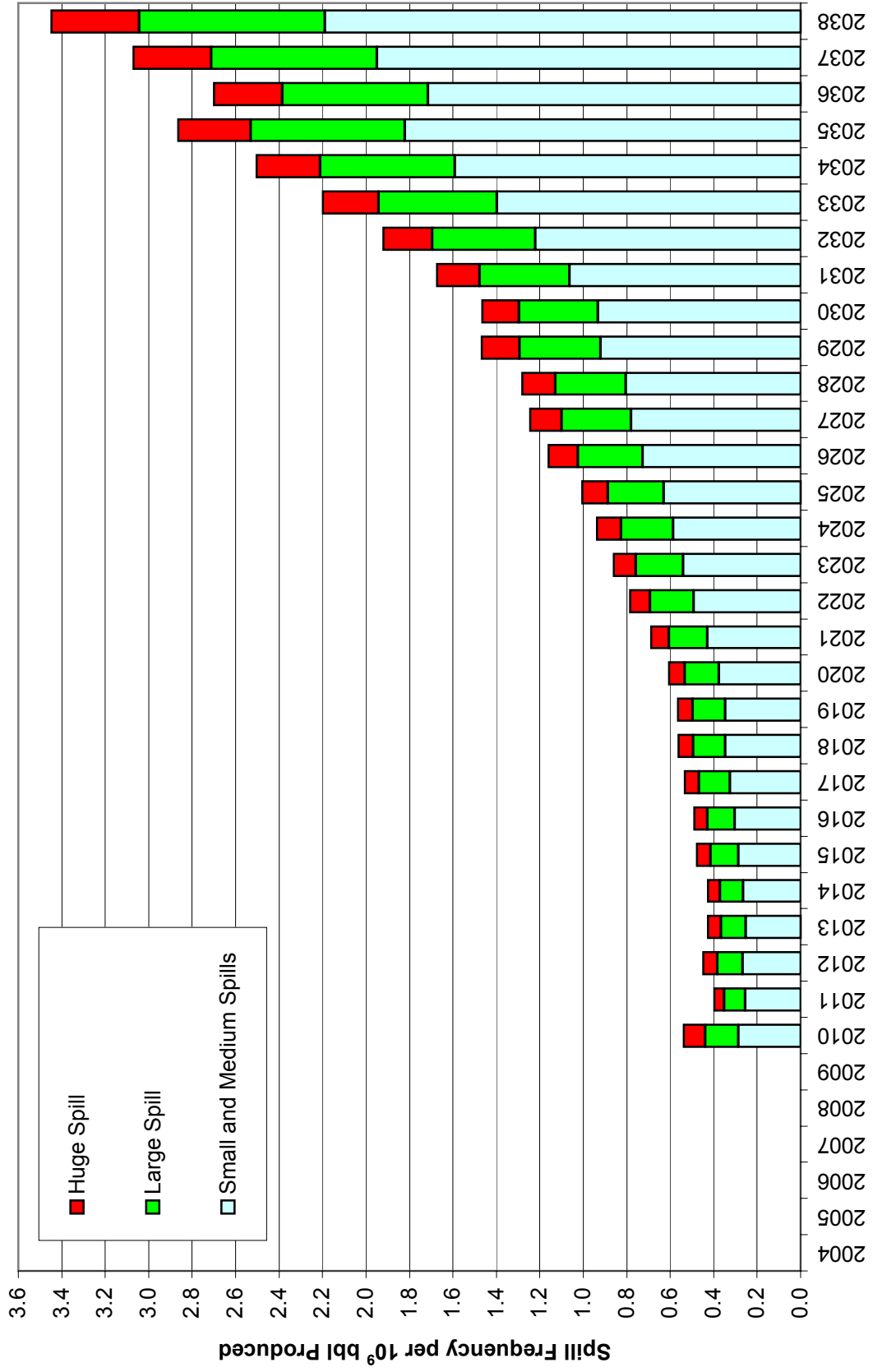
Non Arctic Spill Occurrence Beaufort Sea Sale All Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]
2004		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2005		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2006		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901
2007		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2008		0.089		0.045	0.268		2.807	0.456		42.960	0.813		45.812
2009		0.073		0.036	0.218		2.285	0.381		36.960	0.672		39.281
2010	10.9	0.154	0.014	0.077	0.463	0.042	4.855	0.781	0.072	72.860	1.398	0.128	77.792
2011	19.9	0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
2012	30.8	0.290	0.009	0.145	0.870	0.028	9.127	1.425	0.046	128.400	2.585	0.084	137.672
2013	50.7	0.397	0.008	0.199	1.192	0.024	12.508	2.009	0.040	187.240	3.598	0.071	199.947
2014	56.2	0.412	0.007	0.206	1.236	0.022	12.974	2.112	0.038	199.920	3.760	0.067	213.100
2015	64.2	0.468	0.007	0.234	1.403	0.022	14.727	2.356	0.037	218.660	4.227	0.066	233.621
2016	67.4	0.475	0.007	0.238	1.425	0.021	14.963	2.375	0.035	218.500	4.275	0.063	233.700
2017	77.4	0.572	0.007	0.286	1.715	0.022	18.005	2.850	0.037	261.300	5.137	0.066	279.591
2018	82.9	0.692	0.008	0.346	2.075	0.025	21.785	3.450	0.042	316.500	6.217	0.075	338.631
2019	104.6	0.780	0.007	0.390	2.340	0.022	24.570	3.900	0.037	358.800	7.020	0.067	383.760
2020	104.8	0.880	0.008	0.440	2.640	0.025	27.720	4.400	0.042	404.800	7.920	0.076	432.960
2021	98.6	0.980	0.010	0.490	2.940	0.030	30.870	4.900	0.050	450.800	8.820	0.089	482.160
2022	89.2	1.030	0.012	0.515	3.090	0.035	32.445	5.150	0.058	473.800	9.270	0.104	506.760
2023	81.4	1.030	0.013	0.515	3.090	0.038	32.445	5.150	0.063	473.800	9.270	0.114	506.760
2024	74.8	1.030	0.014	0.515	3.090	0.041	32.445	5.150	0.069	473.800	9.270	0.124	506.760
2025	62.5	0.915	0.015	0.458	2.745	0.044	28.823	4.575	0.073	420.900	8.235	0.132	450.180
2026	54.1	0.915	0.017	0.458	2.745	0.051	28.823	4.575	0.085	420.900	8.235	0.152	450.180
2027	44.6	0.800	0.018	0.400	2.400	0.054	25.200	4.000	0.090	368.000	7.200	0.161	393.600
2028	36.9	0.685	0.019	0.343	2.055	0.056	21.578	3.425	0.093	315.100	6.165	0.167	337.020
2029	32.2	0.685	0.021	0.343	2.055	0.064	21.578	3.425	0.106	315.100	6.165	0.191	337.020
2030	25.8	0.570	0.022	0.285	1.710	0.066	17.955	2.850	0.110	262.200	5.130	0.199	280.440
2031	22.6	0.570	0.025	0.285	1.710	0.076	17.955	2.850	0.126	262.200	5.130	0.227	280.440
2032	19.7	0.570	0.029	0.285	1.710	0.087	17.955	2.850	0.145	262.200	5.130	0.260	280.440
2033	17.2	0.570	0.033	0.285	1.710	0.099	17.955	2.850	0.166	262.200	5.130	0.298	280.440
2034	15.1	0.570	0.038	0.285	1.710	0.113	17.955	2.850	0.189	262.200	5.130	0.340	280.440
2035	13.2	0.570	0.043	0.285	1.710	0.130	17.955	2.850	0.216	262.200	5.130	0.389	280.440
2036	8.3	0.340	0.041	0.170	1.020	0.123	10.710	1.700	0.205	156.400	3.060	0.369	167.280
2037	7.3	0.340	0.047	0.170	1.020	0.140	10.710	1.700	0.233	156.400	3.060	0.419	167.280
2038	6.5	0.340	0.052	0.170	1.020	0.157	10.710	1.700	0.262	156.400	3.060	0.471	167.280

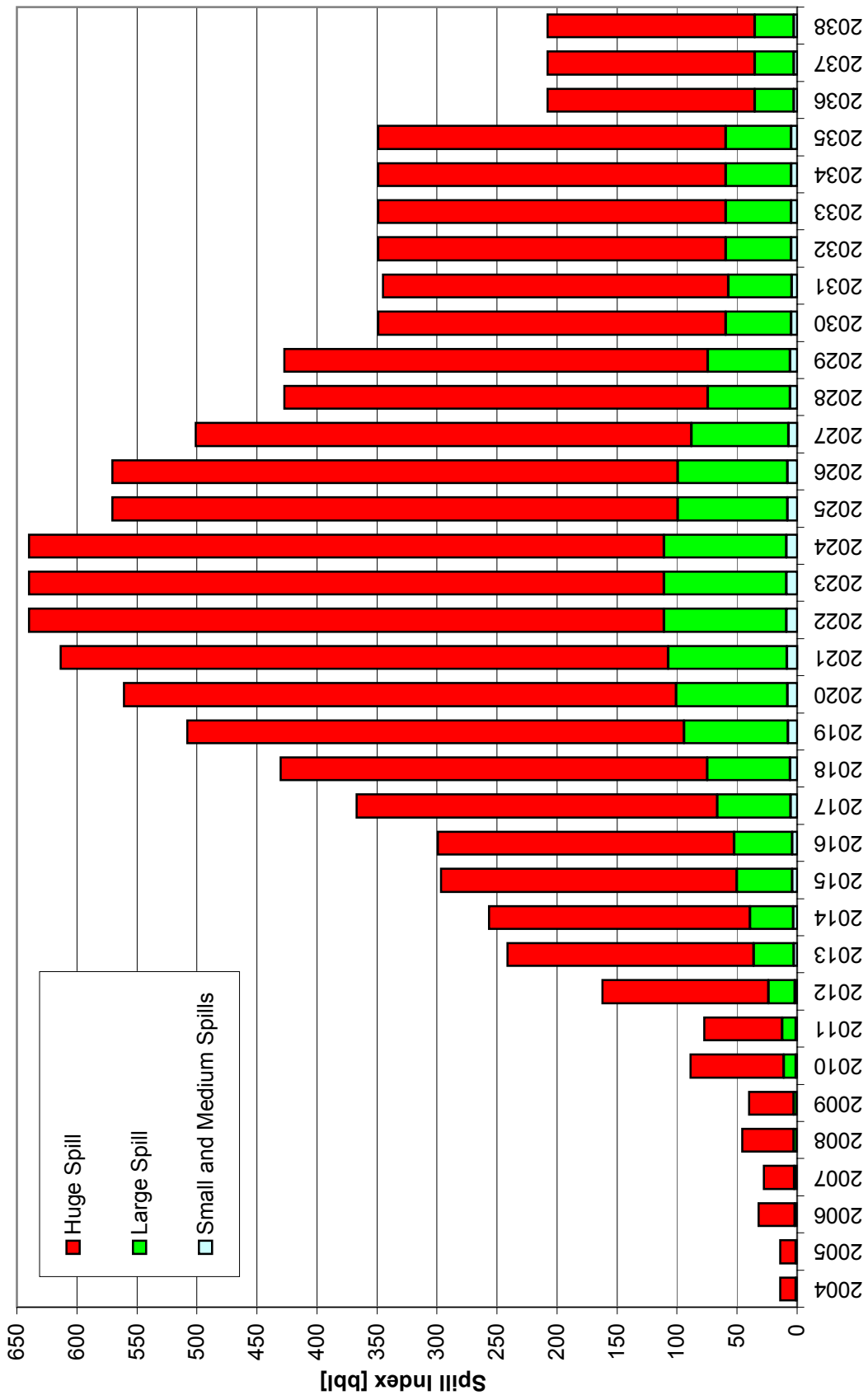
Beaufort Sea Sale All Spill Frequency - Non Arctic



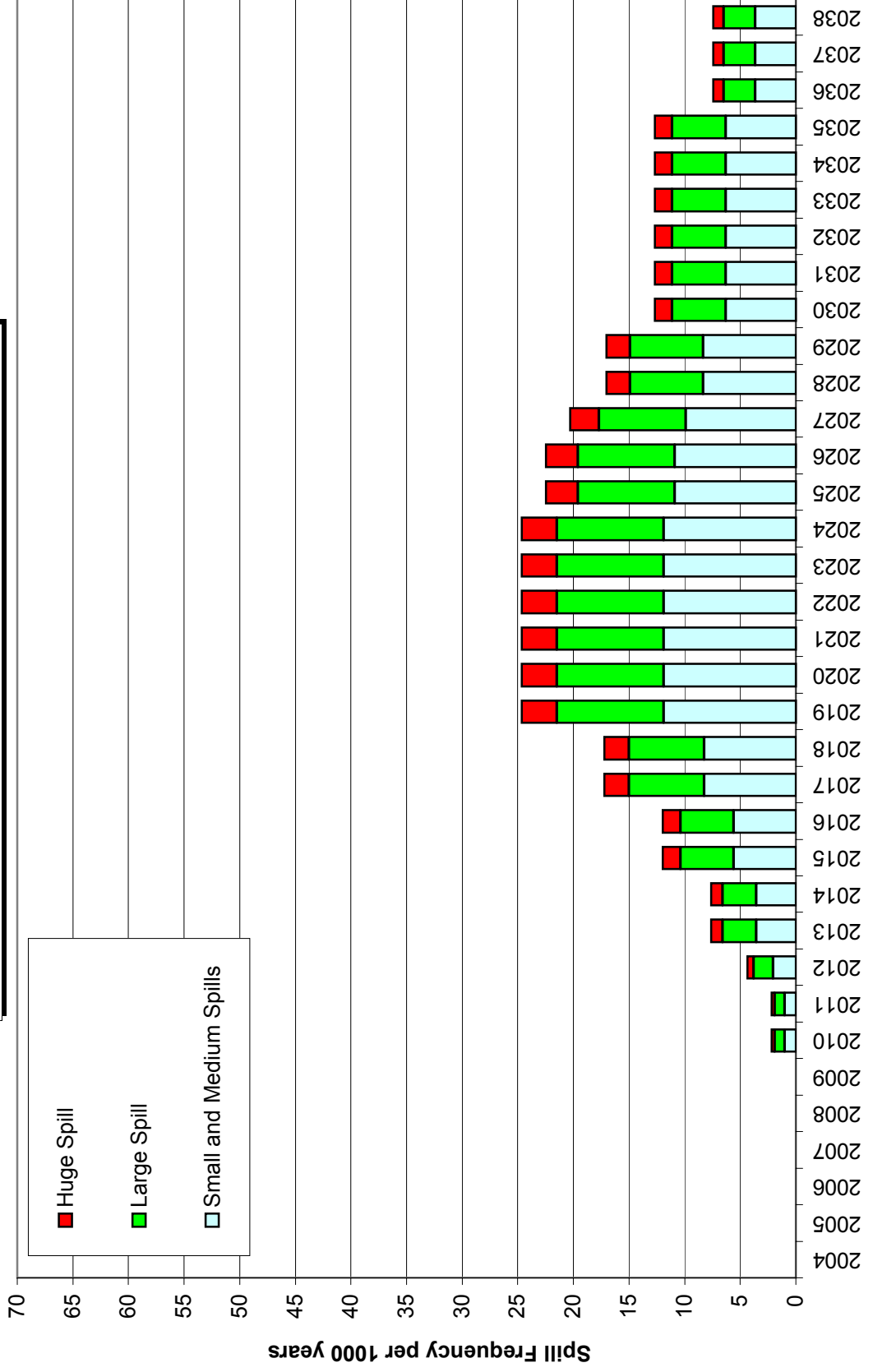
Beaufort Sea Sale All Spill Frequency per 10⁹ bbl Produced - Non Arctic



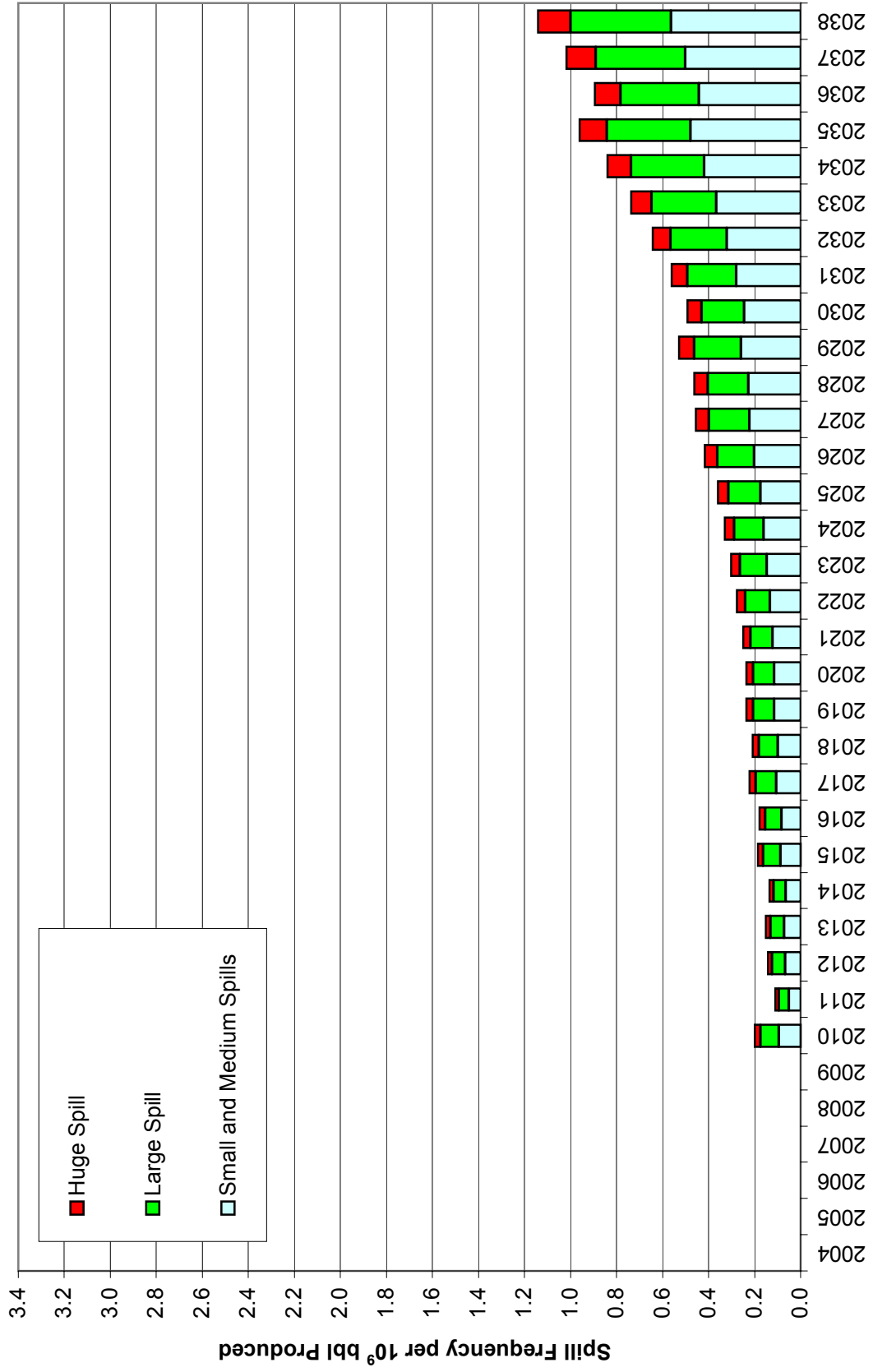
Beaufort Sea Sale All Spill Index - Non Arctic



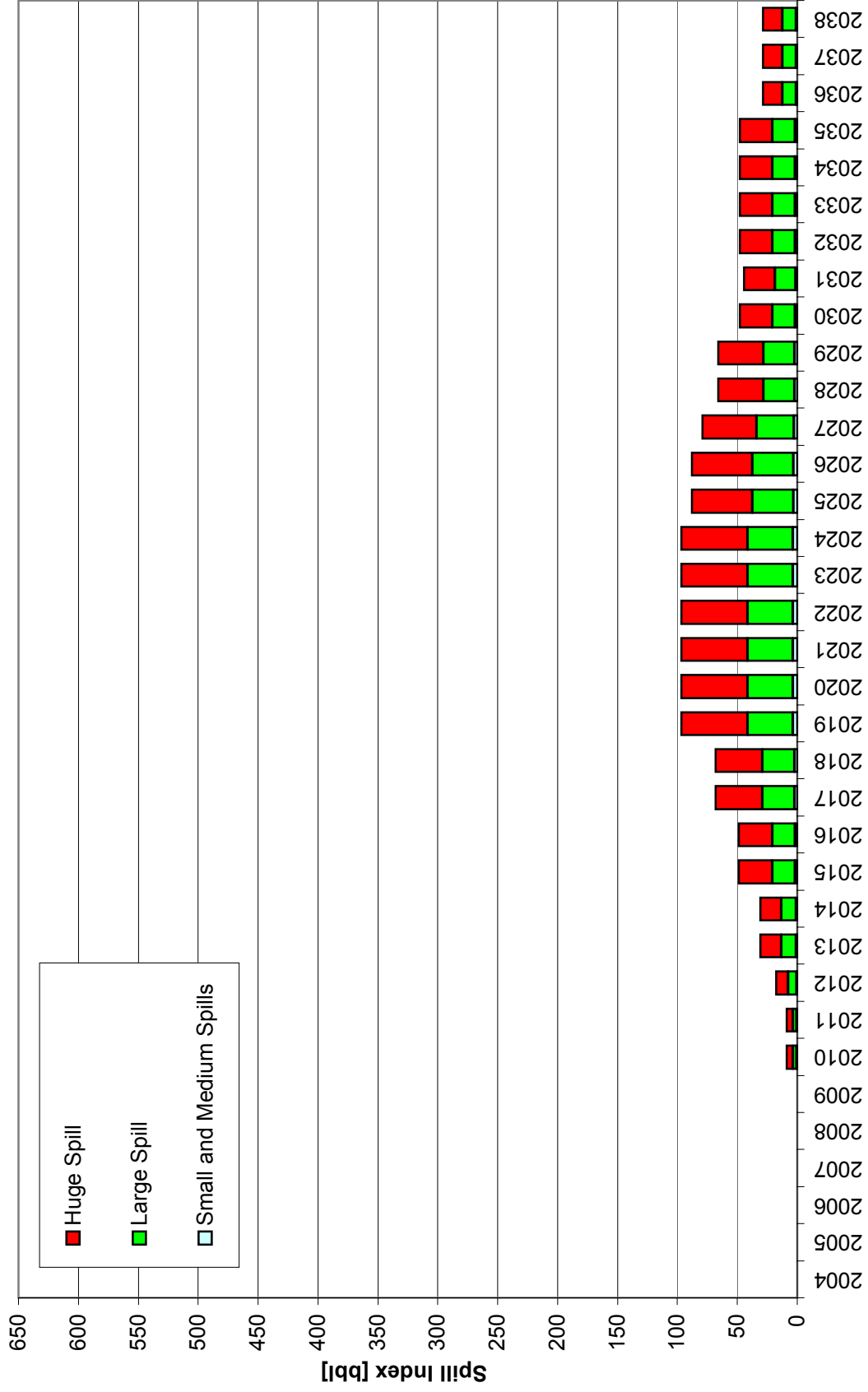
Beaufort Sea Sale All Spill Frequency - Non Arctic - P/L



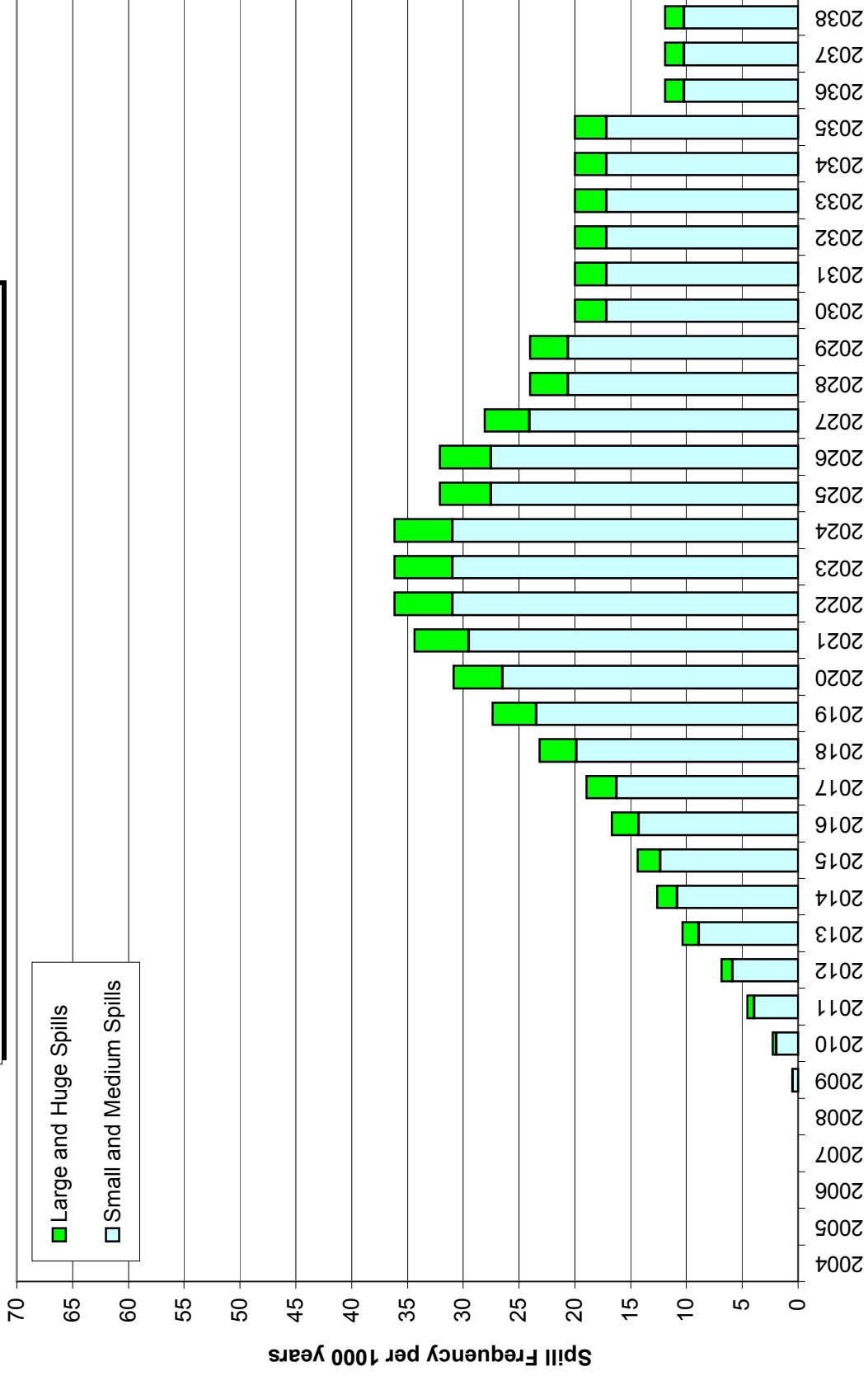
Beaufort Sea Sale All Spill Frequency per 10⁹ bbl Produced - Non Arctic - P/L



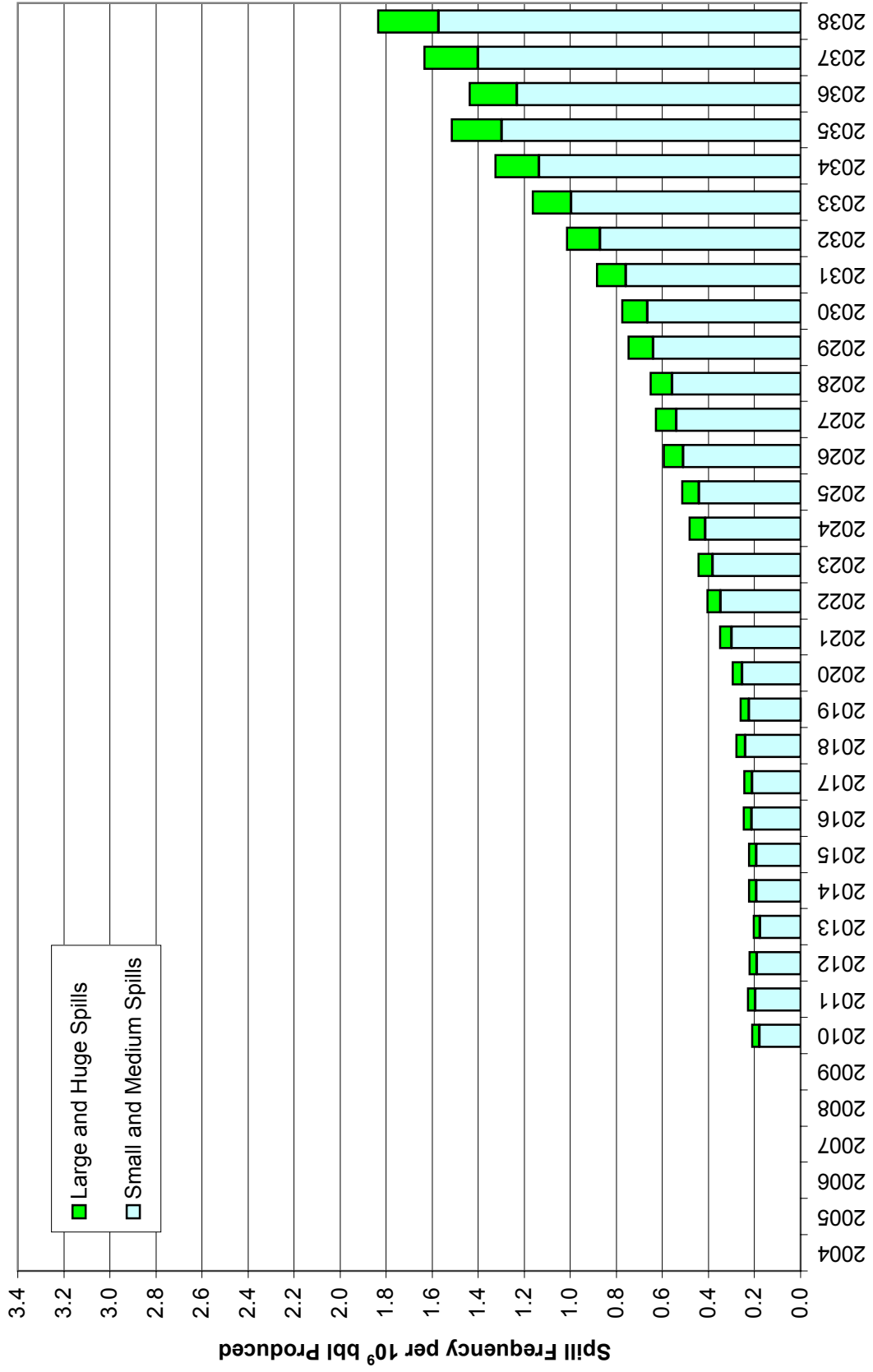
Beaufort Sea Sale All Spill Index - Non Arctic - P/L



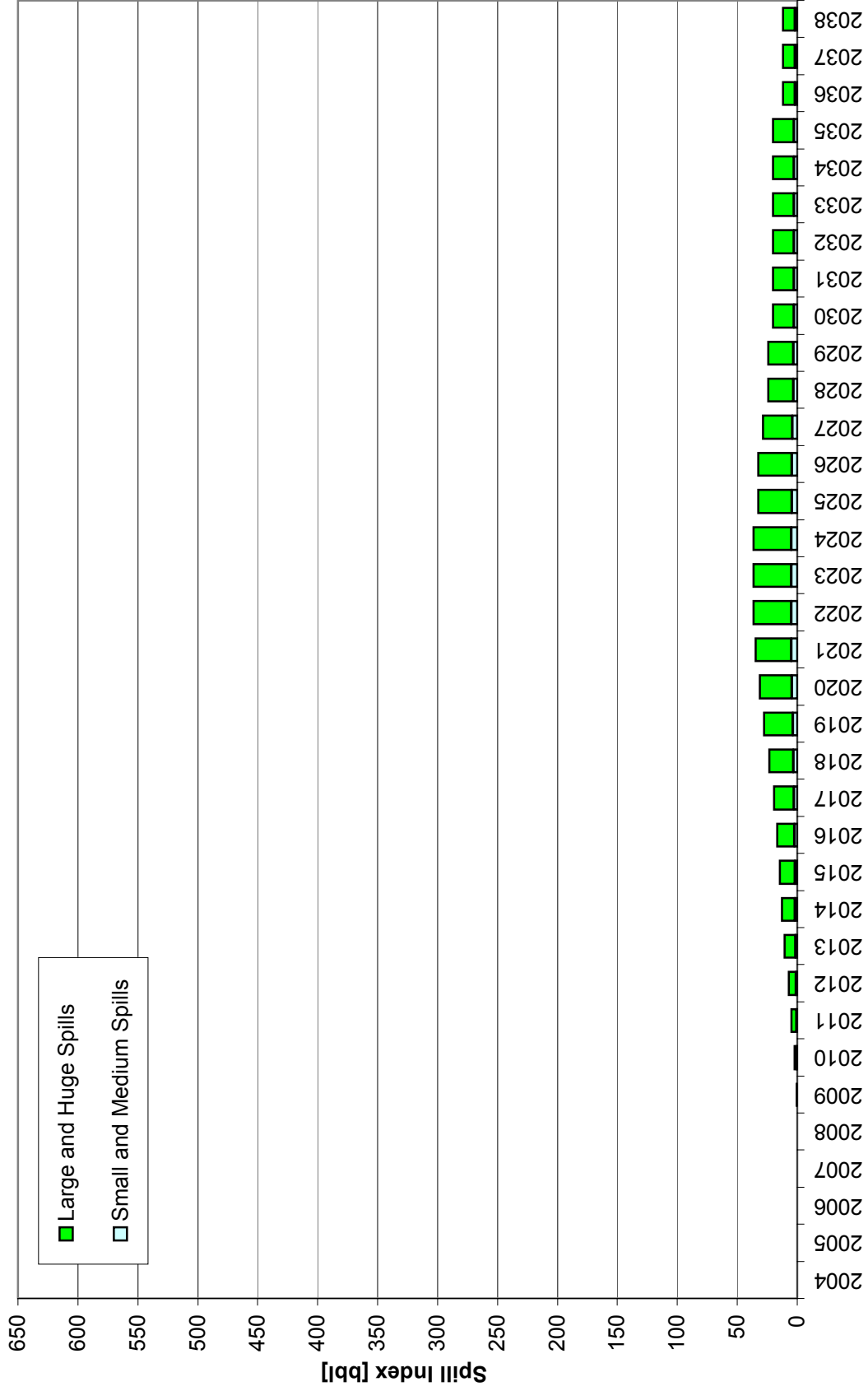
Beaufort Sea Sale All Spill Frequency - Non Arctic - Platforms



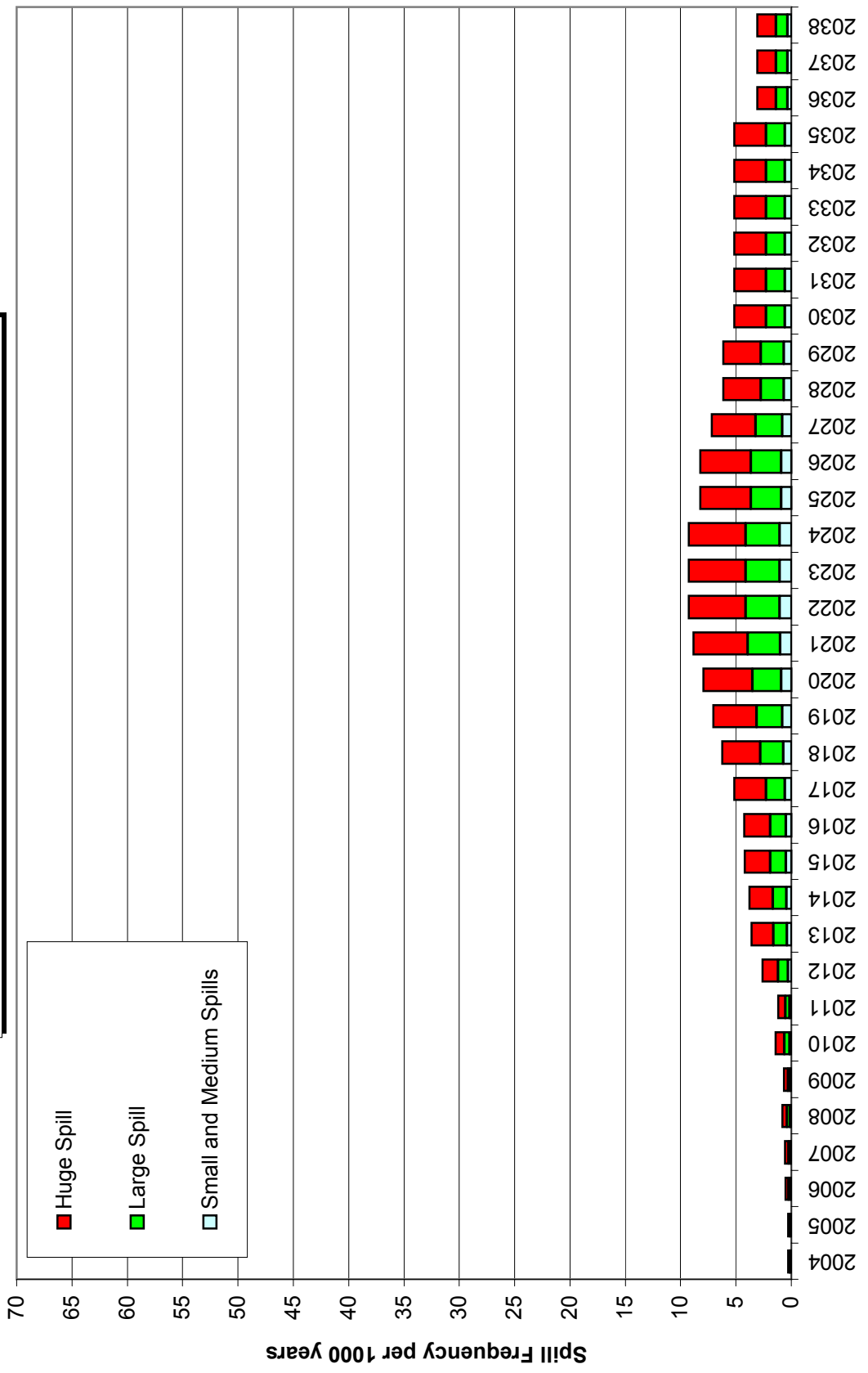
Beaufort Sea Sale All Spill Frequency per 10⁹ bbl Produced - Non Arctic - Platforms



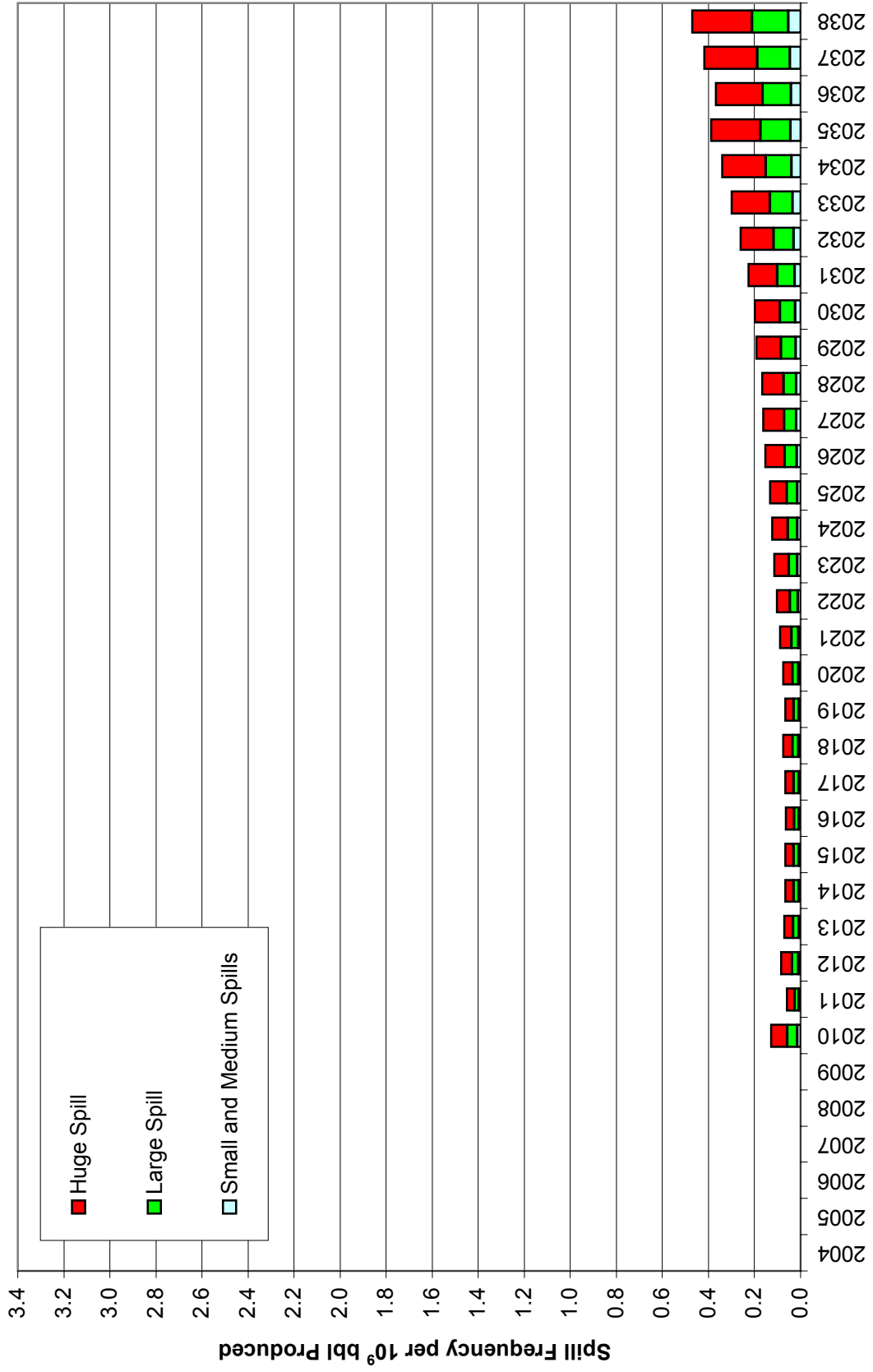
Beaufort Sea Sale All Spill Index - Non Arctic - Platforms



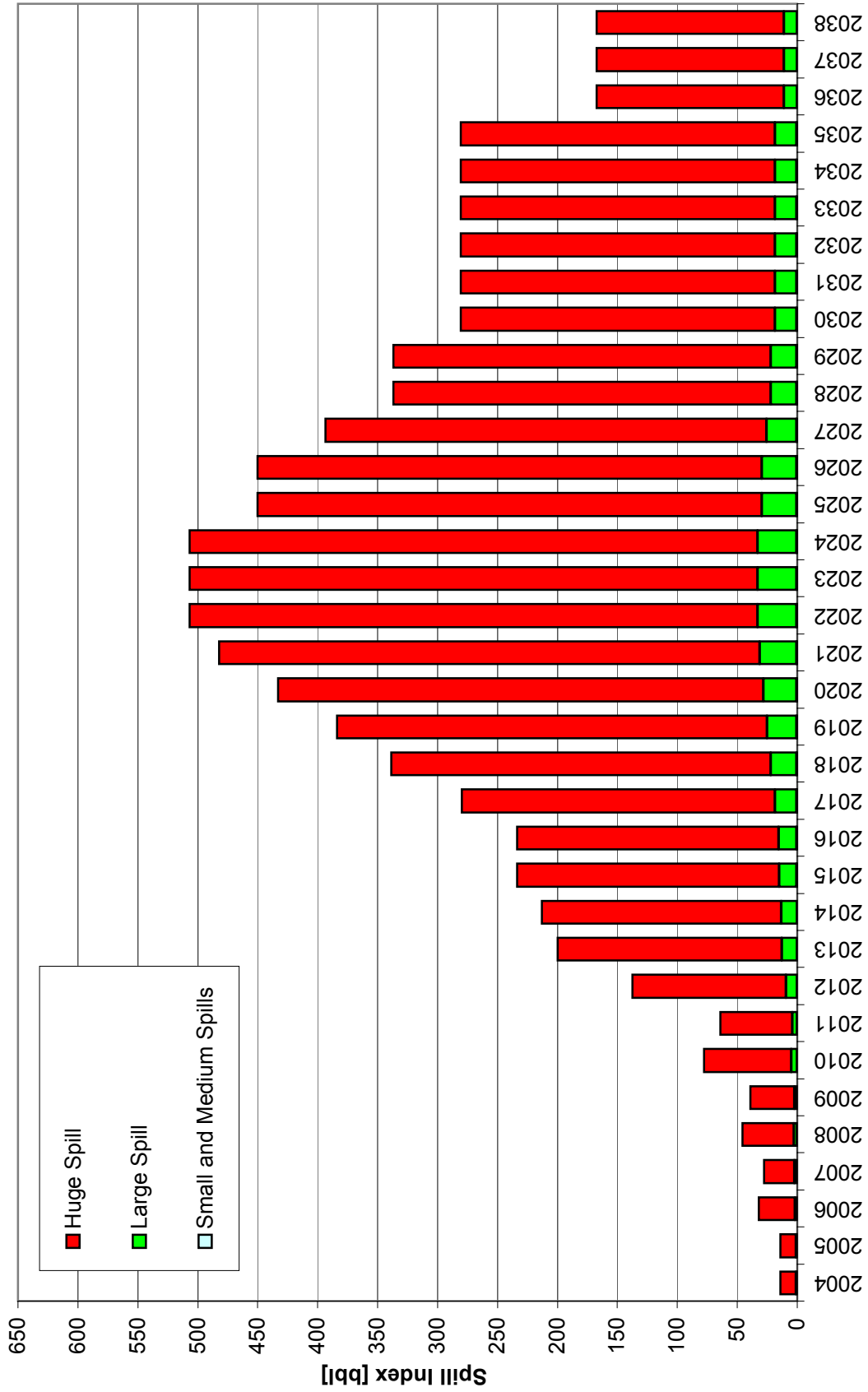
Beaufort Sea Sale All Spill Frequency - Non Arctic - Wells



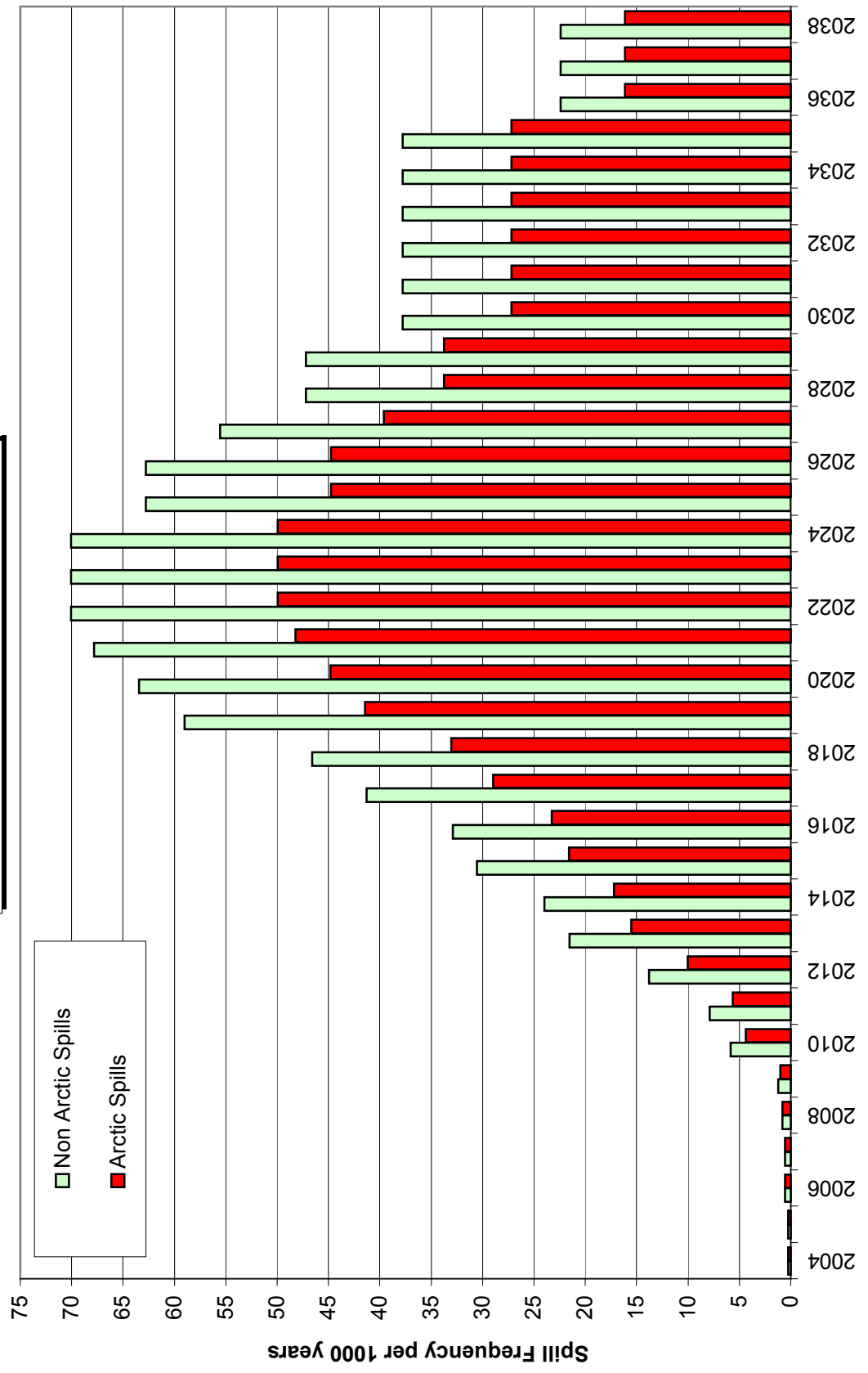
Beaufort Sea Sale All Spill Frequency per 10⁹ bbl Produced - Non Arctic - Wells



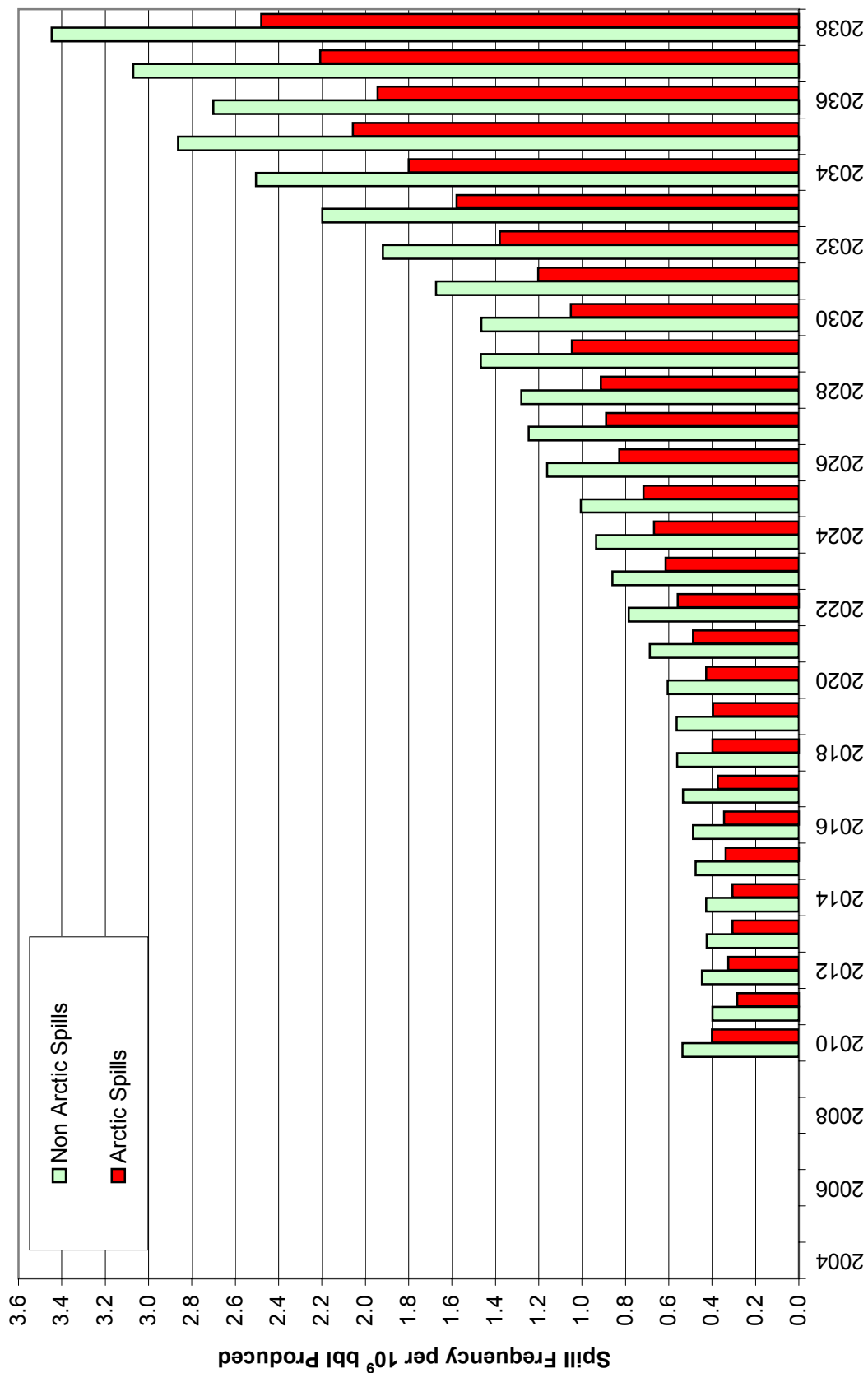
Beaufort Sea Sale All Spill Index - Non Arctic - Wells



Beaufort Sea Sale All Spill Frequency



Beaufort Sea Sale All Spill Frequency per 10⁹ bbl Produced



Beaufort Sea Sale All Spill Index

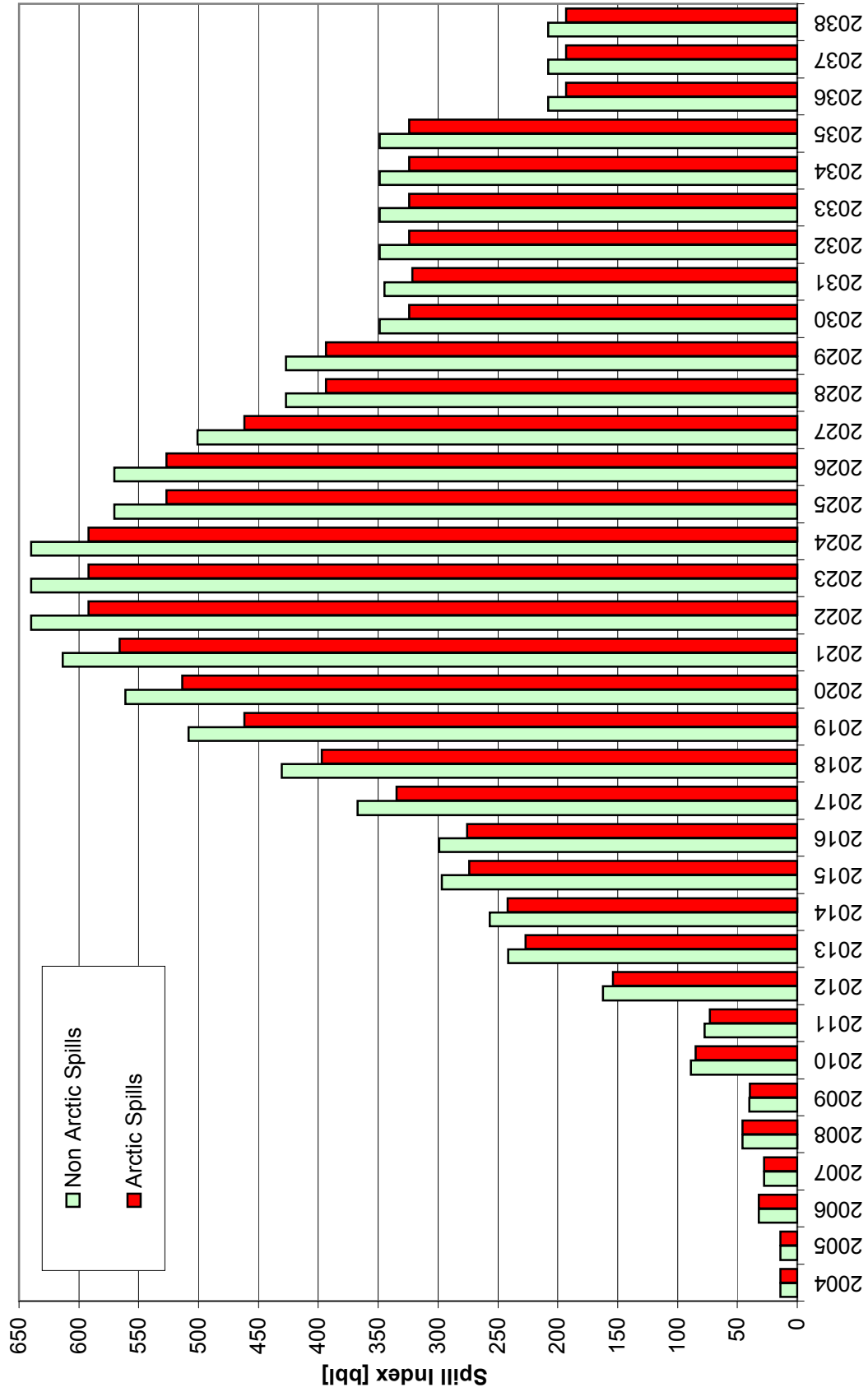


Table 4.5.1
Artic Spill Occurrence Chukchi Sea BC P/L

17706	
Spill	
Index	
bbl	
1.54	
14.69	
25.08	
41.32	
1.54	
14.69	
25.08	
41.32	
1.54	
14.69	
25.08	
41.32	
1.54	
14.69	
25.08	
41.32	
1.54	
14.69	
25.08	
41.32	
1.54	
14.69	
25.08	
41.32	
1.54	
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25.08	
41.32	
1.54	
14.69	
25.08	
41.32	
1.54	
14.69	
25.08	
41.32	
1.54	
14.69	
25.08	
41.32	
1.54	
14.69	
25.08	
41.32	
1.54	
14.69	
25.08	
41.32	

**Table 4.5.2
Arctic Spill Occurrence Chukchi Sea BC P/L Summary**

Year	Production [Mmbbl]			Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills			
	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	
1998	0																					
1999	0	3.394	0.197	8.302		3.213	11.696		3.410	7.154	28.129	2.334			41.316	21.183						72.855
2000	0	3.394	0.197	8.302		3.213	11.696		3.410	7.154	28.129	2.334			41.316	21.183						72.855
2001	0	3.394	0.197	8.302		3.213	11.696		3.410	7.154	28.129	2.334			41.316	21.183						72.855
2002	101	3.394	0.034	8.302	0.082	3.213	11.696	0.116	3.410	7.154	28.129	2.334	0.071	0.023	41.316	21.183	0.210	0.210	21.183	0.210	0.210	72.855
2003	135	3.394	0.025	8.302	0.061	3.213	11.696	0.087	3.410	7.154	28.129	2.334	0.053	0.017	41.316	21.183	0.157	0.157	21.183	0.157	0.157	72.855
2004	135	3.394	0.025	8.302	0.061	3.213	11.696	0.087	3.410	7.154	28.129	2.334	0.053	0.017	41.316	21.183	0.157	0.157	21.183	0.157	0.157	72.855
2005	135	3.394	0.025	8.302	0.061	3.213	11.696	0.087	3.410	7.154	28.129	2.334	0.053	0.017	41.316	21.183	0.157	0.157	21.183	0.157	0.157	72.855
2006	135	3.394	0.025	8.302	0.061	3.213	11.696	0.087	3.410	7.154	28.129	2.334	0.053	0.017	41.316	21.183	0.157	0.157	21.183	0.157	0.157	72.855
2007	135	3.394	0.025	8.302	0.061	3.213	11.696	0.087	3.410	7.154	28.129	2.334	0.053	0.017	41.316	21.183	0.157	0.157	21.183	0.157	0.157	72.855
2008	119	3.394	0.029	8.302	0.070	3.213	11.696	0.098	3.410	7.154	28.129	2.334	0.060	0.020	41.316	21.183	0.178	0.178	21.183	0.178	0.178	72.855
2009	103	3.394	0.033	8.302	0.081	3.213	11.696	0.114	3.410	7.154	28.129	2.334	0.069	0.023	41.316	21.183	0.206	0.206	21.183	0.206	0.206	72.855
2010	92	3.394	0.037	8.302	0.090	3.213	11.696	0.127	3.410	7.154	28.129	2.334	0.078	0.025	41.316	21.183	0.230	0.230	21.183	0.230	0.230	72.855

**Table 4.5.3
Arctic Spill Occurrence Chukchi Sea BC Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
1999	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2000	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	2	8	1.163	0.931	0.15	0.227	0.182	1.12
	Total	2	8		0.931	0.15		0.182	1.12
2001	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	4	48	1.163	5.584	0.88	0.227	1.091	6.69
	Total	4	48		5.584	0.88		1.091	6.69
2002	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	6	108	1.163	12.564	1.99	0.227	2.456	15.05
	Total	6	108		12.564	1.99		2.456	15.05
2003	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	6	188	1.163	21.871	3.46	0.227	4.275	26.21
	Total	6	188		21.871	3.46		4.275	26.21
2004	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	6	214	1.163	24.896	3.93	0.227	4.866	29.83
	Total	6	214		24.896	3.93		4.866	29.83
2005	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	6	214	1.163	24.896	3.93	0.227	4.866	29.83
	Total	6	214		24.896	3.93		4.866	29.83
2006	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	6	214	1.163	24.896	3.93	0.227	4.866	29.83
	Total	6	214		24.896	3.93		4.866	29.83
2007	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	6	214	1.163	24.896	3.93	0.227	4.866	29.83
	Total	6	214		24.896	3.93		4.866	29.83
2008	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	6	214	1.163	24.896	3.93	0.227	4.866	29.83
	Total	6	214		24.896	3.93		4.866	29.83
2009	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	6	214	1.163	24.896	3.93	0.227	4.866	29.83
	Total	6	214		24.896	3.93		4.866	29.83
2010	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	6	214	1.163	24.896	3.93	0.227	4.866	29.83
	Total	6	214		24.896	3.93		4.866	29.83

**Table 4.5.4
Arctic Spill Occurrence Chukchi Sea BC Platforms Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0									
1999	0									
2000	0	0.931		0.147	0.182		1.115	1.113		1.262
2001	0	5.584		0.882	1.091		6.691	6.676		7.573
2002	101	12.564	0.124	1.985	2.456	0.024	15.054	15.020	0.149	17.039
2003	135	21.871	0.162	3.456	4.275	0.032	26.205	26.146	0.194	29.661
2004	135	24.896	0.184	3.934	4.866	0.036	29.829	29.762	0.220	33.763
2005	135	24.896	0.184	3.934	4.866	0.036	29.829	29.762	0.220	33.763
2006	135	24.896	0.184	3.934	4.866	0.036	29.829	29.762	0.220	33.763
2007	135	24.896	0.184	3.934	4.866	0.036	29.829	29.762	0.220	33.763
2008	119	24.896	0.209	3.934	4.866	0.041	29.829	29.762	0.250	33.763
2009	103	24.896	0.242	3.934	4.866	0.047	29.829	29.762	0.289	33.763
2010	92	24.896	0.271	3.934	4.866	0.053	29.829	29.762	0.324	33.763

**Table 4.5.5
Arctic Spill Occurrence Chukchi Sea BC Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
1999	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2000	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	8	0.500	0.040	0.02	3.500	0.280	1.26	1.500	0.120	2.40	1.000	0.080	16.00
	Total	8		0.040	0.02		0.280	1.26		0.120	2.40		0.080	16.00
2001	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	48	0.500	0.240	0.12	3.500	1.680	7.56	1.500	0.720	14.40	1.000	0.480	96.00
	Total	48		0.240	0.12		1.680	7.56		0.720	14.40		0.480	96.00
2002	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	108	0.500	0.540	0.27	3.500	3.780	17.01	1.500	1.620	32.40	1.000	1.080	216.00
	Total	108		0.540	0.27		3.780	17.01		1.620	32.40		1.080	216.00
2003	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	188	0.500	0.940	0.47	3.500	6.580	29.61	1.500	2.820	56.40	1.000	1.880	376.00
	Total	188		0.940	0.47		6.580	29.61		2.820	56.40		1.880	376.00
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	214	0.500	1.070	0.54	3.500	7.490	33.71	1.500	3.210	64.20	1.000	2.140	428.00
	Total	214		1.070	0.54		7.490	33.71		3.210	64.20		2.140	428.00
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	214	0.500	1.070	0.54	3.500	7.490	33.71	1.500	3.210	64.20	1.000	2.140	428.00
	Total	214		1.070	0.54		7.490	33.71		3.210	64.20		2.140	428.00
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	214	0.500	1.070	0.54	3.500	7.490	33.71	1.500	3.210	64.20	1.000	2.140	428.00
	Total	214		1.070	0.54		7.490	33.71		3.210	64.20		2.140	428.00
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	214	0.500	1.070	0.54	3.500	7.490	33.71	1.500	3.210	64.20	1.000	2.140	428.00
	Total	214		1.070	0.54		7.490	33.71		3.210	64.20		2.140	428.00
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	214	0.500	1.070	0.54	3.500	7.490	33.71	1.500	3.210	64.20	1.000	2.140	428.00
	Total	214		1.070	0.54		7.490	33.71		3.210	64.20		2.140	428.00
2009	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	214	0.500	1.070	0.54	3.500	7.490	33.71	1.500	3.210	64.20	1.000	2.140	428.00
	Total	214		1.070	0.54		7.490	33.71		3.210	64.20		2.140	428.00
2010	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	214	0.500	1.070	0.54	3.500	7.490	33.71	1.500	3.210	64.20	1.000	2.140	428.00
	Total	214		1.070	0.54		7.490	33.71		3.210	64.20		2.140	428.00

Table 4.5.6

Arctic Spill Occurrence Chukchi Sea BC Production Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]
1998	0												
1999	0												
2000	0	0.040		0.020	0.120		1.260	0.200		18.400	0.360		19.680
2001	0	0.240		0.120	0.720		7.560	1.200		110.400	2.160		118.080
2002	101	0.540	0.005	0.270	1.620	0.016	17.010	2.700	0.027	248.400	4.860	0.048	265.680
2003	135	0.940	0.007	0.470	2.820	0.021	29.610	4.700	0.035	432.400	8.460	0.063	462.480
2004	135	1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
2005	135	1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
2006	135	1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
2007	135	1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
2008	119	1.070	0.009	0.535	3.210	0.027	33.705	5.350	0.045	492.200	9.630	0.081	526.440
2009	103	1.070	0.010	0.535	3.210	0.031	33.705	5.350	0.052	492.200	9.630	0.093	526.440
2010	92	1.070	0.012	0.535	3.210	0.035	33.705	5.350	0.058	492.200	9.630	0.105	526.440

**Table 4.5.7
Arctic Spill Occurrence Chukchi Sea BC Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
1999	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2000	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2001	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2002	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2003	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2004	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2005	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2006	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2007	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2008	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2010	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.5.8

Arctic Spill Occurrence Chukchi Sea BC Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0	0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
1999	0												
2000	0												
2001	0												
2002	101												
2003	135												
2004	135												
2005	135												
2006	135												
2007	135												
2008	119												
2009	103												
2010	92												

**Table 4.5.9
Arctic Spill Occurrence Chukchi Sea BC Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
1999	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2000	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2001	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2002	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2003	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2009	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.5.10

Arctic Spill Occurrence Chukchi Sea BC Development Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0	0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
1999	0												
2000	0												
2001	0												
2002	101												
2003	135												
2004	135												
2005	135												
2006	135												
2007	135												
2008	119												
2009	103												
2010	92												

**Table 4.5.11
Arctic Spill Occurrence Chukchi Sea BC Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]
1998	Pipeline	0												
	Platforms													
	Production Wells													
	Exploration Wells		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
Total	0.089		0.045	0.268		2.807	0.456		42.960	0.813		45.812		
1999	Pipeline	0	11.696		3.410	7.154		28.129	2.334		41.316	21.183		72.855
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total	11.696		3.410	7.154		28.129	2.334		41.316	21.183		72.855		
2000	Pipeline	0	11.696		3.410	7.154		28.129	2.334		41.316	21.183		72.855
	Platforms		0.931		0.147	0.182		1.115			1.113		1.262	
	Production Wells		0.040		0.020	0.120		1.260	0.200		18.400	0.360		19.680
	Exploration Wells													
	Development Wells													
Total	12.666		3.577	7.456		30.504	2.534		59.716	22.656		93.797		
2001	Pipeline	0	11.696		3.410	7.154		28.129	2.334		41.316	21.183		72.855
	Platforms		5.584		0.882	1.091		6.691			6.676		7.573	
	Production Wells		0.240		0.120	0.720		7.560	1.200		110.400	2.160		118.080
	Exploration Wells													
	Development Wells													
Total	17.520		4.412	8.965		42.380	3.534		151.716	30.019		198.508		
2002	Pipeline	101.0	11.696	0.116	3.410	7.154	0.071	28.129	2.334	0.023	41.316	21.183	0.210	72.855
	Platforms		12.564	0.124	1.985	2.456	0.024	15.054				15.020	0.149	17.039
	Production Wells		0.540	0.005	0.270	1.620	0.016	17.010	2.700	0.027	248.400	4.860	0.048	265.680
	Exploration Wells													
	Development Wells													
Total	24.800	0.246	5.665	11.230	0.111	60.193	5.034	0.050	289.716	41.064	0.407	355.574		
2003	Pipeline	135.0	11.696	0.087	3.410	7.154	0.053	28.129	2.334	0.017	41.316	21.183	0.157	72.855
	Platforms		21.871	0.162	3.456	4.275	0.032	26.205				26.146	0.194	29.661
	Production Wells		0.940	0.007	0.470	2.820	0.021	29.610	4.700	0.035	432.400	8.460	0.063	462.480
	Exploration Wells													
	Development Wells													
Total	34.507	0.256	7.335	14.249	0.106	83.944	7.034	0.052	473.716	55.790	0.413	564.996		
2004	Pipeline	135.0	11.696	0.087	3.410	7.154	0.053	28.129	2.334	0.017	41.316	21.183	0.157	72.855
	Platforms		24.896	0.184	3.934	4.866	0.036	29.829				29.762	0.220	33.763
	Production Wells		1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
	Exploration Wells													
	Development Wells													
Total	37.662	0.279	7.878	15.230	0.113	91.663	7.684	0.057	533.516	60.576	0.449	633.058		
2005	Pipeline	135.0	11.696	0.087	3.410	7.154	0.053	28.129	2.334	0.017	41.316	21.183	0.157	72.855
	Platforms		24.896	0.184	3.934	4.866	0.036	29.829				29.762	0.220	33.763
	Production Wells		1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
	Exploration Wells													
	Development Wells													
Total	37.662	0.279	7.878	15.230	0.113	91.663	7.684	0.057	533.516	60.576	0.449	633.058		
2006	Pipeline	135.0	11.696	0.087	3.410	7.154	0.053	28.129	2.334	0.017	41.316	21.183	0.157	72.855
	Platforms		24.896	0.184	3.934	4.866	0.036	29.829				29.762	0.220	33.763
	Production Wells		1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
	Exploration Wells													
	Development Wells													
Total	37.662	0.279	7.878	15.230	0.113	91.663	7.684	0.057	533.516	60.576	0.449	633.058		
2007	Pipeline	135.0	11.696	0.087	3.410	7.154	0.053	28.129	2.334	0.017	41.316	21.183	0.157	72.855
	Platforms		24.896	0.184	3.934	4.866	0.036	29.829				29.762	0.220	33.763
	Production Wells		1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
	Exploration Wells													
	Development Wells													
Total	37.662	0.279	7.878	15.230	0.113	91.663	7.684	0.057	533.516	60.576	0.449	633.058		

**Table 4.5.11
Artic Spill Occurrence Chukchi Sea BC Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills			
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	
2008	Pipeline	119.0	11.696	0.098	3.410	7.154	0.060	28.129	2.334	0.020	41.316	21.183	0.178	72.855	
	Platforms		24.896	0.209	3.934	4.866	0.041	29.829				29.762	0.250	33.763	
	Production Wells		1.070	0.009	0.535	3.210	0.027	33.705	5.350	0.045	492.200	9.630	0.081	526.440	
	Exploration Wells														
	Development Wells														
	Total		37.662	0.316	7.878	15.230	0.128	91.663	7.684	0.065	533.516	60.576	0.509	633.058	
2009	Pipeline	103.0	11.696	0.114	3.410	7.154	0.069	28.129	2.334	0.023	41.316	21.183	0.206	72.855	
	Platforms		24.896	0.242	3.934	4.866	0.047	29.829				29.762	0.289	33.763	
	Production Wells		1.070	0.010	0.535	3.210	0.031	33.705	5.350	0.052	492.200	9.630	0.093	526.440	
	Exploration Wells														
	Development Wells														
	Total		37.662	0.366	7.878	15.230	0.148	91.663	7.684	0.075	533.516	60.576	0.588	633.058	
2010	Pipeline	92.0	11.696	0.127	3.410	7.154	0.078	28.129	2.334	0.025	41.316	21.183	0.230	72.855	
	Platforms		24.896	0.271	3.934	4.866	0.053	29.829				29.762	0.324	33.763	
	Production Wells		1.070	0.012	0.535	3.210	0.035	33.705	5.350	0.058	492.200	9.630	0.105	526.440	
	Exploration Wells														
	Development Wells														
	Total		37.662	0.409	7.878	15.230	0.166	91.663	7.684	0.084	533.516	60.576	0.658	633.058	

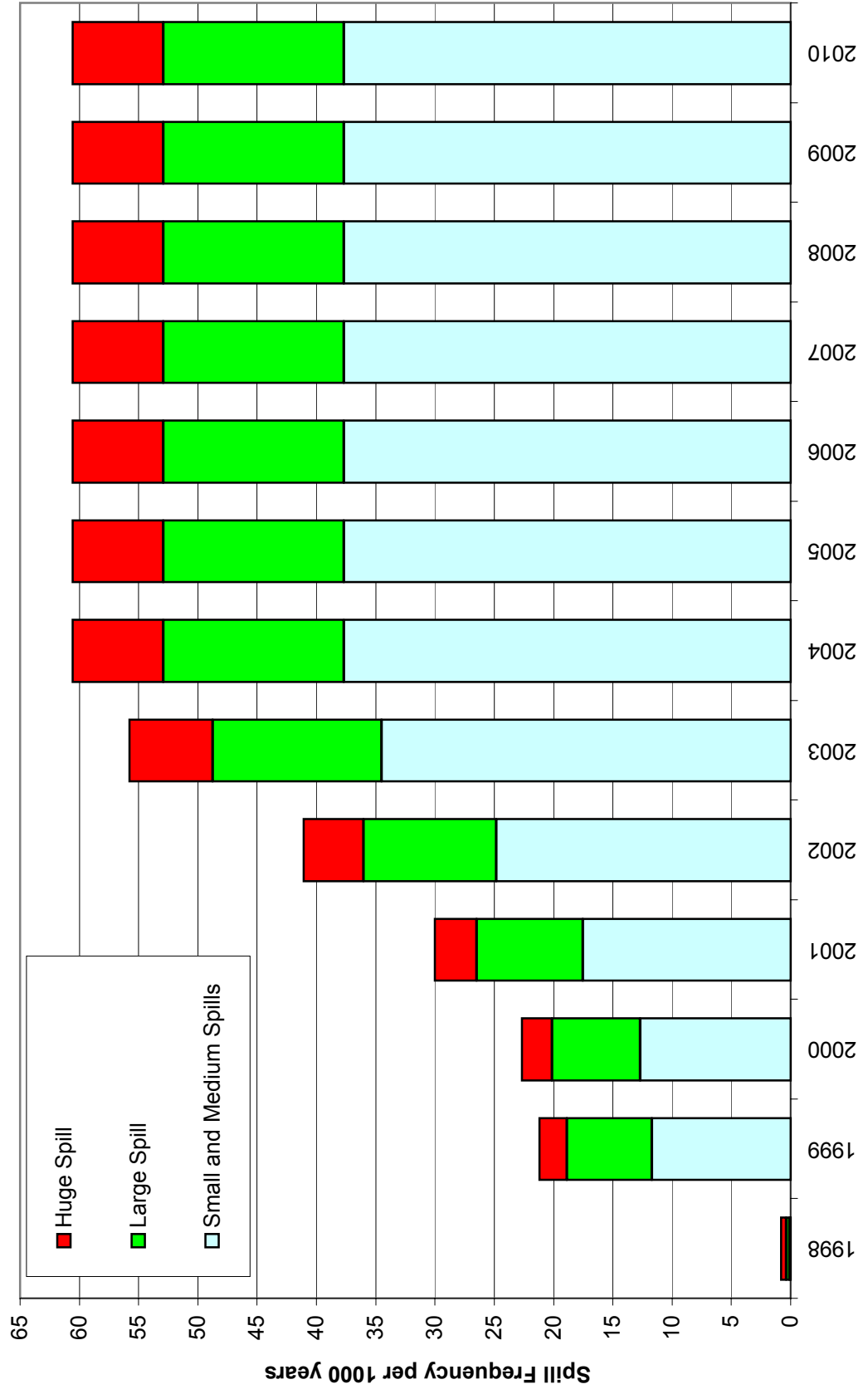
**Table 4.5.12
Arctic Spill Occurrence Chukchi Sea BC Annual Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
1998	0	0.09		0.045	0.27		2.807	0.456		42.96	0.813		45.812
1999	0	11.70		3.410	7.15		28.129	2.334		41.32	21.183		72.855
2000	0	12.67		3.577	7.46		30.504	2.534		59.72	22.656		93.797
2001	0	17.52		4.412	8.97		42.380	3.534		151.72	30.019		198.508
2002	101.0	24.80	0.246	5.665	11.23	0.111	60.193	5.034	0.050	289.72	41.064	0.407	355.574
2003	135.0	34.51	0.256	7.335	14.25	0.106	83.944	7.034	0.052	473.72	55.790	0.413	564.996
2004	135.0	37.66	0.279	7.878	15.23	0.113	91.663	7.684	0.057	533.52	60.576	0.449	633.058
2005	135.0	37.66	0.279	7.878	15.23	0.113	91.663	7.684	0.057	533.52	60.576	0.449	633.058
2006	135.0	37.66	0.279	7.878	15.23	0.113	91.663	7.684	0.057	533.52	60.576	0.449	633.058
2007	135.0	37.66	0.279	7.878	15.23	0.113	91.663	7.684	0.057	533.52	60.576	0.449	633.058
2008	119.0	37.66	0.316	7.878	15.23	0.128	91.663	7.684	0.065	533.52	60.576	0.509	633.058
2009	103.0	37.66	0.366	7.878	15.23	0.148	91.663	7.684	0.075	533.52	60.576	0.588	633.058
2010	92.0	37.66	0.409	7.878	15.23	0.166	91.663	7.684	0.084	533.52	60.576	0.658	633.058

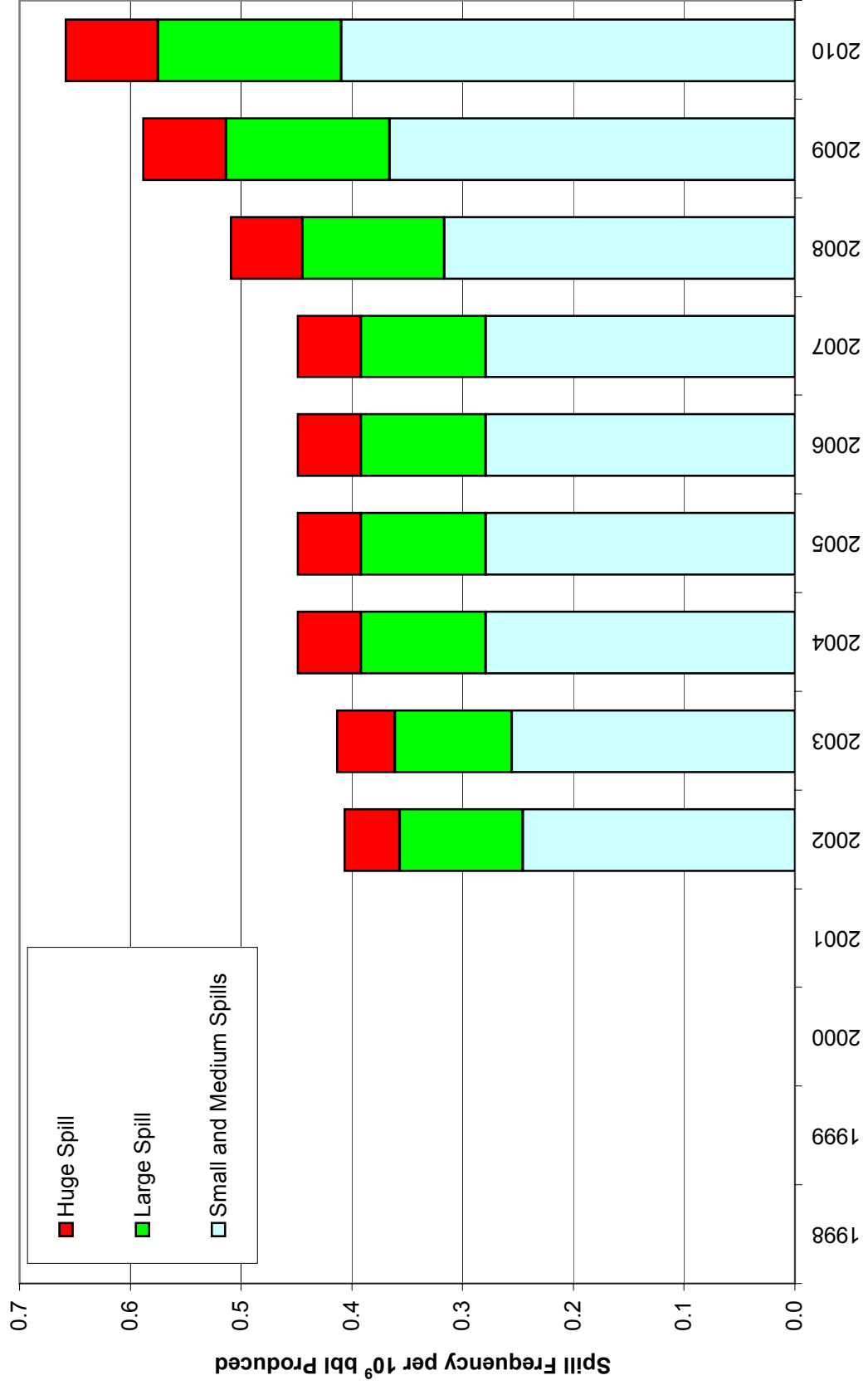
**Table 4.5.14
Chukchi Sea Base Case 2010 - Monte Carlo Results**

Base Case	Small and Medium Spills			Large Spill			Huge Spill		
Year 2010	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
Mean =	44.70	0.486	9.06	20.18	0.219	121.98	7.70	0.084	533.85
Std Deviation =	11.18	0.122	1.78	2.44	0.026	14.43	0.26	0.003	4.57
Variance =	125.08	0.015	3.16	5.94	0.001	208.23	0.07	0.000	20.88
Skewness =	0.44	0.440	0.44	0.26	0.264	0.29	0.21	0.208	0.21
Kurtosis =	2.54	2.538	2.55	2.76	2.760	2.75	2.95	2.951	2.95
Mode =	41.25	0.448	7.82	23.87	0.208	126.67	7.46	0.081	530.83
Minimum =	18.57	0.202	4.98	13.25	0.144	80.22	6.89	0.075	519.38
5% Perc =	28.67	0.312	6.49	16.44	0.179	100.13	7.30	0.079	526.67
10% Perc =	31.12	0.338	6.91	17.11	0.186	103.85	7.37	0.080	528.01
15% Perc =	33.00	0.359	7.22	17.59	0.191	106.56	7.43	0.081	529.07
20% Perc =	34.60	0.376	7.46	18.04	0.196	109.03	7.48	0.081	529.89
25% Perc =	36.02	0.392	7.68	18.39	0.200	111.31	7.52	0.082	530.69
30% Perc =	37.50	0.408	7.92	18.76	0.204	113.37	7.56	0.082	531.29
35% Perc =	38.79	0.422	8.14	19.09	0.208	115.54	7.59	0.083	531.89
40% Perc =	40.29	0.438	8.35	19.42	0.211	117.35	7.62	0.083	532.46
45% Perc =	41.92	0.456	8.61	19.73	0.214	119.23	7.66	0.083	533.13
50% Perc =	43.25	0.470	8.83	20.03	0.218	121.18	7.69	0.084	533.68
55% Perc =	44.75	0.486	9.08	20.37	0.221	123.08	7.72	0.084	534.23
60% Perc =	46.47	0.505	9.35	20.71	0.225	125.10	7.76	0.084	534.89
65% Perc =	48.17	0.524	9.61	21.06	0.229	127.03	7.80	0.085	535.59
70% Perc =	50.30	0.547	9.94	21.42	0.233	129.34	7.84	0.085	536.21
75% Perc =	52.37	0.569	10.27	21.80	0.237	131.56	7.87	0.086	536.88
80% Perc =	54.79	0.596	10.65	22.29	0.242	134.19	7.92	0.086	537.71
85% Perc =	57.58	0.626	11.08	22.81	0.248	137.72	7.97	0.087	538.59
90% Perc =	60.87	0.662	11.66	23.51	0.255	141.74	8.04	0.087	539.86
95% Perc =	65.06	0.707	12.29	24.35	0.265	146.80	8.14	0.088	541.57
Maximum =	79.59	0.865	14.69	28.67	0.312	174.27	8.67	0.094	550.90

Chukchi Sea BC Spill Frequency



Chukchi Sea BC Spill Frequency per 10⁹ bbl Produced



Chukchi Sea BC Spill Index

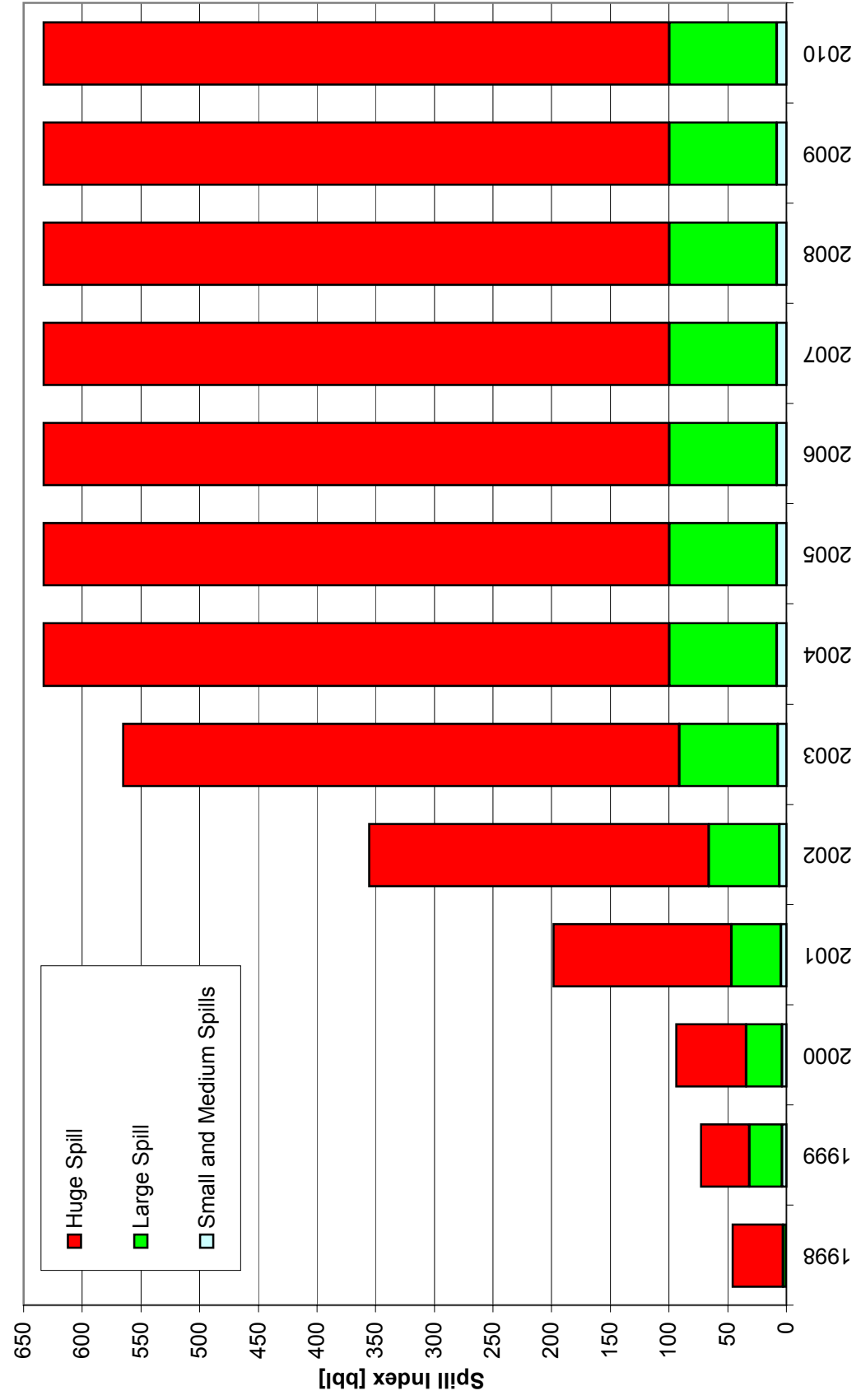
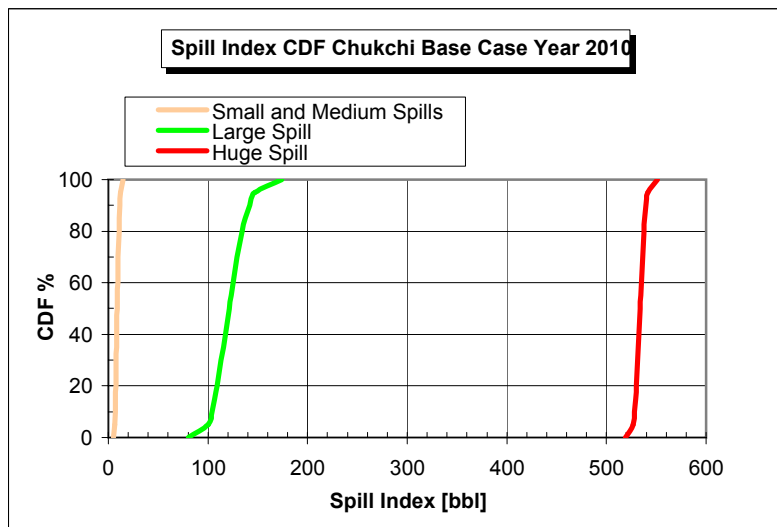
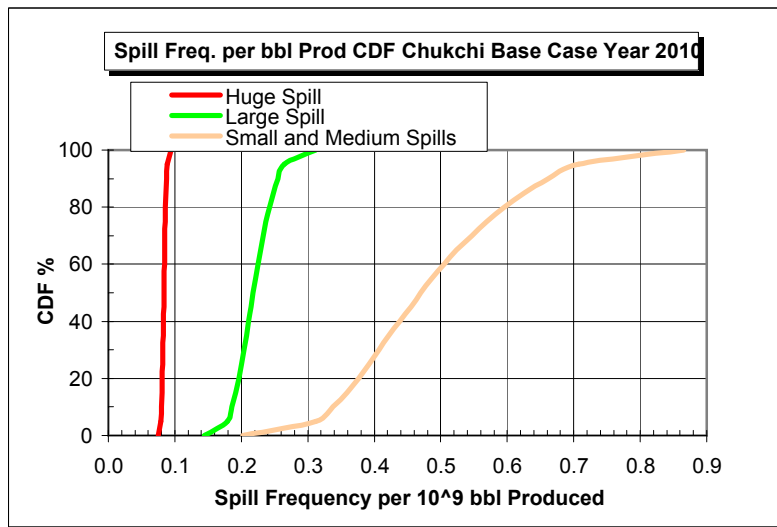
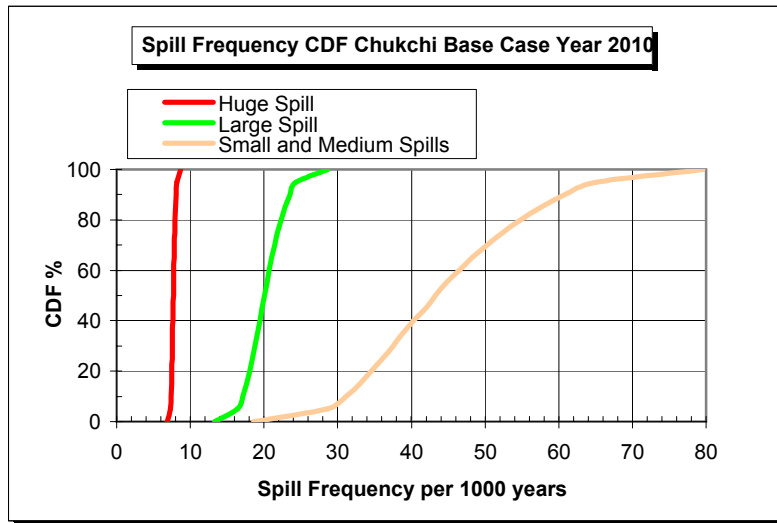


Figure 4.5.13



**Table 4.6.2
Arctic Spill Occurrence Chukchi Sea HC P/L Summary**

Year	Production [Mmbbl]			Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills			
	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	
1998	0																					
1999	0																					
2000	0	3.394	0.197	8.302		3.213	11.696		3.410	7.154	28.129	2.334		41.316	21.183							72.855
2001	0	3.394	0.197	8.302		3.213	11.696		3.410	7.154	28.129	2.334		41.316	21.183							72.855
2002	0	3.394	0.197	8.302		3.213	11.696		3.410	7.154	28.129	2.334		41.316	21.183							72.855
2003	223	3.394	0.015	8.302	0.037	3.213	11.696	0.052	3.410	7.154	0.032	28.129	2.334	0.010	41.316	21.183	0.095					72.855
2004	297	3.394	0.011	8.302	0.028	3.213	11.696	0.039	3.410	7.154	0.024	28.129	2.334	0.008	41.316	21.183	0.071					72.855
2005	297	3.394	0.011	8.302	0.028	3.213	11.696	0.039	3.410	7.154	0.024	28.129	2.334	0.008	41.316	21.183	0.071					72.855
2006	297	3.394	0.011	8.302	0.028	3.213	11.696	0.039	3.410	7.154	0.024	28.129	2.334	0.008	41.316	21.183	0.071					72.855
2007	297	3.394	0.011	8.302	0.028	3.213	11.696	0.039	3.410	7.154	0.024	28.129	2.334	0.008	41.316	21.183	0.071					72.855
2008	297	3.394	0.011	8.302	0.028	3.213	11.696	0.039	3.410	7.154	0.024	28.129	2.334	0.008	41.316	21.183	0.071					72.855
2009	262	3.394	0.013	8.302	0.032	3.213	11.696	0.045	3.410	7.154	0.027	28.129	2.334	0.009	41.316	21.183	0.081					72.855
2010	227	3.394	0.015	8.302	0.037	3.213	11.696	0.052	3.410	7.154	0.032	28.129	2.334	0.010	41.316	21.183	0.093					72.855

**Table 4.6.3
Arctic Spill Occurrence Chukchi Sea HC Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
1999	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep			1.163			0.227		
	Total								
2000	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	2		1.163			0.227		
	Total	2							
2001	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	8	50	1.163	5.817	0.92	0.227	1.137	6.97
	Total	8	50		5.817	0.92		1.137	6.97
2002	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	12	130	1.163	15.124	2.39	0.227	2.956	18.12
	Total	12	130		15.124	2.39		2.956	18.12
2003	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	12	270	1.163	31.411	4.96	0.227	6.139	37.63
	Total	12	270		31.411	4.96		6.139	37.63
2004	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	12	410	1.163	47.698	7.54	0.227	9.323	57.15
	Total	12	410		47.698	7.54		9.323	57.15
2005	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	12	482	1.163	56.075	8.86	0.227	10.960	67.19
	Total	12	482		56.075	8.86		10.960	67.19
2006	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	12	482	1.163	56.075	8.86	0.227	10.960	67.19
	Total	12	482		56.075	8.86		10.960	67.19
2007	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	12	482	1.163	56.075	8.86	0.227	10.960	67.19
	Total	12	482		56.075	8.86		10.960	67.19
2008	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	12	482	1.163	56.075	8.86	0.227	10.960	67.19
	Total	12	482		56.075	8.86		10.960	67.19
2009	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	12	482	1.163	56.075	8.86	0.227	10.960	67.19
	Total	12	482		56.075	8.86		10.960	67.19
2010	Shallow			0.964			0.192		
	Medium			1.044			0.206		
	Deep	12	482	1.163	56.075	8.86	0.227	10.960	67.19
	Total	12	482		56.075	8.86		10.960	67.19

**Table 4.6.4
Arctic Spill Occurrence Chukchi Sea HC Platforms Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
1998	0									
1999	0									
2000	0									
2001	0	5.817		0.919	1.137		6.969	6.954		7.889
2002	0	15.124		2.390	2.956		18.121	18.080		20.510
2003	223	31.411	0.141	4.963	6.139	0.028	37.635	37.551	0.168	42.598
2004	297	47.698	0.161	7.536	9.323	0.031	57.149	57.021	0.192	64.686
2005	297	56.075	0.189	8.860	10.960	0.037	67.185	67.035	0.226	76.045
2006	297	56.075	0.189	8.860	10.960	0.037	67.185	67.035	0.226	76.045
2007	297	56.075	0.189	8.860	10.960	0.037	67.185	67.035	0.226	76.045
2008	297	56.075	0.189	8.860	10.960	0.037	67.185	67.035	0.226	76.045
2009	262	56.075	0.214	8.860	10.960	0.042	67.185	67.035	0.256	76.045
2010	227	56.075	0.247	8.860	10.960	0.048	67.185	67.035	0.295	76.045

**Table 4.6.5
Arctic Spill Occurrence Chukchi Sea HC Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
1999	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2000	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2001	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	50	0.500	0.250	0.13	3.500	1.750	7.88	1.500	0.750	15.00	1.000	0.500	100.00
	Total	50		0.250	0.13		1.750	7.88		0.750	15.00		0.500	100.00
2002	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	130	0.500	0.650	0.33	3.500	4.550	20.48	1.500	1.950	39.00	1.000	1.300	260.00
	Total	130		0.650	0.33		4.550	20.48		1.950	39.00		1.300	260.00
2003	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	270	0.500	1.350	0.68	3.500	9.450	42.53	1.500	4.050	81.00	1.000	2.700	540.00
	Total	270		1.350	0.68		9.450	42.53		4.050	81.00		2.700	540.00
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	410	0.500	2.050	1.03	3.500	14.350	64.58	1.500	6.150	123.00	1.000	4.100	820.00
	Total	410		2.050	1.03		14.350	64.58		6.150	123.00		4.100	820.00
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2009	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2010	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00

Table 4.6.6

Arctic Spill Occurrence Chukchi Sea HC Production Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0												
1999	0												
2000	0												
2001	0	0.250		0.125	0.750		7.875	1.250		115.000	2.250		123.000
2002	0	0.650		0.325	1.950		20.475	3.250		299.000	5.850		319.800
2003	223	1.350	0.006	0.675	4.050	0.018	42.525	6.750	0.030	621.000	12.150	0.054	664.200
2004	297	2.050	0.007	1.025	6.150	0.021	64.575	10.250	0.035	943.000	18.450	0.062	1008.600
2005	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2006	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2007	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2008	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2009	262	2.410	0.009	1.205	7.230	0.028	75.915	12.050	0.046	1108.600	21.690	0.083	1185.720
2010	227	2.410	0.011	1.205	7.230	0.032	75.915	12.050	0.053	1108.600	21.690	0.096	1185.720

**Table 4.6.7
Arctic Spill Occurrence Chukchi Sea HC Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	3	3.160	0.095	0.05	22.110	0.663	2.98	9.500	0.285	5.70	5.500	0.165	33.00
	Total	3		0.095	0.05		0.663	2.98		0.285	5.70		0.165	33.00
1999	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2000	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2001	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2002	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2003	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2004	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2005	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2006	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2007	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2008	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2010	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.6.8

Arctic Spill Occurrence Chukchi Sea HC Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0	0.095		0.047	0.285		2.985	0.450		38.700	0.830		41.732
1999	0	0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2000	0	0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2001	0												
2002	0												
2003	223												
2004	297												
2005	297												
2006	297												
2007	297												
2008	297												
2009	262												
2010	227												

**Table 4.6.9
Arctic Spill Occurrence Chukchi Sea HC Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep	1	1.300	0.013	0.01	9.080	0.091	0.41	3.900	0.039	0.78	3.900	0.039	7.80
	Total	1		0.013	0.01		0.091	0.41		0.039	0.78		0.039	7.80
1999	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep	1	1.300	0.013	0.01	9.080	0.091	0.41	3.900	0.039	0.78	3.900	0.039	7.80
	Total	1		0.013	0.01		0.091	0.41		0.039	0.78		0.039	7.80
2000	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2001	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2002	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2003	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2009	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.6.10

Arctic Spill Occurrence Chukchi Sea HC Development Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0	0.013		0.007	0.039		0.409	0.078		8.580	0.130		8.995
1999	0	0.013		0.007	0.039		0.409	0.078		8.580	0.130		8.995
2000	0												
2001	0												
2002	0												
2003	223												
2004	297												
2005	297												
2006	297												
2007	297												
2008	297												
2009	262												
2010	227												

**Table 4.6.11
Arctic Spill Occurrence Chukchi Sea HC Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]
1998	Pipeline	0												
	Platforms													
	Production Wells													
	Exploration Wells		0.095	0.047	0.285	2.985	0.450		38.700	0.830		41.732		
	Development Wells		0.013	0.007	0.039	0.409	0.078		8.580	0.130		8.995		
Total	0.108	0.054	0.324	3.393	0.528		47.280	0.960		50.727				
1999	Pipeline	0												
	Platforms													
	Production Wells													
	Exploration Wells		0.063	0.032	0.190	1.990	0.300		25.800	0.553		27.822		
	Development Wells		0.013	0.007	0.039	0.409	0.078		8.580	0.130		8.995		
Total	0.076	0.038	0.229	2.399	0.378		34.380	0.683		36.817				
2000	Pipeline	0	11.696	3.410	7.154	28.129	2.334		41.316	21.183		72.855		
	Platforms													
	Production Wells													
	Exploration Wells		0.063	0.032	0.190	1.990	0.300		25.800	0.553		27.822		
	Development Wells													
Total	11.759	3.441	7.344	30.119	2.634		67.116	21.737		100.677				
2001	Pipeline	0	11.696	3.410	7.154	28.129	2.334		41.316	21.183		72.855		
	Platforms		5.817	0.919	1.137	6.969				6.954		7.889		
	Production Wells		0.250	0.125	0.750	7.875	1.250		115.000	2.250		123.000		
	Exploration Wells													
	Development Wells													
Total	17.763	4.454	9.041	42.974	3.584		156.316	30.387		203.744				
2002	Pipeline	0	11.696	3.410	7.154	28.129	2.334		41.316	21.183		72.855		
	Platforms		15.124	2.390	2.956	18.121				18.080		20.510		
	Production Wells		0.650	0.325	1.950	20.475	3.250		299.000	5.850		319.800		
	Exploration Wells													
	Development Wells													
Total	27.470	6.124	12.060	66.725	5.584		340.316	45.113		413.165				
2003	Pipeline	223.0	11.696	0.052	3.410	7.154	0.032	28.129	2.334	0.010	41.316	21.183	0.095	72.855
	Platforms		31.411	0.141	4.963	6.139	0.028	37.635				37.551	0.168	42.598
	Production Wells		1.350	0.006	0.675	4.050	0.018	42.525	6.750	0.030	621.000	12.150	0.054	664.200
	Exploration Wells													
	Development Wells													
Total	44.457	0.199	9.048	17.343	0.078	108.289	9.084	0.041	662.316	70.884	0.318	779.653		
2004	Pipeline	297.0	11.696	0.039	3.410	7.154	0.024	28.129	2.334	0.008	41.316	21.183	0.071	72.855
	Platforms		47.698	0.161	7.536	9.323	0.031	57.149				57.021	0.192	64.686
	Production Wells		2.050	0.007	1.025	6.150	0.021	64.575	10.250	0.035	943.000	18.450	0.062	1008.600
	Exploration Wells													
	Development Wells													
Total	61.444	0.207	11.971	22.627	0.076	149.854	12.584	0.042	984.316	96.654	0.325	1146.141		
2005	Pipeline	297.0	11.696	0.039	3.410	7.154	0.024	28.129	2.334	0.008	41.316	21.183	0.071	72.855
	Platforms		56.075	0.189	8.860	10.960	0.037	67.185				67.035	0.226	76.045
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
	Exploration Wells													
	Development Wells													
Total	70.180	0.236	13.475	25.344	0.085	171.230	14.384	0.048	1149.916	109.908	0.370	1334.620		
2006	Pipeline	297.0	11.696	0.039	3.410	7.154	0.024	28.129	2.334	0.008	41.316	21.183	0.071	72.855
	Platforms		56.075	0.189	8.860	10.960	0.037	67.185				67.035	0.226	76.045
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
	Exploration Wells													
	Development Wells													
Total	70.180	0.236	13.475	25.344	0.085	171.230	14.384	0.048	1149.916	109.908	0.370	1334.620		
2007	Pipeline	297.0	11.696	0.039	3.410	7.154	0.024	28.129	2.334	0.008	41.316	21.183	0.071	72.855
	Platforms		56.075	0.189	8.860	10.960	0.037	67.185				67.035	0.226	76.045
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
	Exploration Wells													
	Development Wells													
Total	70.180	0.236	13.475	25.344	0.085	171.230	14.384	0.048	1149.916	109.908	0.370	1334.620		

**Table 4.6.11
Arctic Spill Occurrence Chukchi Sea HC Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills			
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	
2008	Pipeline	297.0	11.696	0.039	3.410	7.154	0.024	28.129	2.334	0.008	41.316	21.183	0.071	72.855	
	Platforms		56.075	0.189	8.860	10.960	0.037	67.185				67.035	0.226	76.045	
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720	
	Exploration Wells														
	Development Wells														
	Total		70.180	0.236	13.475	25.344	0.085	171.230	14.384	0.048	1149.916	109.908	0.370	1334.620	
2009	Pipeline	262.0	11.696	0.045	3.410	7.154	0.027	28.129	2.334	0.009	41.316	21.183	0.081	72.855	
	Platforms		56.075	0.214	8.860	10.960	0.042	67.185				67.035	0.256	76.045	
	Production Wells		2.410	0.009	1.205	7.230	0.028	75.915	12.050	0.046	1108.600	21.690	0.083	1185.720	
	Exploration Wells														
	Development Wells														
	Total		70.180	0.268	13.475	25.344	0.097	171.230	14.384	0.055	1149.916	109.908	0.419	1334.620	
2010	Pipeline	227.0	11.696	0.052	3.410	7.154	0.032	28.129	2.334	0.010	41.316	21.183	0.093	72.855	
	Platforms		56.075	0.247	8.860	10.960	0.048	67.185				67.035	0.295	76.045	
	Production Wells		2.410	0.011	1.205	7.230	0.032	75.915	12.050	0.053	1108.600	21.690	0.096	1185.720	
	Exploration Wells														
	Development Wells														
	Total		70.180	0.309	13.475	25.344	0.112	171.230	14.384	0.063	1149.916	109.908	0.484	1334.620	

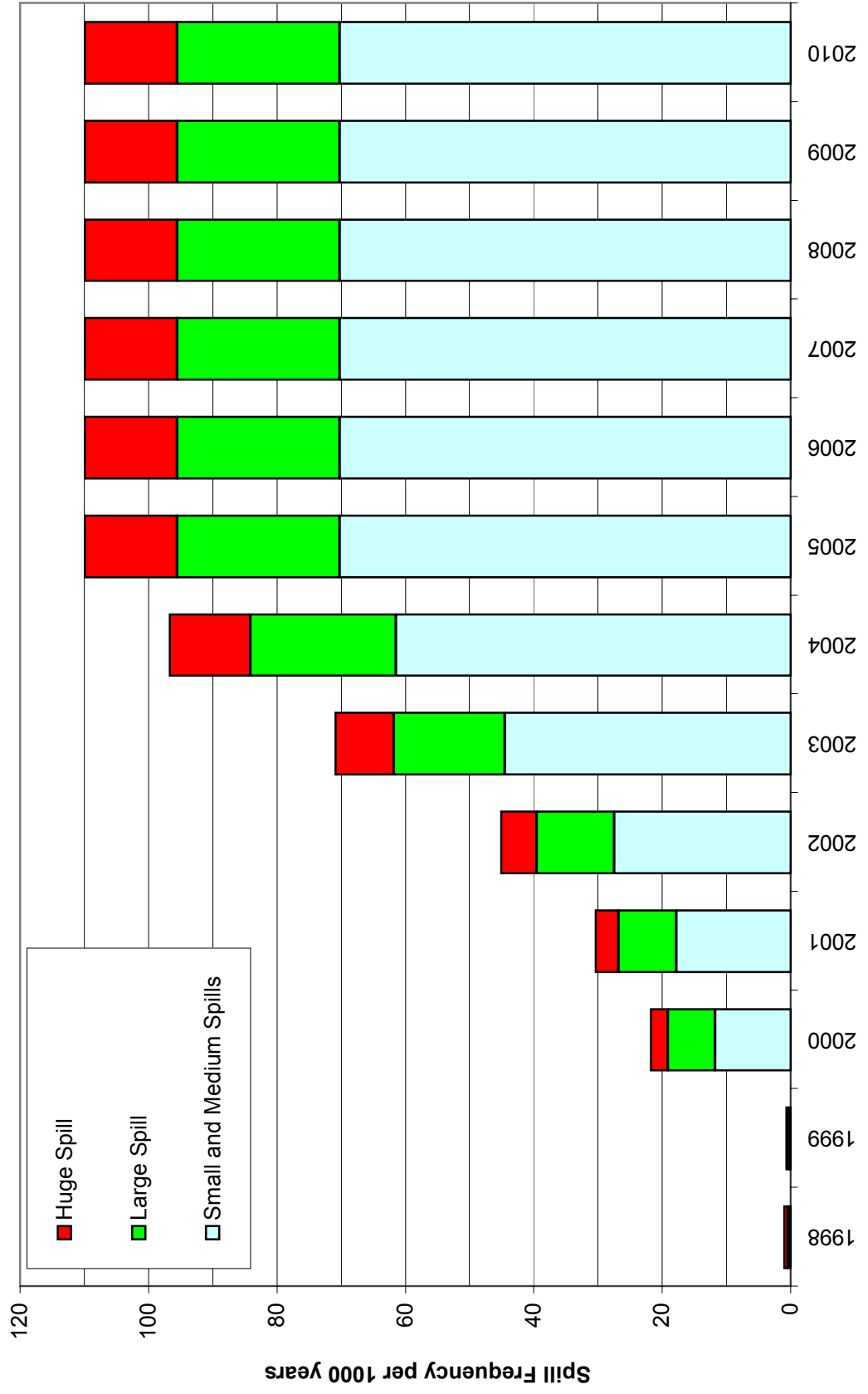
**Table 4.6.12
Arctic Spill Occurrence Chukchi Sea HC Annual Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
1998	0	0.11		0.054	0.32		3.393	0.528		47.28	0.960		50.727
1999	0	0.08		0.038	0.23		2.399	0.378		34.38	0.683		36.817
2000	0	11.76		3.441	7.34		30.119	2.634		67.12	21.737		100.677
2001	0	17.76		4.454	9.04		42.974	3.584		156.32	30.387		203.744
2002	0	27.47		6.124	12.06		66.725	5.584		340.32	45.113		413.165
2003	223	44.46	0.199	9.048	17.34	0.078	108.289	9.084	0.041	662.32	70.884	0.318	779.653
2004	297	61.44	0.207	11.971	22.63	0.076	149.854	12.584	0.042	984.32	96.654	0.325	1146.141
2005	297	70.18	0.236	13.475	25.34	0.085	171.230	14.384	0.048	1149.92	109.908	0.370	1334.620
2006	297	70.18	0.236	13.475	25.34	0.085	171.230	14.384	0.048	1149.92	109.908	0.370	1334.620
2007	297	70.18	0.236	13.475	25.34	0.085	171.230	14.384	0.048	1149.92	109.908	0.370	1334.620
2008	297	70.18	0.236	13.475	25.34	0.085	171.230	14.384	0.048	1149.92	109.908	0.370	1334.620
2009	262	70.18	0.268	13.475	25.34	0.097	171.230	14.384	0.055	1149.92	109.908	0.419	1334.620
2010	227	70.18	0.309	13.475	25.34	0.112	171.230	14.384	0.063	1149.92	109.908	0.484	1334.620

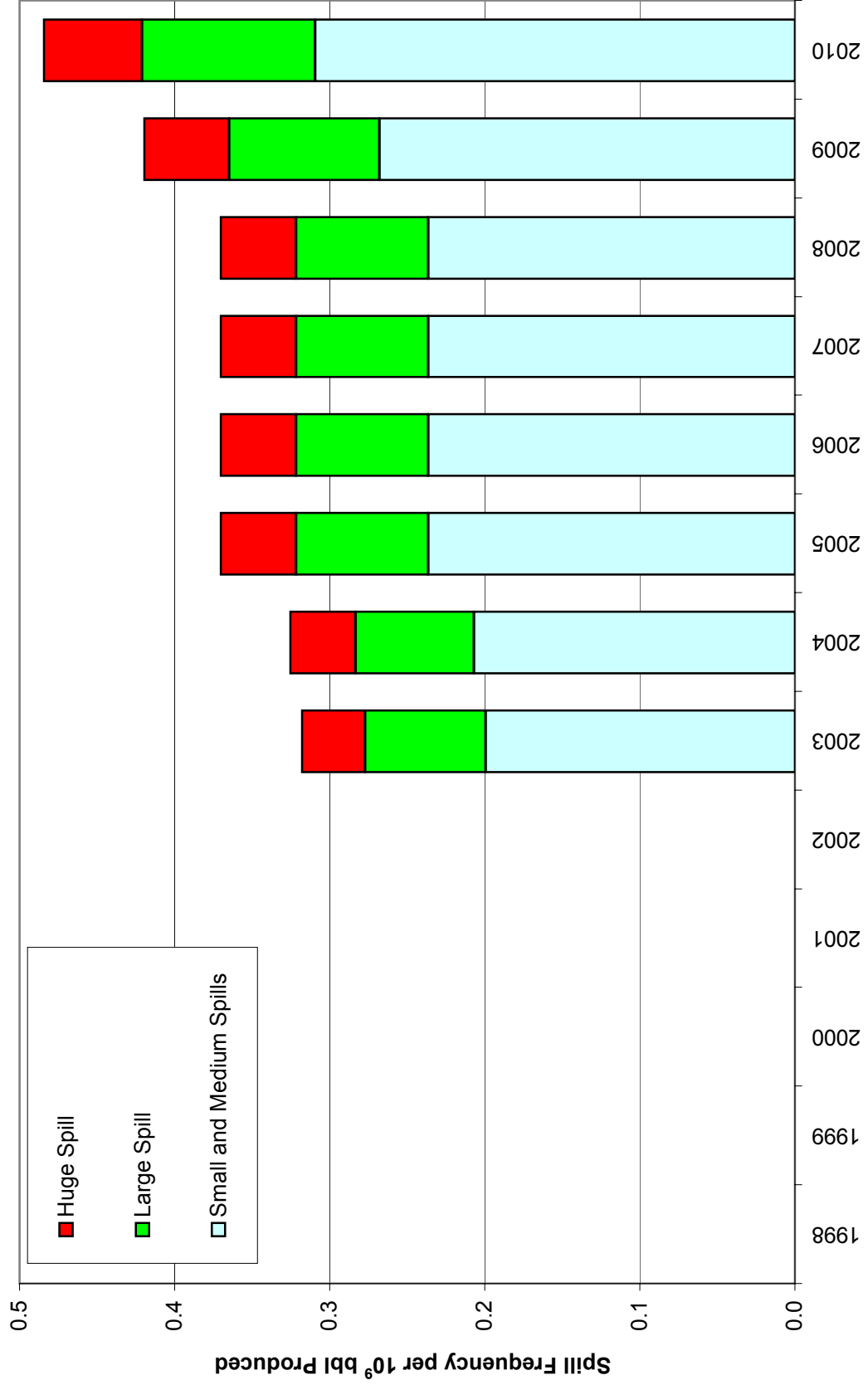
**Table 4.6.14
Chukchi Sea High Case 2010 - Monte Carlo Results**

High Case	Small and Medium Spills			Large Spill			Huge Spill		
Year 2010	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
Mean =	88.00	0.388	16.36	36.48	0.161	239.47	14.40	0.063	1150.25
Std Deviation =	25.21	0.111	3.99	5.24	0.023	31.90	0.26	0.001	4.56
Variance =	635.37	0.012	15.88	27.51	0.001	1017.45	0.07	0.000	20.77
Skewness =	0.43	0.433	0.43	0.32	0.323	0.33	0.15	0.152	0.15
Kurtosis =	2.51	2.509	2.51	2.77	2.768	2.76	2.86	2.858	2.86
Mode =	67.50	0.446	16.59	32.36	0.143	235.62	14.06	0.062	1150.58
Minimum =	31.63	0.139	7.37	22.55	0.099	158.10	13.62	0.060	1136.31
5% Perc =	52.03	0.229	10.67	28.46	0.125	190.25	13.99	0.062	1142.98
10% Perc =	57.45	0.253	11.52	29.89	0.132	199.48	14.07	0.062	1144.42
15% Perc =	61.42	0.271	12.17	30.86	0.136	205.51	14.13	0.062	1145.41
20% Perc =	65.19	0.287	12.78	31.79	0.140	210.82	14.18	0.062	1146.31
25% Perc =	68.30	0.301	13.27	32.63	0.144	216.04	14.22	0.063	1147.08
30% Perc =	71.66	0.316	13.78	33.35	0.147	220.48	14.26	0.063	1147.66
35% Perc =	74.81	0.330	14.26	34.09	0.150	224.92	14.29	0.063	1148.31
40% Perc =	78.05	0.344	14.78	34.78	0.153	228.92	14.33	0.063	1148.90
45% Perc =	81.02	0.357	15.28	35.53	0.157	233.62	14.36	0.063	1149.57
50% Perc =	84.48	0.372	15.79	36.15	0.159	237.36	14.40	0.063	1150.15
55% Perc =	88.47	0.390	16.43	36.77	0.162	241.19	14.43	0.064	1150.72
60% Perc =	92.20	0.406	17.04	37.60	0.166	246.23	14.47	0.064	1151.37
65% Perc =	96.19	0.424	17.68	38.41	0.169	251.04	14.50	0.064	1151.99
70% Perc =	100.51	0.443	18.36	39.12	0.172	255.73	14.54	0.064	1152.63
75% Perc =	105.37	0.464	19.10	39.95	0.176	260.75	14.58	0.064	1153.36
80% Perc =	110.61	0.487	19.97	40.92	0.180	266.51	14.62	0.064	1154.07
85% Perc =	116.86	0.515	20.93	42.09	0.185	273.26	14.67	0.065	1155.01
90% Perc =	124.54	0.549	22.19	43.52	0.192	282.20	14.74	0.065	1156.23
95% Perc =	133.85	0.590	23.62	45.63	0.201	295.19	14.83	0.065	1157.90
Maximum =	163.02	0.718	28.12	54.94	0.242	354.85	15.28	0.067	1165.81

Chukchi Sea HC Spill Frequency



Chukchi Sea HC Spill Frequency per 10⁹ bbl Produced



Chukchi Sea HC Spill Index

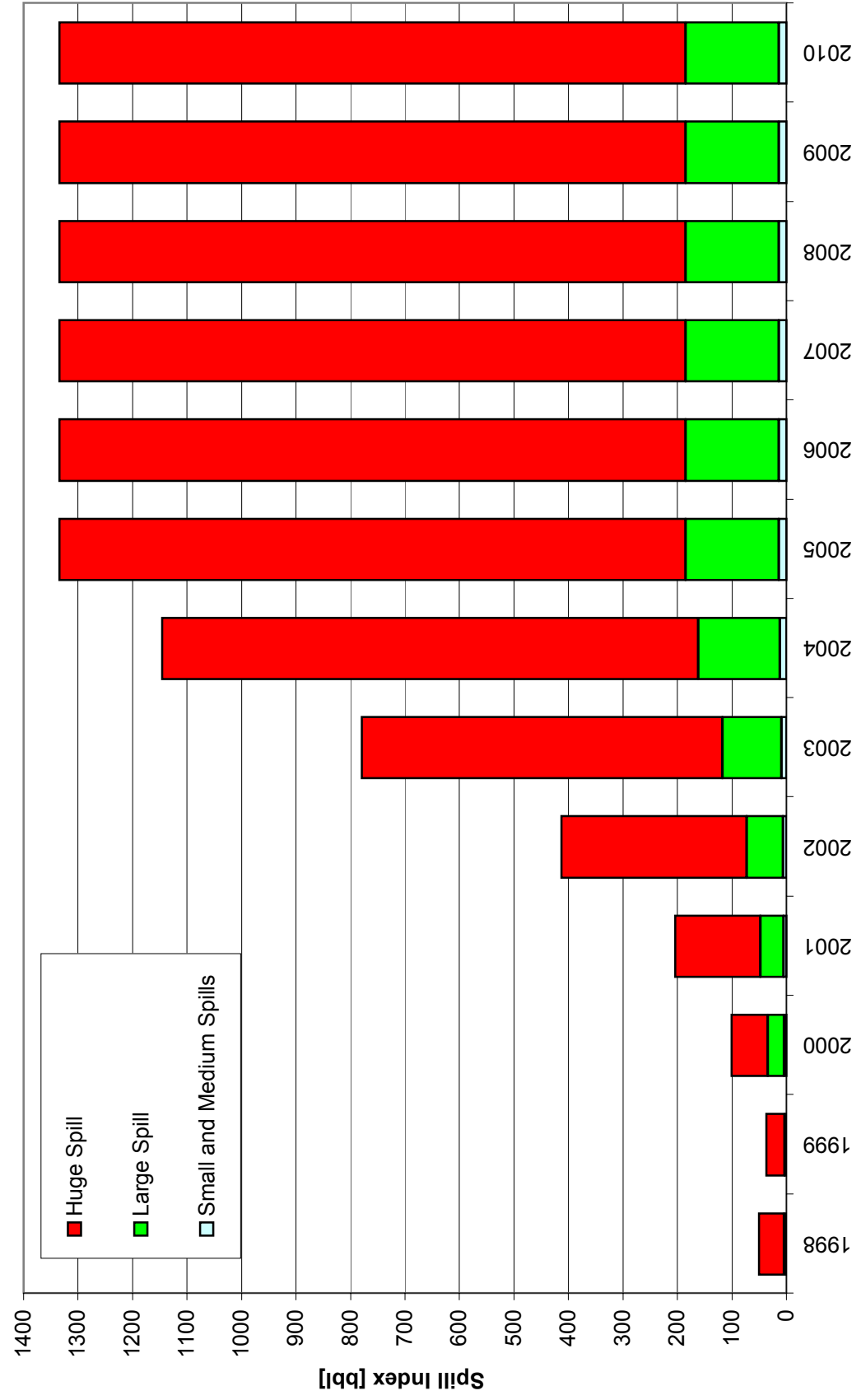
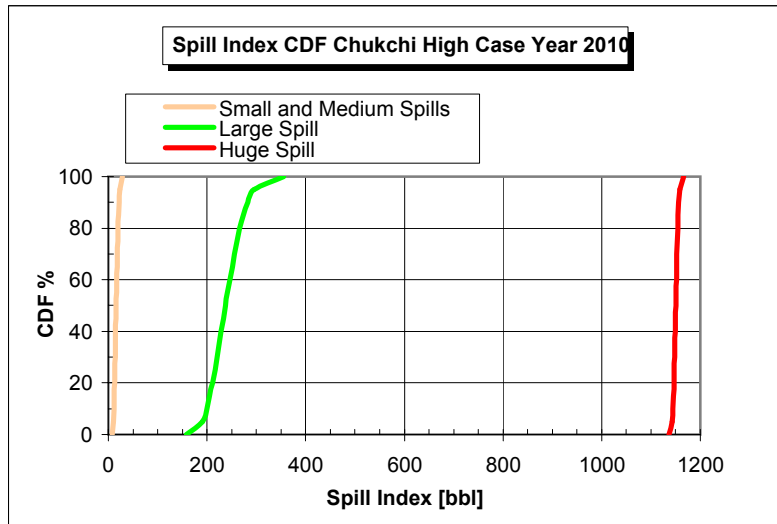
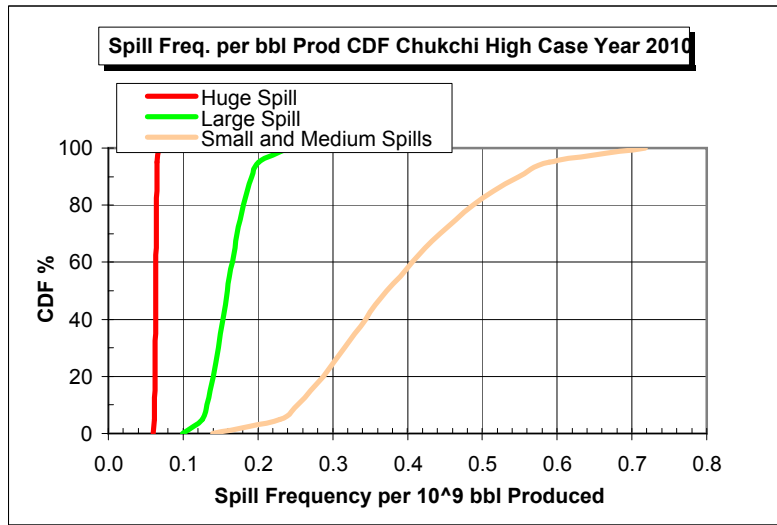
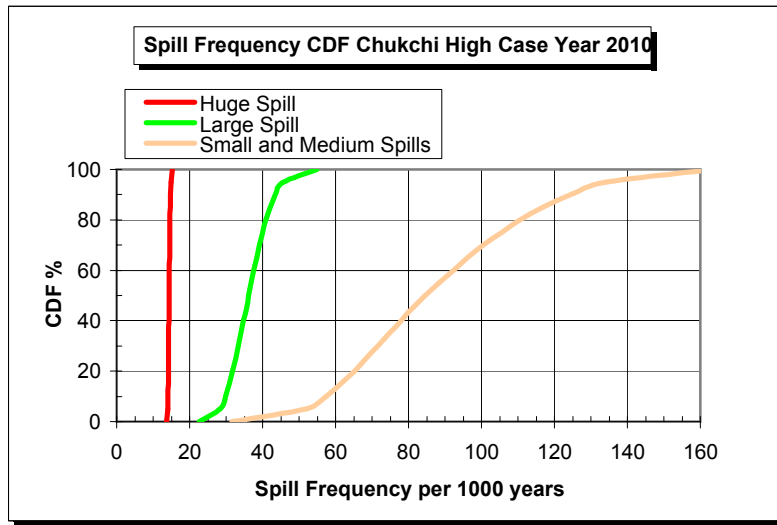


Figure 4.6.13



**Table 4.6A.2
Non Arctic Spill Occurrence Chukchi Sea HC P/L Summary**

Year	Production [Mmbbl]	Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	10 ⁹ bbl Produced	Spill Index [bbl]
1998	0																		
1999	0																		
2000	0	5.798		0.336	14.494	5.609	20.292	5.945	17.393	68.389	5.798	102.647	43.482						176.982
2001	0	5.798		0.336	14.494	5.609	20.292	5.945	17.393	68.389	5.798	102.647	43.482						176.982
2002	0	5.798		0.336	14.494	5.609	20.292	5.945	17.393	68.389	5.798	102.647	43.482						176.982
2003	223	5.798	0.026	0.336	14.494	5.609	20.292	0.091	5.945	17.393	0.078	68.389	0.026	0.026	102.647	43.482	0.195	176.982	
2004	297	5.798	0.020	0.336	14.494	5.609	20.292	0.068	5.945	17.393	0.059	68.389	0.020	0.020	102.647	43.482	0.146	176.982	
2005	297	5.798	0.020	0.336	14.494	5.609	20.292	0.068	5.945	17.393	0.059	68.389	0.020	0.020	102.647	43.482	0.146	176.982	
2006	297	5.798	0.020	0.336	14.494	5.609	20.292	0.068	5.945	17.393	0.059	68.389	0.020	0.020	102.647	43.482	0.146	176.982	
2007	297	5.798	0.020	0.336	14.494	5.609	20.292	0.068	5.945	17.393	0.059	68.389	0.020	0.020	102.647	43.482	0.146	176.982	
2008	297	5.798	0.020	0.336	14.494	5.609	20.292	0.068	5.945	17.393	0.059	68.389	0.020	0.020	102.647	43.482	0.146	176.982	
2009	262	5.798	0.022	0.336	14.494	5.609	20.292	0.077	5.945	17.393	0.066	68.389	0.022	0.022	102.647	43.482	0.166	176.982	
2010	227	5.798	0.026	0.336	14.494	5.609	20.292	0.089	5.945	17.393	0.077	68.389	0.026	0.026	102.647	43.482	0.192	176.982	

**Table 4.6A.3
Non Arctic Spill Occurrence Chukchi Sea HC Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep			1.504			0.251		
	Total								
1999	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep			1.504			0.251		
	Total								
2000	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	2		1.504			0.251		
	Total	2							
2001	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	8	50	1.504	7.518	1.19	0.251	1.253	7.68
	Total	8	50		7.518	1.19		1.253	7.68
2002	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	130	1.504	19.547	3.09	0.251	3.258	19.97
	Total	12	130		19.547	3.09		3.258	19.97
2003	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	270	1.504	40.597	6.41	0.251	6.766	41.48
	Total	12	270		40.597	6.41		6.766	41.48
2004	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	410	1.504	61.647	9.74	0.251	10.274	62.98
	Total	12	410		61.647	9.74		10.274	62.98
2005	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	482	1.504	72.473	11.45	0.251	12.079	74.04
	Total	12	482		72.473	11.45		12.079	74.04
2006	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	482	1.504	72.473	11.45	0.251	12.079	74.04
	Total	12	482		72.473	11.45		12.079	74.04
2007	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	482	1.504	72.473	11.45	0.251	12.079	74.04
	Total	12	482		72.473	11.45		12.079	74.04
2008	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	482	1.504	72.473	11.45	0.251	12.079	74.04
	Total	12	482		72.473	11.45		12.079	74.04
2009	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	482	1.504	72.473	11.45	0.251	12.079	74.04
	Total	12	482		72.473	11.45		12.079	74.04
2010	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	482	1.504	72.473	11.45	0.251	12.079	74.04
	Total	12	482		72.473	11.45		12.079	74.04

**Table 4.6A.4
Non Artic Spill Occurrence Chukchi Sea HC Platforms Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
1998	0									
1999	0									
2000	0									
2001	0	7.518		1.188	1.253		7.681	8.771		8.869
2002	0	19.547		3.088	3.258		19.970	22.804		23.058
2003	223	40.597	0.182	6.414	6.766	0.030	41.476	47.363	0.212	47.891
2004	297	61.647	0.208	9.740	10.274	0.035	62.983	71.921	0.242	72.723
2005	297	72.473	0.244	11.451	12.079	0.041	74.043	84.552	0.285	85.494
2006	297	72.473	0.244	11.451	12.079	0.041	74.043	84.552	0.285	85.494
2007	297	72.473	0.244	11.451	12.079	0.041	74.043	84.552	0.285	85.494
2008	297	72.473	0.244	11.451	12.079	0.041	74.043	84.552	0.285	85.494
2009	262	72.473	0.277	11.451	12.079	0.046	74.043	84.552	0.323	85.494
2010	227	72.473	0.319	11.451	12.079	0.053	74.043	84.552	0.372	85.494

**Table 4.6A.5
Non Arctic Spill Occurrence Chukchi Sea HC Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
1999	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2000	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2001	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	50	0.500	0.250	0.13	3.500	1.750	7.88	1.500	0.750	15.00	1.000	0.500	100.00
	Total	50		0.250	0.13		1.750	7.88		0.750	15.00		0.500	100.00
2002	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	130	0.500	0.650	0.33	3.500	4.550	20.48	1.500	1.950	39.00	1.000	1.300	260.00
	Total	130		0.650	0.33		4.550	20.48		1.950	39.00		1.300	260.00
2003	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	270	0.500	1.350	0.68	3.500	9.450	42.53	1.500	4.050	81.00	1.000	2.700	540.00
	Total	270		1.350	0.68		9.450	42.53		4.050	81.00		2.700	540.00
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	410	0.500	2.050	1.03	3.500	14.350	64.58	1.500	6.150	123.00	1.000	4.100	820.00
	Total	410		2.050	1.03		14.350	64.58		6.150	123.00		4.100	820.00
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2009	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2010	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00

Table 4.6A.6

Non Artic Spill Occurrence Chukchi Sea HC Production Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0												
1999	0												
2000	0												
2001	0	0.250		0.125	0.750		7.875	1.250		115.000	2.250		123.000
2002	0	0.650		0.325	1.950		20.475	3.250		299.000	5.850		319.800
2003	223	1.350	0.006	0.675	4.050	0.018	42.525	6.750	0.030	621.000	12.150	0.054	664.200
2004	297	2.050	0.007	1.025	6.150	0.021	64.575	10.250	0.035	943.000	18.450	0.062	1008.600
2005	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2006	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2007	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2008	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2009	262	2.410	0.009	1.205	7.230	0.028	75.915	12.050	0.046	1108.600	21.690	0.083	1185.720
2010	227	2.410	0.011	1.205	7.230	0.032	75.915	12.050	0.053	1108.600	21.690	0.096	1185.720

**Table 4.6A.7
Non Arctic Spill Occurrence Chukchi Sea HC Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	3	3.160	0.095	0.05	22.110	0.663	2.98	9.500	0.285	5.70	5.500	0.165	33.00
	Total	3		0.095	0.05		0.663	2.98		0.285	5.70		0.165	33.00
1999	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2000	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2001	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2002	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2003	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2004	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2005	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2006	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2007	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2008	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2010	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.6A.8

Non Arctic Spill Occurrence Chukchi Sea HC Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0	0.095		0.047	0.285		2.985	0.450		38.700	0.830		41.732
1999	0	0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2000	0	0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2001	0												
2002	0												
2003	223												
2004	297												
2005	297												
2006	297												
2007	297												
2008	297												
2009	262												
2010	227												

**Table 4.6A.9
Non Arctic Spill Occurrence Chukchi Sea HC Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep	1	1.300	0.013	0.01	9.080	0.091	0.41	3.900	0.039	0.78	3.900	0.039	7.80
	Total	1		0.013	0.01		0.091	0.41		0.039	0.78		0.039	7.80
1999	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep	1	1.300	0.013	0.01	9.080	0.091	0.41	3.900	0.039	0.78	3.900	0.039	7.80
	Total	1		0.013	0.01		0.091	0.41		0.039	0.78		0.039	7.80
2000	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2001	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2002	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2003	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2009	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.6A.10

Non Arctic Spill Occurrence Chukchi Sea HC Development Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0	0.013		0.007	0.039		0.409	0.078		8.580	0.130		8.995
1999	0	0.013		0.007	0.039		0.409	0.078		8.580	0.130		8.995
2000	0												
2001	0												
2002	0												
2003	223												
2004	297												
2005	297												
2006	297												
2007	297												
2008	297												
2009	262												
2010	227												

**Table 4.6A.11
Non Arctic Spill Occurrence Chukchi Sea HC Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]
1998	Pipeline	0												
	Platforms													
	Production Wells													
	Exploration Wells		0.095	0.047	0.285	2.985	0.450	38.700	0.830	41.732				
	Development Wells		0.013	0.007	0.039	0.409	0.078	8.580	0.130	8.995				
Total	0.108	0.054	0.324	3.393	0.528	47.280	0.960	50.727						
1999	Pipeline	0												
	Platforms													
	Production Wells													
	Exploration Wells		0.063	0.032	0.190	1.990	0.300	25.800	0.553	27.822				
	Development Wells		0.013	0.007	0.039	0.409	0.078	8.580	0.130	8.995				
Total	0.076	0.038	0.229	2.399	0.378	34.380	0.683	36.817						
2000	Pipeline	0	20.292	5.945	17.393	68.389	5.798	102.647	43.482	176.982				
	Platforms													
	Production Wells													
	Exploration Wells		0.063	0.032	0.190	1.990	0.300	25.800	0.553	27.822				
	Development Wells													
Total	20.355	5.977	17.583	70.379	6.098	128.447	44.035	204.803						
2001	Pipeline	0	20.292	5.945	17.393	68.389	5.798	102.647	43.482	176.982				
	Platforms		7.518	1.188	1.253	7.681			8.771	8.869				
	Production Wells		0.250	0.125	0.750	7.875	1.250	115.000	2.250	123.000				
	Exploration Wells													
	Development Wells													
Total	28.060	7.258	19.396	83.945	7.048	217.647	54.503	308.850						
2002	Pipeline	0	20.292	5.945	17.393	68.389	5.798	102.647	43.482	176.982				
	Platforms		19.547	3.088	3.258	19.970			22.804	23.058				
	Production Wells		0.650	0.325	1.950	20.475	3.250	299.000	5.850	319.800				
	Exploration Wells													
	Development Wells													
Total	40.488	9.359	22.601	108.834	9.048	401.647	72.137	519.840						
2003	Pipeline	223.0	20.292	0.091	5.945	17.393	0.078	68.389	5.798	0.026	102.647	43.482	0.195	176.982
	Platforms		40.597	0.182	6.414	6.766	0.030	41.476				47.363	0.212	47.891
	Production Wells		1.350	0.006	0.675	4.050	0.018	42.525	6.750	0.030	621.000	12.150	0.054	664.200
	Exploration Wells													
	Development Wells													
Total	62.238	0.279	13.035	28.209	0.126	152.390	12.548	0.056	723.647	102.995	0.462	889.072		
2004	Pipeline	297.0	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
	Platforms		61.647	0.208	9.740	10.274	0.035	62.983				71.921	0.242	72.723
	Production Wells		2.050	0.007	1.025	6.150	0.021	64.575	10.250	0.035	943.000	18.450	0.062	1008.600
	Exploration Wells													
	Development Wells													
Total	83.989	0.283	16.711	33.817	0.114	195.947	16.048	0.054	1045.647	133.854	0.451	1258.304		
2005	Pipeline	297.0	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
	Platforms		72.473	0.244	11.451	12.079	0.041	74.043				84.552	0.285	85.494
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
	Exploration Wells													
	Development Wells													
Total	95.174	0.320	18.601	36.702	0.124	218.347	17.848	0.060	1211.247	149.724	0.504	1448.195		
2006	Pipeline	297.0	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
	Platforms		72.473	0.244	11.451	12.079	0.041	74.043				84.552	0.285	85.494
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
	Exploration Wells													
	Development Wells													
Total	95.174	0.320	18.601	36.702	0.124	218.347	17.848	0.060	1211.247	149.724	0.504	1448.195		
2007	Pipeline	297.0	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
	Platforms		72.473	0.244	11.451	12.079	0.041	74.043				84.552	0.285	85.494
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
	Exploration Wells													
	Development Wells													
Total	95.174	0.320	18.601	36.702	0.124	218.347	17.848	0.060	1211.247	149.724	0.504	1448.195		

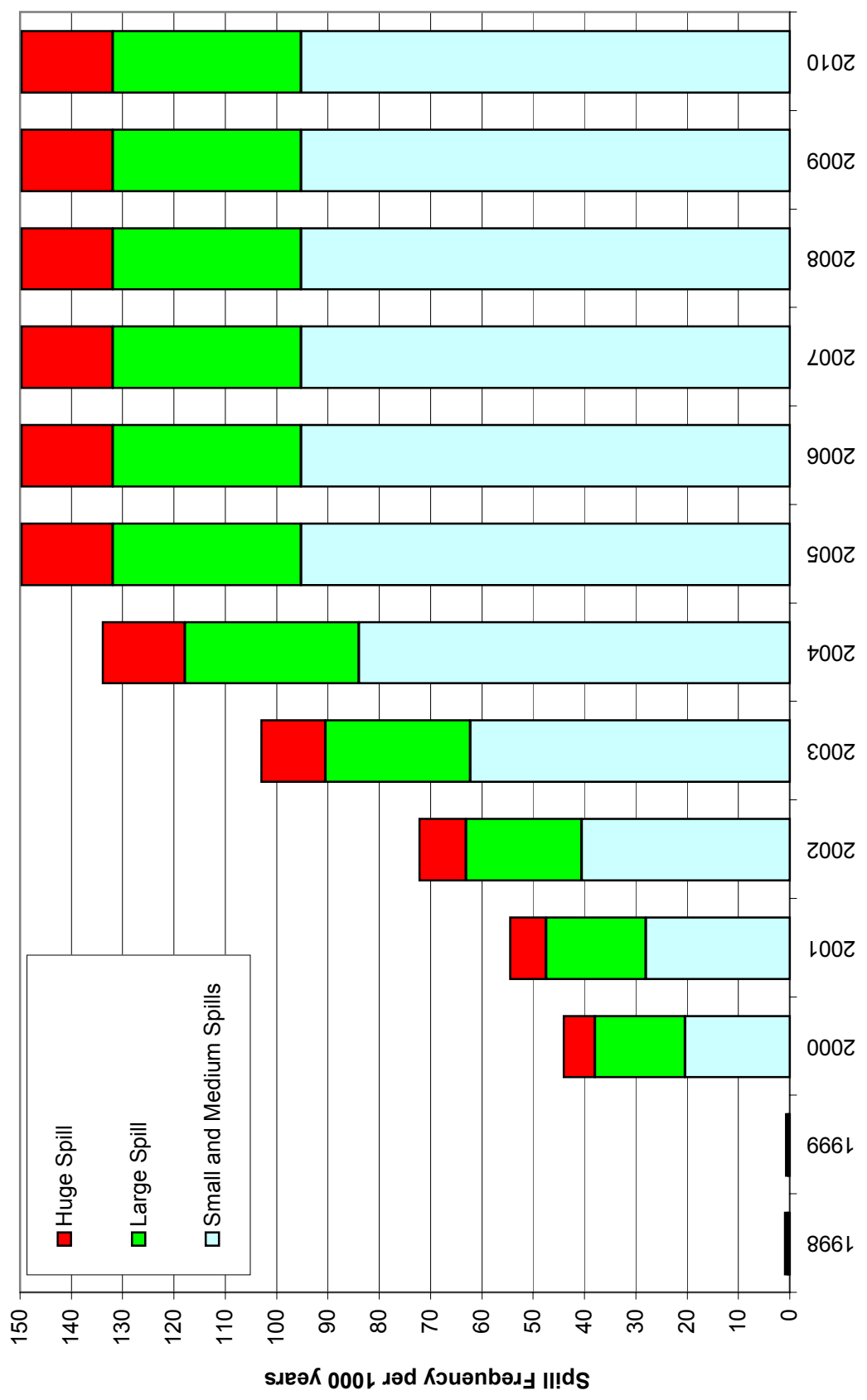
**Table 4.6A.11
Non Arctic Spill Occurrence Chukchi Sea HC Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills			
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	
2008	Pipeline	297.0	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982	
	Platforms		72.473	0.244	11.451	12.079	0.041	74.043				84.552	0.285	85.494	
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720	
	Exploration Wells														
	Development Wells														
	Total		95.174	0.320	18.601	36.702	0.124	218.347	17.848	0.060	1211.247	149.724	0.504	1448.195	
2009	Pipeline	262.0	20.292	0.077	5.945	17.393	0.066	68.389	5.798	0.022	102.647	43.482	0.166	176.982	
	Platforms		72.473	0.277	11.451	12.079	0.046	74.043				84.552	0.323	85.494	
	Production Wells		2.410	0.009	1.205	7.230	0.028	75.915	12.050	0.046	1108.600	21.690	0.083	1185.720	
	Exploration Wells														
	Development Wells														
	Total		95.174	0.363	18.601	36.702	0.140	218.347	17.848	0.068	1211.247	149.724	0.571	1448.195	
2010	Pipeline	227.0	20.292	0.089	5.945	17.393	0.077	68.389	5.798	0.026	102.647	43.482	0.192	176.982	
	Platforms		72.473	0.319	11.451	12.079	0.053	74.043				84.552	0.372	85.494	
	Production Wells		2.410	0.011	1.205	7.230	0.032	75.915	12.050	0.053	1108.600	21.690	0.096	1185.720	
	Exploration Wells														
	Development Wells														
	Total		95.174	0.419	18.601	36.702	0.162	218.347	17.848	0.079	1211.247	149.724	0.660	1448.195	

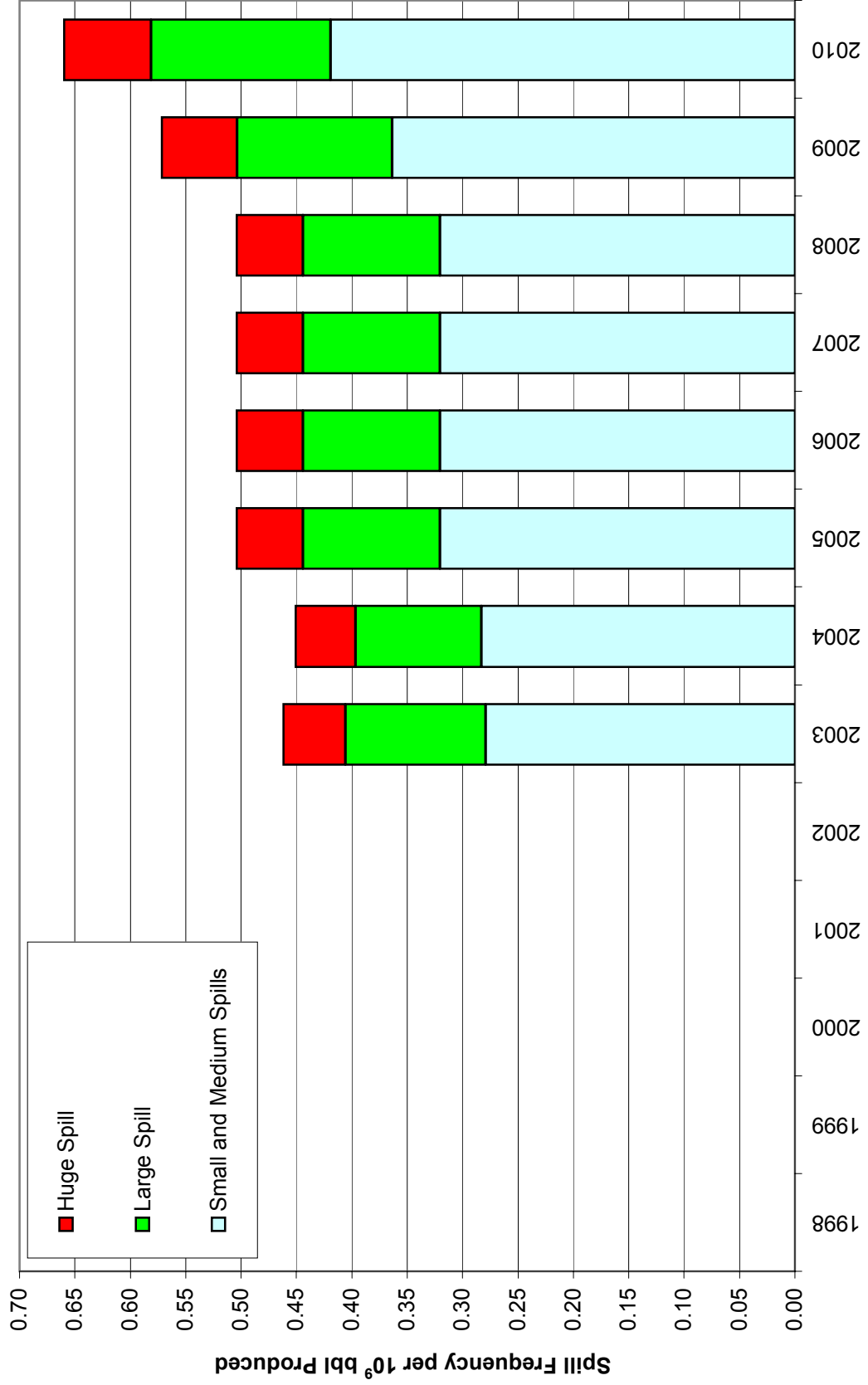
**Table 4.6A.12
Non Arctic Spill Occurrence Chukchi Sea HC Annual Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
1998	0	0.11		0.054	0.32		3.393	0.528		47.28	0.960		50.727
1999	0	0.08		0.038	0.23		2.399	0.378		34.38	0.683		36.817
2000	0	20.35		5.977	17.58		70.379	6.098		128.45	44.035		204.803
2001	0	28.06		7.258	19.40		83.945	7.048		217.65	54.503		308.850
2002	0	40.49		9.359	22.60		108.834	9.048		401.65	72.137		519.840
2003	223	62.24	0.279	13.035	28.21	0.126	152.390	12.548	0.056	723.65	102.995	0.462	889.072
2004	297	83.99	0.283	16.711	33.82	0.114	195.947	16.048	0.054	1045.65	133.854	0.451	1258.304
2005	297	95.17	0.320	18.601	36.70	0.124	218.347	17.848	0.060	1211.25	149.724	0.504	1448.195
2006	297	95.17	0.320	18.601	36.70	0.124	218.347	17.848	0.060	1211.25	149.724	0.504	1448.195
2007	297	95.17	0.320	18.601	36.70	0.124	218.347	17.848	0.060	1211.25	149.724	0.504	1448.195
2008	297	95.17	0.320	18.601	36.70	0.124	218.347	17.848	0.060	1211.25	149.724	0.504	1448.195
2009	262	95.17	0.363	18.601	36.70	0.140	218.347	17.848	0.068	1211.25	149.724	0.571	1448.195
2010	227	95.17	0.419	18.601	36.70	0.162	218.347	17.848	0.079	1211.25	149.724	0.660	1448.195

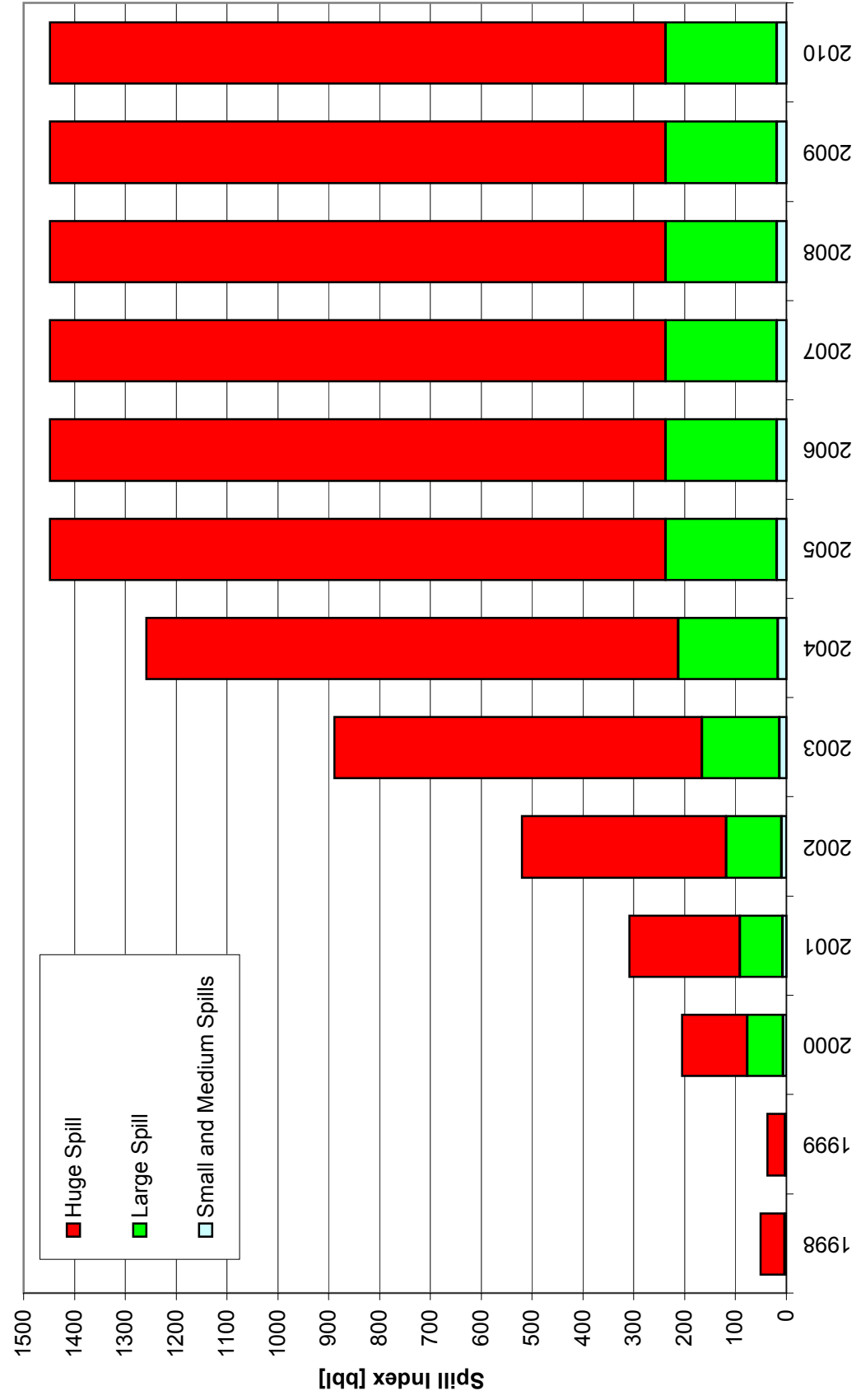
Chukchi Sea HC Spill Frequency - Non Arctic

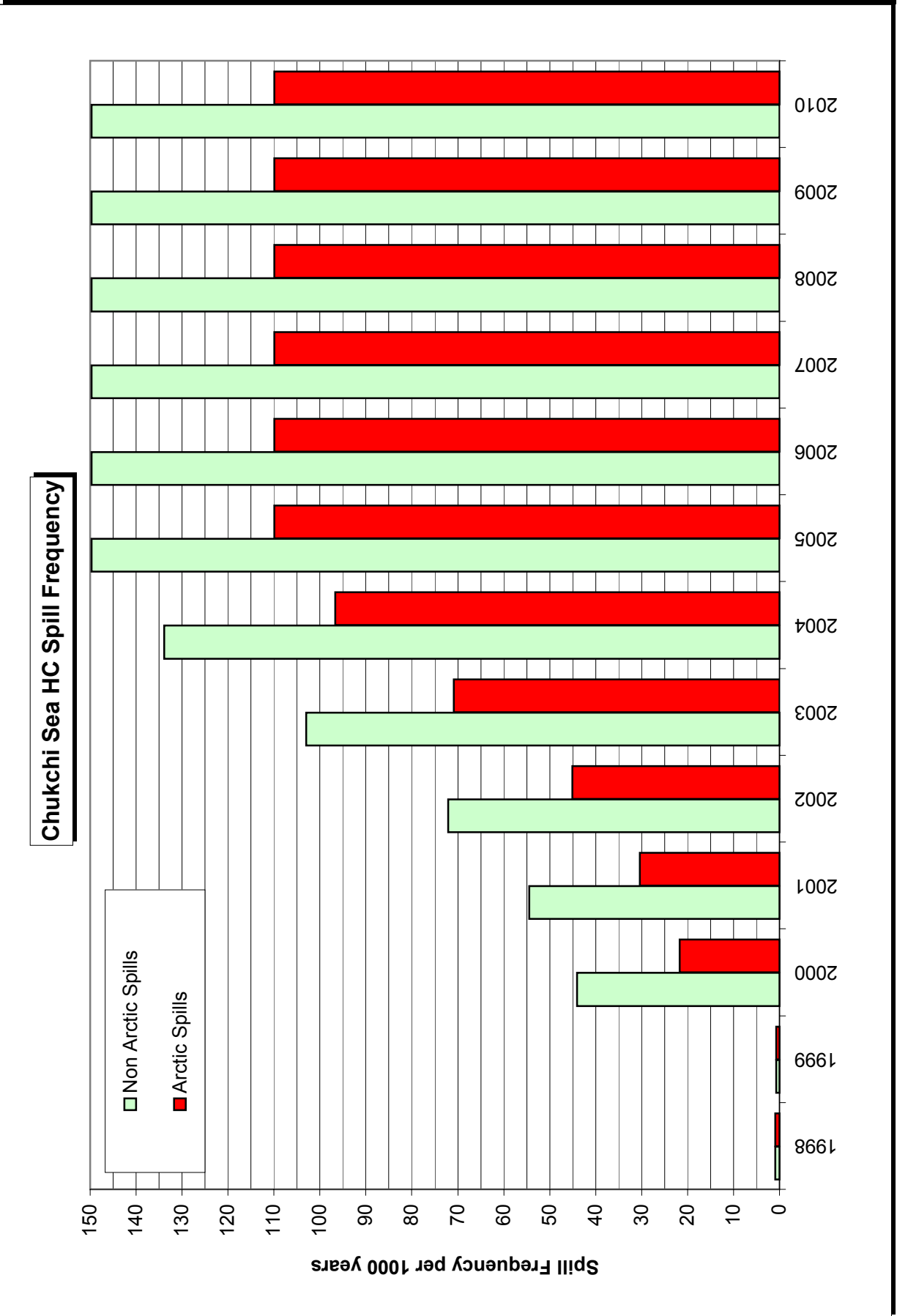


Chukchi Sea HC Spill Frequency per 10⁹ bbl Produced - Non Arctic

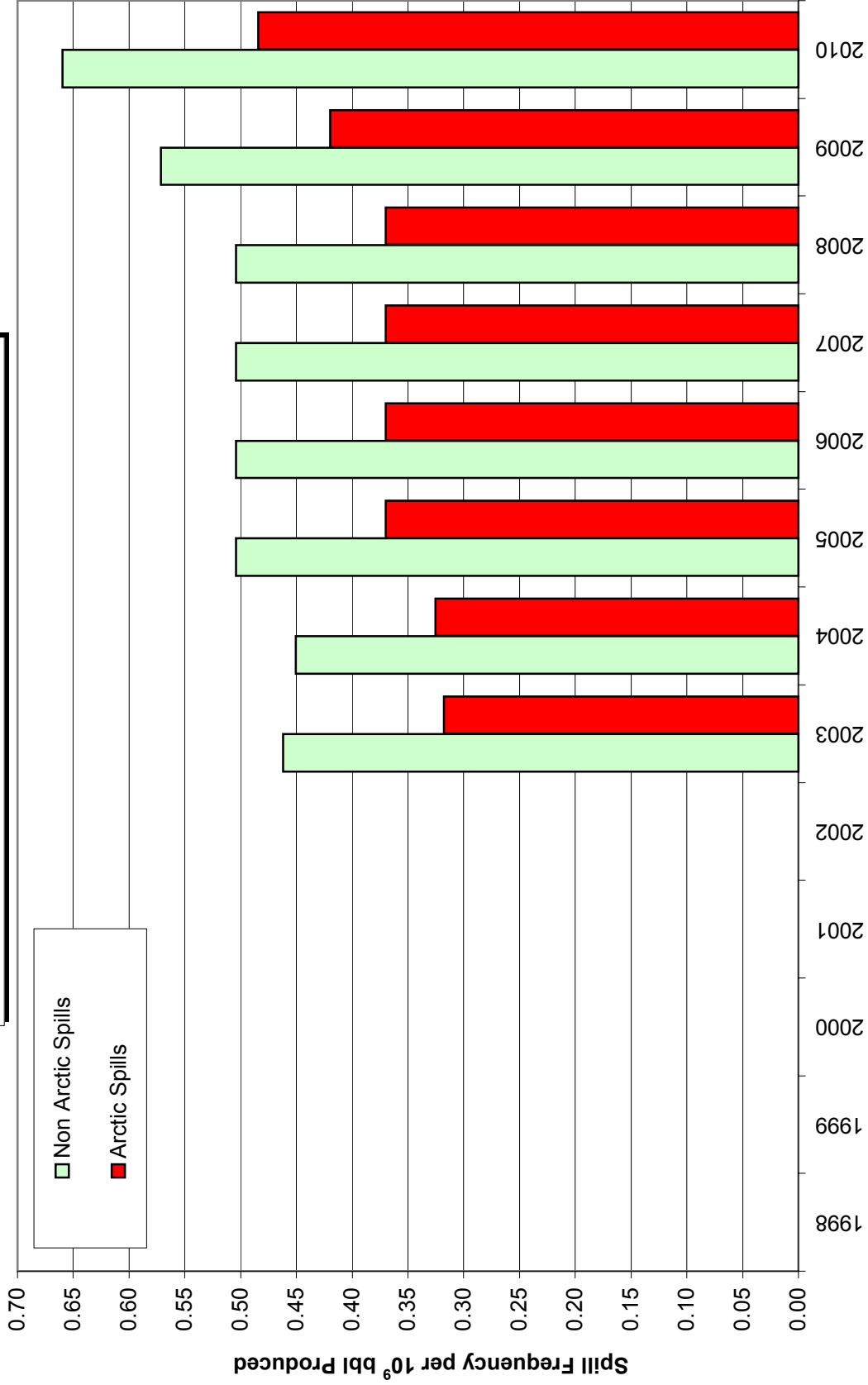


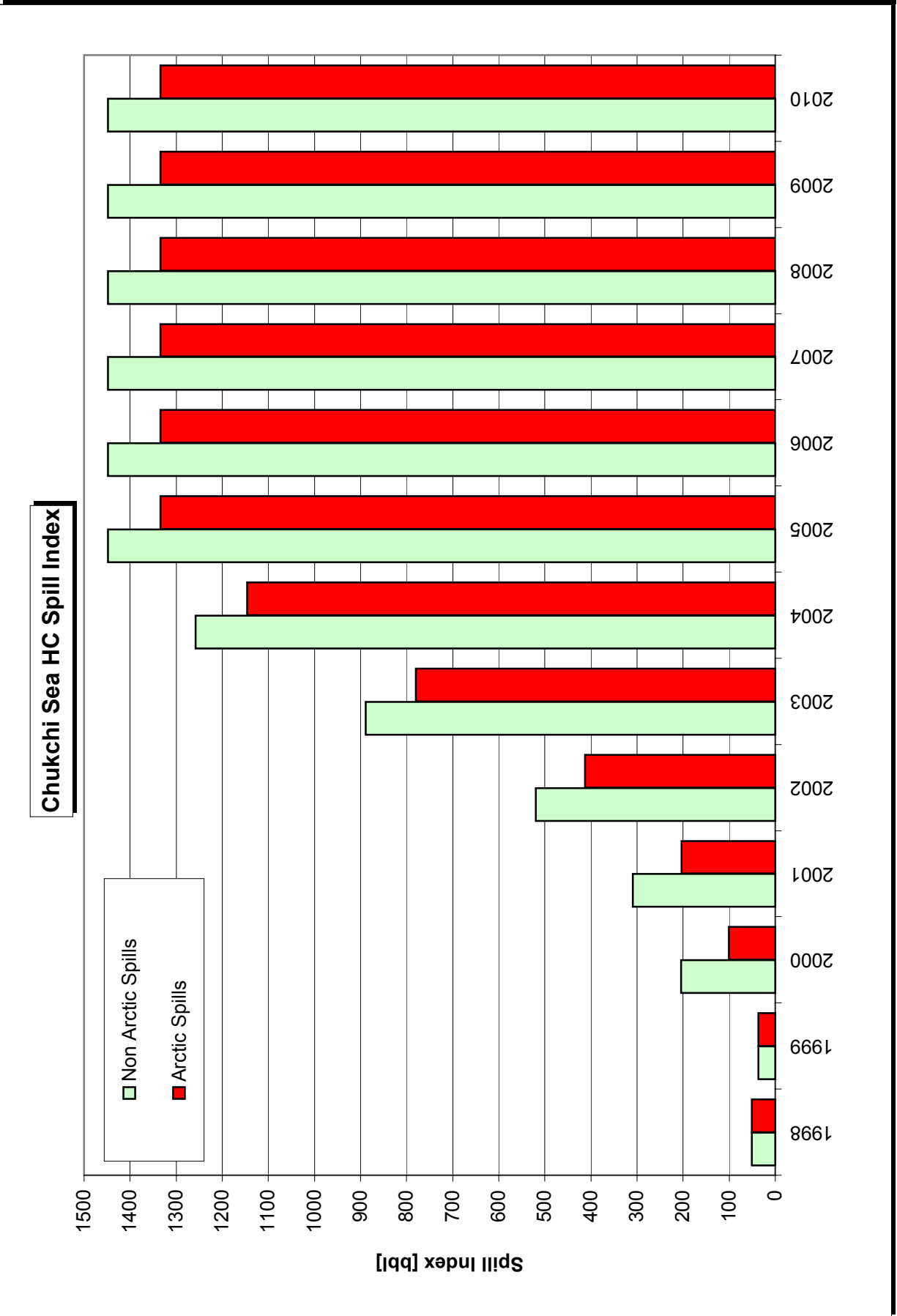
Chukchi Sea HC Spill Index - Non Arctic





Chukchi Sea HC Spill Frequency per 10⁹ bbl Produced





**Table 5.1
Summary of Spill Indicators for All Scenarios**

SPILL INDICATORS	Spill Size bbl x 1000	Beaufort Sea					Chukchi Sea		
		Year 2016	Year 2019	Year 2024	Year 2020	Year 2020	Year 2010	Year 2010	Year 2010
		Sale 1	Sale 2	Sale 3	Sale All	Sale All Non Arctic	Base Case	High Case	High C Non Arctic
Spill Frequency per 10 ³ years	SM	9.97	10.17	9.84	29.98	43.90	37.66	70.18	95.17
	L	4.53	4.42	4.07	13.02	17.83	15.23	25.34	36.70
	H	2.39	2.34	2.21	6.93	8.31	7.68	14.38	17.85
	All	16.88	16.93	16.12	49.93	70.04	60.58	109.91	149.72
Spill Frequency per 10 ⁹ bbl produced	SM	0.21	0.24	0.25	0.40	0.59	0.41	0.31	0.42
	L	0.10	0.11	0.11	0.17	0.24	0.17	0.11	0.16
	H	0.05	0.06	0.06	0.09	0.11	0.08	0.06	0.08
	All	0.36	0.40	0.42	0.67	0.94	0.66	0.48	0.66
Maximum Spill Frequency per 10 ⁹ bbl produced (year varies)	All	2.53	2.99	2.48	2.48	3.45	0.66	0.48	0.66
Spill Index [bbl]	SM	2	2	2	6	9	8	13	19
	L	28	27	26	81	102	92	171	218
	H	170	169	165	505	529	534	1150	1211
	All	200	199	193	592	640	633	1335	1448

**Table 5.2
Composition of Spill Indicators**

SPILL INDICATORS	Beaufort Sea				Chukchi Sea			
	Sale All - Year 2024				High Case - Year 2010			
	P/L	Platforms	Wells	TOTAL	P/L	Platforms	Wells	TOTAL
Spill Frequency per 10 ³ years	15.55	25.11	9.27	49.93	21.18	67.03	21.69	109.91
	31%	50%	19%	100%	19%	61%	20%	100%
Spill Frequency per 10 ⁹ bbl produced	0.21	0.34	0.12	0.67	0.09	0.30	0.10	0.48
	31%	50%	19%	100%	19%	61%	20%	100%
Spill Index [bbl]	56	29	507	592	73	76	1186	1335
	10%	5%	86%	100%	5%	6%	89%	100%

Figure 5.1
Baufort Sea Sale All - 2024 year - Spill Indicators

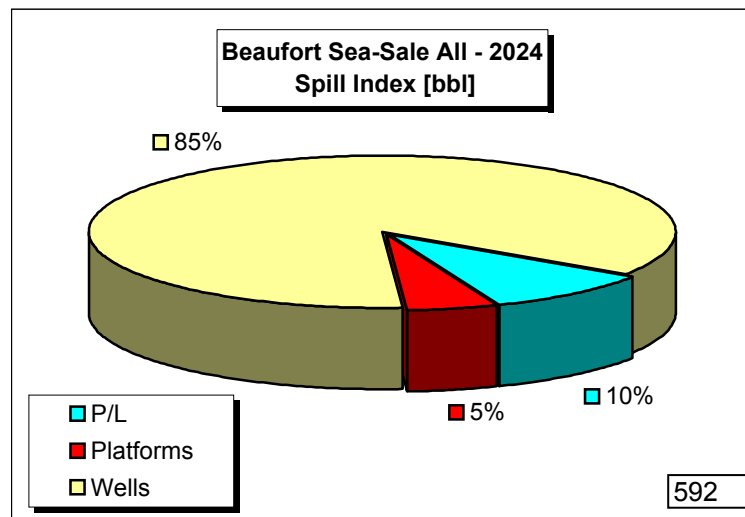
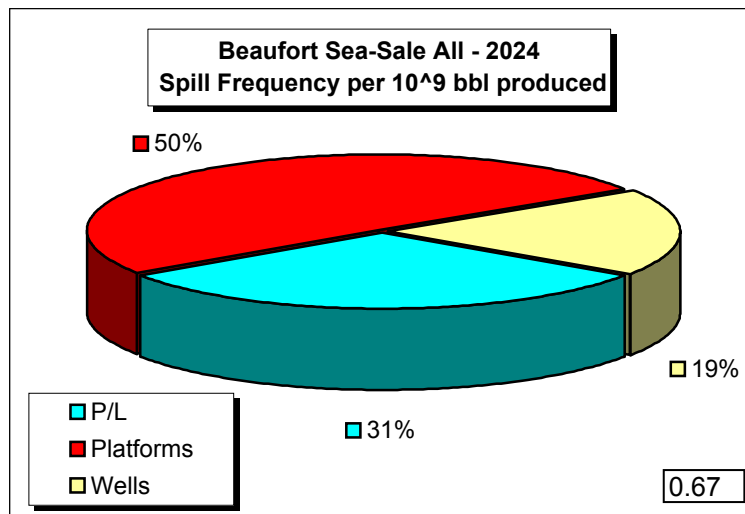
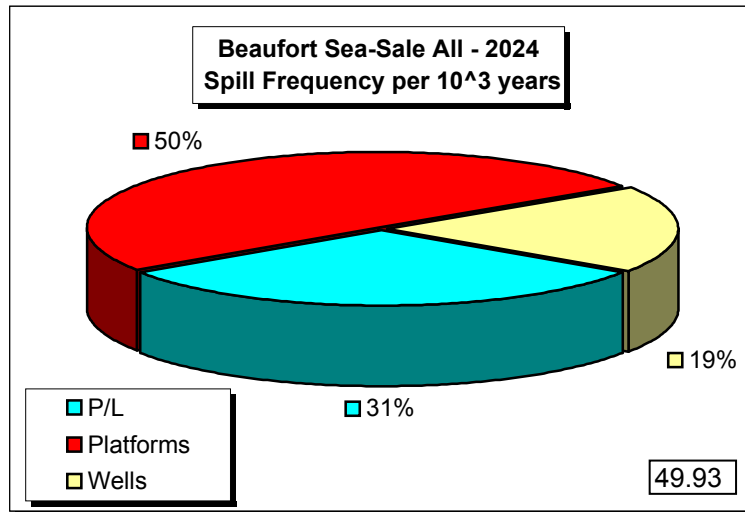


Figure 5.2
Baufort Sea Sale All - 2024 year - Spill Indicators

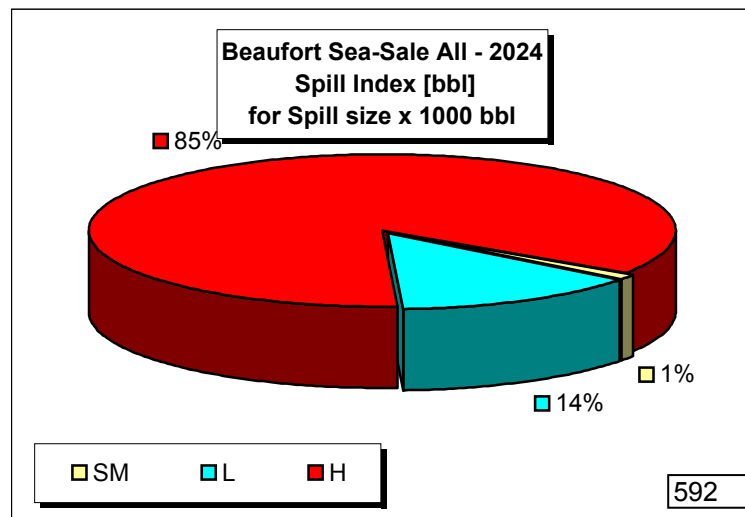
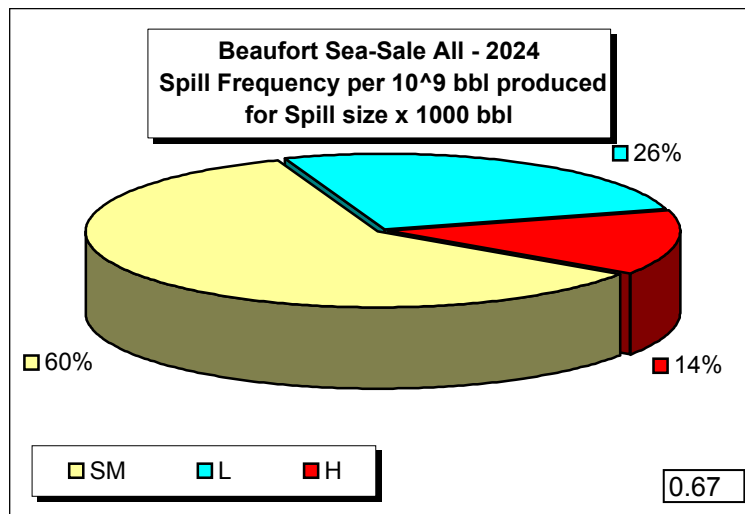
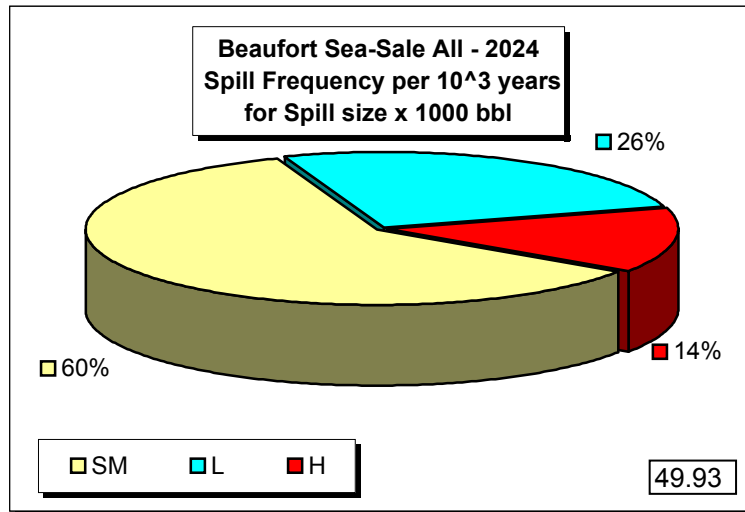


Figure 5.3
Chukchi Sea High Case - 2010 year - Spill Indicators

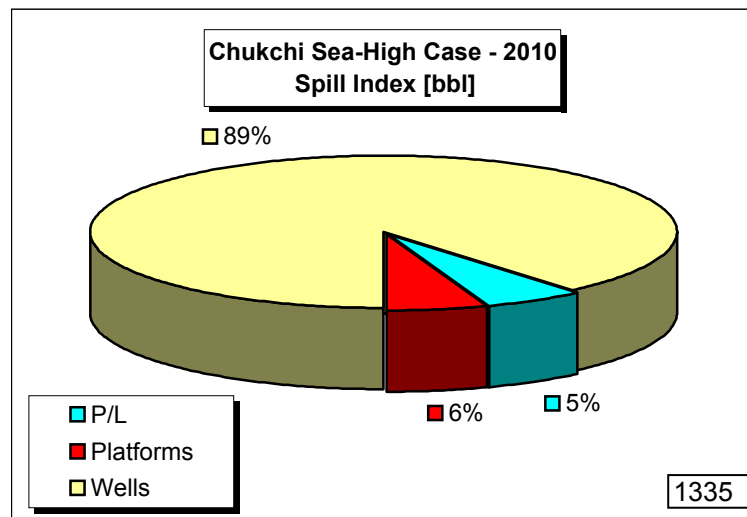
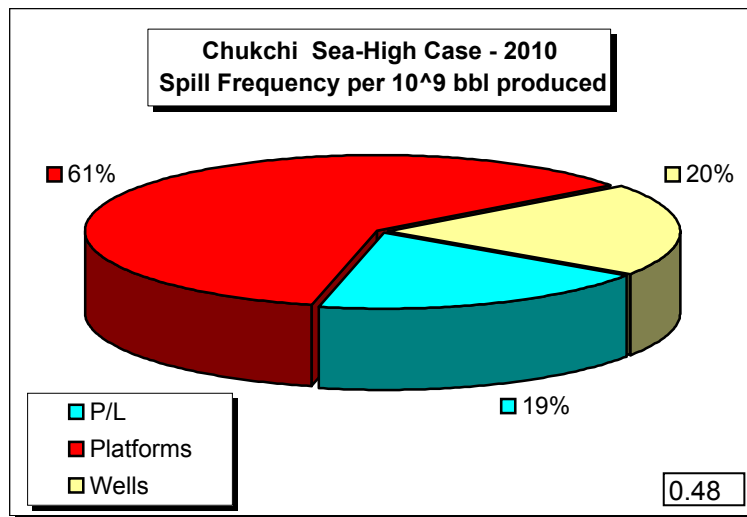
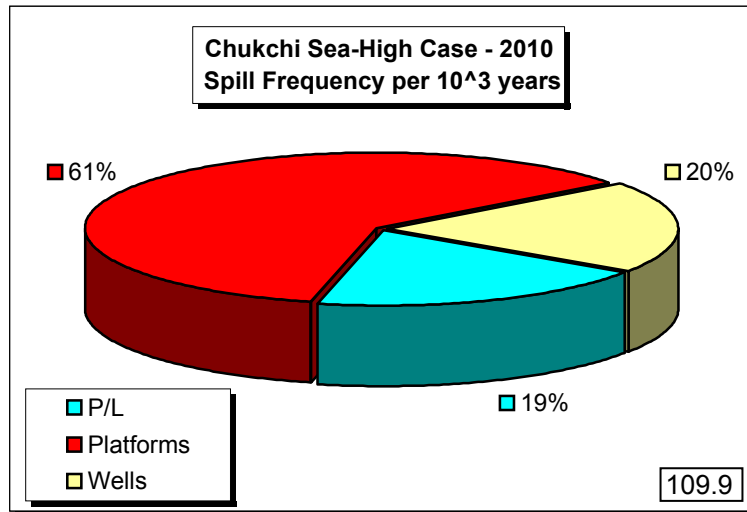
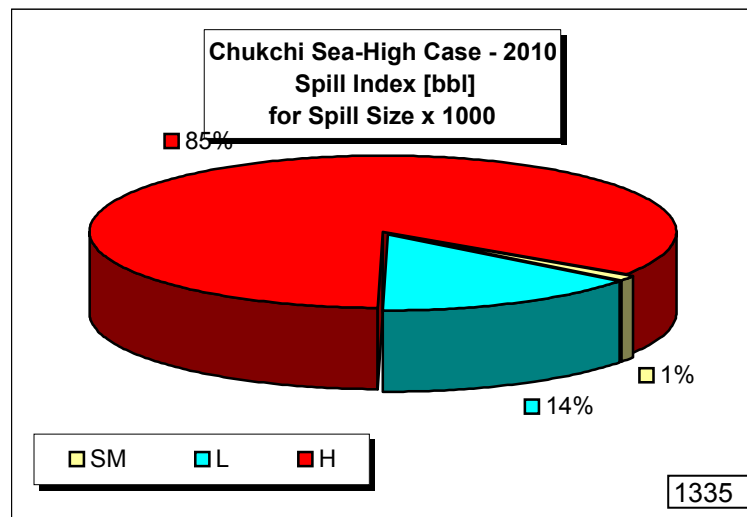
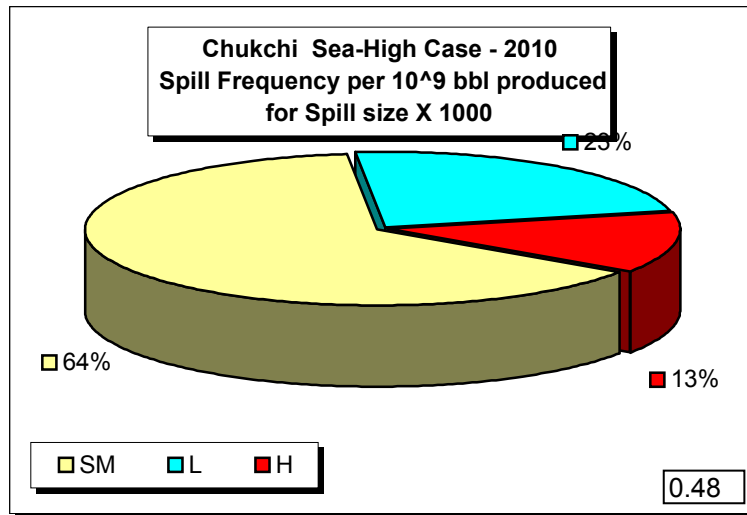
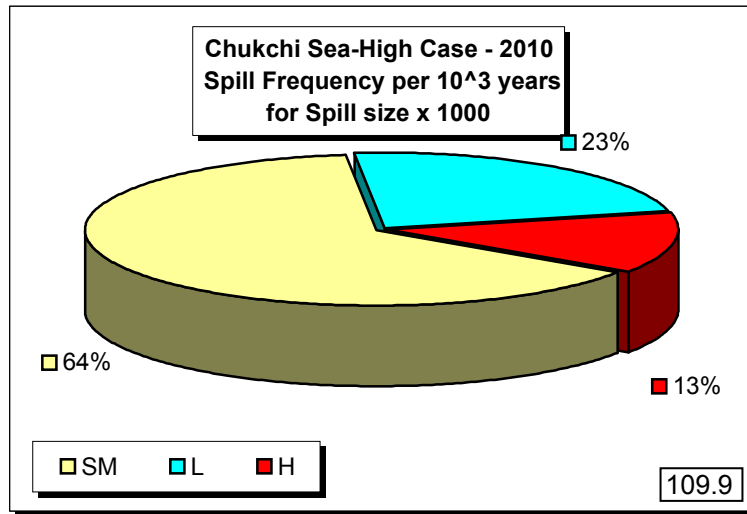


Figure 5.4
Chukchi Sea High Case - 2010 year - Spill Indicators



- T.4.1.7 Arctic Spill Occurrence - Sale 1 - Exploration Wells
- T.4.1.8 Arctic Spill Occurrence - Sale 1 - Exploration Wells - Summary
- T.4.1.9 Arctic Spill Occurrence - Sale 1 - Development Wells
- T.4.1.10 Arctic Spill Occurrence - Sale 1 - Development Wells - Summary
- T.4.1.11 Arctic Spill Occurrence - Sale 1 - Summary
- T.4.1.12 Arctic Spill Occurrence - Sale 1 - Annual Summary
- T.4.1.13 Arctic Spill Occurrence - Sale 1 - Wells - Summary
- T.4.1.14 Monte Carlo Results - Sale 1 - Year 2016

- F.4.1.1 Beaufort Sea Sale 1 Spill Frequency
- F.4.1.2 Beaufort Sea Sale 1 Spill Frequency per 10⁹ bbl Produced
- F.4.1.3 Beaufort Sea Sale 1 Spill Index
- F.4.1.4 Beaufort Sea Sale 1 Spill Frequency - P/L
- F.4.1.5 Beaufort Sea Sale 1 Spill Frequency per 10⁹ bbl Produced - P/L
- F.4.1.6 Beaufort Sea Sale 1 Spill Index - P/L
- F.4.1.7 Beaufort Sea Sale 1 Spill Frequency - Platforms
- F.4.1.8 Beaufort Sea Sale 1 Spill Frequency per 10⁹ bbl Produced - Platforms
- F.4.1.9 Beaufort Sea Sale 1 Spill Index - Platforms
- F.4.1.10 Beaufort Sea Sale 1 Spill Frequency - Wells
- F.4.1.11 Beaufort Sea Sale 1 Spill Frequency per 10⁹ bbl Produced - Wells
- F.4.1.12 Beaufort Sea Sale 1 Spill Index - Wells
- F.4.1.13 CDF - Sale 1 - Year 2016

- 4.2 Arctic Spill Occurrence - Beaufort Sea Sale 2**
- T.4.2.1 Arctic Spill Occurrence - Sale 2 - Pipeline
- T.4.2.2 Arctic Spill Occurrence - Sale 2 - Pipeline - Summary
- T.4.2.3 Arctic Spill Occurrence - Sale 2 - Platforms
- T.4.2.4 Arctic Spill Occurrence - Sale 2 - Platforms - Summary
- T.4.2.5 Arctic Spill Occurrence - Sale 2 - Production Wells
- T.4.2.6 Arctic Spill Occurrence - Sale 2 - Production Wells - Summary
- T.4.2.7 Arctic Spill Occurrence - Sale 2 - Exploration Wells
- T.4.2.8 Arctic Spill Occurrence - Sale 2 - Exploration Wells - Summary
- T.4.2.9 Arctic Spill Occurrence - Sale 2 - Development Wells
- T.4.2.10 Arctic Spill Occurrence - Sale 2 - Development Wells - Summary
- T.4.2.11 Arctic Spill Occurrence - Sale 2 - Summary
- T.4.2.12 Arctic Spill Occurrence - Sale 2 - Annual Summary
- T.4.2.13 Arctic Spill Occurrence - Sale 2 - Wells - Summary
- T.4.2.14 Monte Carlo Results - Sale 2 - Year 2019

- F.4.2.1 Beaufort Sea Sale 2 Spill Frequency
- F.4.2.2 Beaufort Sea Sale 2 Spill Frequency per 10⁹ bbl Produced
- F.4.2.3 Beaufort Sea Sale 2 Spill Index
- F.4.2.4 Beaufort Sea Sale 2 Spill Frequency - P/L
- F.4.2.5 Beaufort Sea Sale 2 Spill Frequency per 10⁹ bbl Produced - P/L
- F.4.2.6 Beaufort Sea Sale 2 Spill Index - P/L
- F.4.2.7 Beaufort Sea Sale 2 Spill Frequency - Platforms
- F.4.2.8 Beaufort Sea Sale 2 Spill Frequency per 10⁹ bbl Produced - Platforms
- F.4.2.9 Beaufort Sea Sale 2 Spill Index - Platforms
- F.4.2.10 Beaufort Sea Sale 2 Spill Frequency - Wells
- F.4.2.11 Beaufort Sea Sale 2 Spill Frequency per 10⁹ bbl Produced - Wells
- F.4.2.12 Beaufort Sea Sale 2 Spill Index - Wells
- F.4.2.13 CDF - Sale 2 - Year 2019

- 4.3 Arctic Spill Occurrence - Beaufort Sea Sale 3**
- T.4.3.1 Arctic Spill Occurrence - Sale 3 - Pipeline
- T.4.3.2 Arctic Spill Occurrence - Sale 3 - Pipeline - Summary
- T.4.3.3 Arctic Spill Occurrence - Sale 3 - Platforms
- T.4.3.4 Arctic Spill Occurrence - Sale 3 - Platforms - Summary

- T.4.3.5 Arctic Spill Occurrence - Sale 3 - Production Wells
- T.4.3.6 Arctic Spill Occurrence - Sale 3 - Production Wells - Summary
- T.4.3.7 Arctic Spill Occurrence - Sale 3 - Exploration Wells
- T.4.3.8 Arctic Spill Occurrence - Sale 3 - Exploration Wells - Summary
- T.4.3.9 Arctic Spill Occurrence - Sale 3 - Development Wells
- T.4.3.10 Arctic Spill Occurrence - Sale 3 - Development Wells - Summary
- T.4.3.11 Arctic Spill Occurrence - Sale 3 - Summary
- T.4.3.12 Arctic Spill Occurrence - Sale 3 - Annual Summary
- T.4.3.13 Arctic Spill Occurrence - Sale 3 - Wells - Summary
- T.4.3.14 Monte Carlo Results - Sale 3 - Year 2024
- F.4.3.1 Beaufort Sea Sale 3 Spill Frequency
- F.4.3.2 Beaufort Sea Sale 3 Spill Frequency per 10⁹ bbl Produced
- F.4.3.3 Beaufort Sea Sale 3 Spill Index
- F.4.3.4 Beaufort Sea Sale 3 Spill Frequency - P/L
- F.4.3.5 Beaufort Sea Sale 3 Spill Frequency per 10⁹ bbl Produced - P/L
- F.4.3.6 Beaufort Sea Sale 3 Spill Index - P/L
- F.4.3.7 Beaufort Sea Sale 3 Spill Frequency - Platforms
- F.4.3.8 Beaufort Sea Sale 3 Spill Frequency per 10⁹ bbl Produced - Platforms
- F.4.3.9 Beaufort Sea Sale 3 Spill Index - Platforms
- F.4.3.10 Beaufort Sea Sale 3 Spill Frequency - Wells
- F.4.3.11 Beaufort Sea Sale 3 Spill Frequency per 10⁹ bbl Produced - Wells
- F.4.3.12 Beaufort Sea Sale 3 Spill Index - Wells
- F.4.3.13 CDF - Sale 3 - Year 2024

4.4 Arctic Spill Occurrence - Beaufort Sea All Sales

- T.4.4.1 Arctic Spill Occurrence - All Sales - Pipeline
- T.4.4.2 Arctic Spill Occurrence - All Sales - Pipeline - Summary
- T.4.4.3 Arctic Spill Occurrence - All Sales - Platforms
- T.4.4.4 Arctic Spill Occurrence - All Sales - Platforms - Summary
- T.4.4.5 Arctic Spill Occurrence - All Sales - Production Wells
- T.4.4.6 Arctic Spill Occurrence - All Sales - Production Wells - Summary
- T.4.4.7 Arctic Spill Occurrence - All Sales - Exploration Wells
- T.4.4.8 Arctic Spill Occurrence - All Sales - Exploration Wells - Summary
- T.4.4.9 Arctic Spill Occurrence - All Sales - Development Wells
- T.4.4.10 Arctic Spill Occurrence - All Sales - Development Wells - Summary
- T.4.4.11 Arctic Spill Occurrence - All Sales - Summary
- T.4.4.12 Arctic Spill Occurrence - All Sales - Annual Summary
- T.4.4.13 Arctic Spill Occurrence - All Sales - Wells - Summary
- T.4.4.14 Monte Carlo Results - All Sales - Year 2024
- F.4.4.1 Beaufort Sea All Sales Spill Frequency
- F.4.4.2 Beaufort Sea All Sales Spill Frequency per 10⁹ bbl Produced
- F.4.4.3 Beaufort Sea All Sales Spill Index
- F.4.4.4 Beaufort Sea All Sales Spill Frequency - P/L
- F.4.4.5 Beaufort Sea All Sales Spill Frequency per 10⁹ bbl Produced - P/L
- F.4.4.6 Beaufort Sea All Sales Spill Index - P/L
- F.4.4.7 Beaufort Sea All Sales Spill Frequency - Platforms
- F.4.4.8 Beaufort Sea All Sales Spill Frequency per 10⁹ bbl Produced - Platforms
- F.4.4.9 Beaufort Sea All Sales Spill Index - Platforms
- F.4.4.10 Beaufort Sea All Sales Spill Frequency - Wells
- F.4.4.11 Beaufort Sea All Sales Spill Frequency per 10⁹ bbl Produced - Wells
- F.4.4.12 Beaufort Sea All Sales Spill Index - Wells
- F.4.4.13 CDF - All Sales - Year 2024

4.4A Non Arctic Spill Occurrence - Beaufort Sea All Sales

- T.4.4A.1 Non Arctic Spill Occurrence - All Sales - Pipeline
- T.4.4A.2 Non Arctic Spill Occurrence - All Sales - Pipeline - Summary

- T.4.4A.3 Non Arctic Spill Occurrence - All Sales - Platforms
- T.4.4A.4 Non Arctic Spill Occurrence - All Sales - Platforms - Summary
- T.4.4A.5 Non Arctic Spill Occurrence - All Sales - Production Wells
- T.4.4A.6 Non Arctic Spill Occurrence - All Sales - Production Wells - Summary
- T.4.4A.7 Non Arctic Spill Occurrence - All Sales - Exploration Wells
- T.4.4A.8 Non Arctic Spill Occurrence - All Sales - Exploration Wells - Summary
- T.4.4A.9 Non Arctic Spill Occurrence - All Sales - Development Wells
- T.4.4A.10 Non Arctic Spill Occurrence - All Sales - Development Wells - Summary
- T.4.4A.11 Non Arctic Spill Occurrence - All Sales - Summary
- T.4.4A.12 Non Arctic Spill Occurrence - All Sales - Annual Summary
- T.4.4A.13 Non Arctic Spill Occurrence - All Sales - Wells - Summary
- F.4.4A.1 Beaufort Sea All Sales Spill Frequency
- F.4.4A.2 Beaufort Sea All Sales Spill Frequency per 10⁹ bbl Produced
- F.4.4A.3 Beaufort Sea All Sales Spill Index
- F.4.4A.4 Beaufort Sea All Sales Spill Frequency - P/L
- F.4.4A.5 Beaufort Sea All Sales Spill Frequency per 10⁹ bbl Produced - P/L
- F.4.4A.6 Beaufort Sea All Sales Spill Index - P/L
- F.4.4A.7 Beaufort Sea All Sales Spill Frequency - Platforms
- F.4.4A.8 Beaufort Sea All Sales Spill Frequency per 10⁹ bbl Produced - Platforms
- F.4.4A.9 Beaufort Sea All Sales Spill Index - Platforms
- F.4.4A.10 Beaufort Sea All Sales Spill Frequency - Wells
- F.4.4A.11 Beaufort Sea All Sales Spill Frequency per 10⁹ bbl Produced - Wells
- F.4.4A.12 Beaufort Sea All Sales Spill Index - Wells
- F.4.4A.13 Beaufort Sea All Sales Spill Frequency Arctic and Non Arctic
- F.4.4A.14 Beaufort Sea All Sales Spill Frequency per 10⁹ bbl Produced Arctic and Non Arctic
- F.4.4A.15 Beaufort Sea All Sales Spill Index Arctic and Non Arctic

4.5 Arctic Spill Occurrence - Chukchi Sea Base Case

- T.4.5.1 Arctic Spill Occurrence - Base Case - Pipeline
- T.4.5.2 Arctic Spill Occurrence - Base Case - Pipeline - Summary
- T.4.5.3 Arctic Spill Occurrence - Base Case - Platforms
- T.4.5.4 Arctic Spill Occurrence - Base Case - Platforms - Summary
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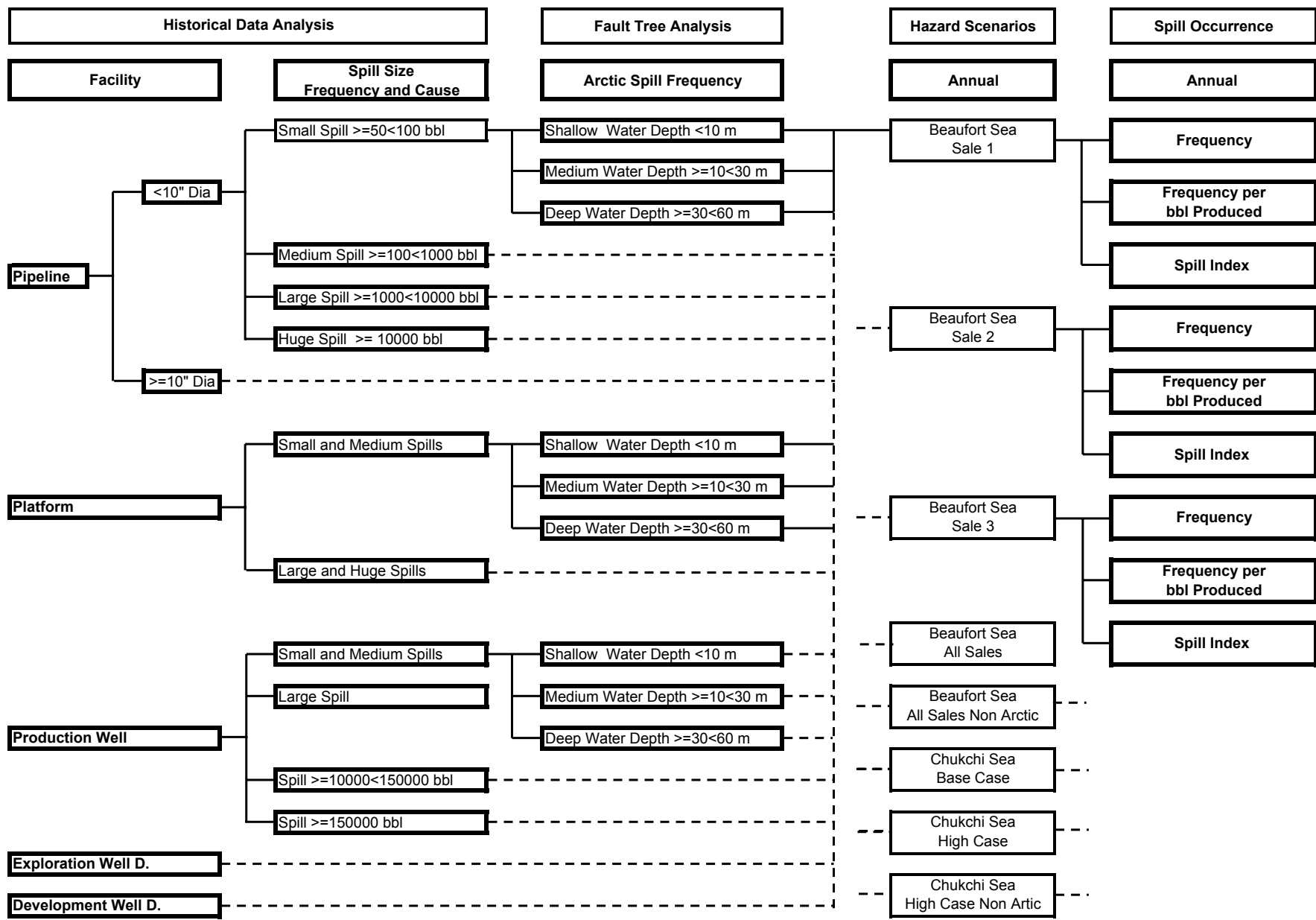
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Figure T.0 Flow Chart



**Table 1.1
Analysis of Historical Spills - P/L**

CAUSE CLASSIFICATION	NUMBER OF SPILLS	SPILL SIZE BBL										NUMBER OF SPILLS						
		1	2	3	4	5	6	7	8	9	10	S	M	L	H	SM	LH	
CORROSION	4												1	2	1		3	1
External	1	80											1				1	
Internal	3	100	5000	414										2	1		2	1
THIRD PARTY IMPACT	16												2	5	6	3	7	9
Anchor Impact	10	19833	65	50	300	900	323	15576	2000	800	1211		2	4	2	2	6	4
Jackup Rig or Spud Barge	1	3200													1			1
Trawl/Fishing Net	5	4000	100	14423	4569	4533							1	3	1	1	1	4
OPERATION IMPACT	4												3		1		3	1
Rig Anchoring	1	50											1				1	
Work Boat Anchoring	3	50	5100	50									2		1		2	1
MECHANICAL	2												2				2	
Connection Failure	1	135												1			1	
Material Failure	1	210												1			1	
NATURAL HAZARD	4												1	1	2		2	2
Mud Slide	3	250	80	8212									1	1	1		2	1
Storm/ Hurricane	1	3500													1			1
ARCTIC																		
Ice Gouging																		
Strudel Scour																		
Upheaval Buckling																		
Thaw Settlement																		
Other																		
UNKNOWN	1	119												1			1	
TOTALS	31												7	11	10	3	18	13

**Table 1.2
Distribution and Frequency of Historical Spills - P/L**

CAUSE CLASSIFICATION	Small and Medium Spills				Large and Huge Spills			
	HIST. DISTRIBUTION %	NUMBER OF SPILLS	EXPOSURE [km-years]	FREQUENCY spill per 10 ⁴ km-year	HIST. DISTRIBUTION %	NUMBER OF SPILLS	EXPOSURE [km-years]	FREQUENCY spill per 10 ⁴ km-year
CORROSION	16.67	3	253903	0.1182	7.69	1	253903	0.0394
External	5.56	1		0.0394				
Internal	11.11	2		0.0788	7.69	1		0.0394
THIRD PARTY IMPACT	38.89	7		0.2757	69.23	9		0.3545
Anchor Impact	33.33	6		0.2363	30.77	4		0.1575
Jackup Rig or Spud Barge					7.69	1		0.0394
Trawl/Fishing Net	5.56	1		0.0394	30.77	4		0.1575
OPERATION IMPACT	16.67	3		0.1182	7.69	1		0.0394
Rig Anchoring	5.56	1		0.0394				
Work Boat Anchoring	11.11	2		0.0788	7.69	1		0.0394
MECHANICAL	11.11	2		0.0788				
Connection Failure	5.56	1		0.0394				
Material Failure	5.56	1		0.0394				
NATURAL HAZARD	11.11	2		0.0788	15.38	2		0.0788
Mud Slide	11.11	2		0.0788	7.69	1		0.0394
Storm/ Hurricane					7.69	1		0.0394
ARCTIC								
Ice Gouging								
Strudel Scour								
Upheaval Buckling								
Thaw Settlement								
Other								
UNKNOWN	5.56	1	0.0394					
TOTALS	100.00	18	0.7089	100.00	13	0.5120		

**Table 1.2A
Historical Spills Data - Pipeline**

GOM OCS Pipeline Spills, Categorized 1972-99		Spill Statistics			Exposure**	Frequency	
		Number of Spills	Average Volume bbl	Median Volume bbl	km-years	spill per 10 ⁴ km-years	
By Pipe Diameter							
	<10"	16	2141	173	142,892	1.1197	
	>=10"	15	4070	1211	111,011	1.3512	
By Pipeline Minimum Depth							
	Bad Depth Data*	14					
	<10m	6	2310	1211	161,966	0.3704	
	>=10m	11	3165	1040	94,641	1.1623	
By Segment Length							
	<0.5km	0	0	0	2,359	0.0000	
	>=0.5<2km	2	2335	2335	25,484	0.7848	
	>=2<5km	7	820	100	35,279	1.9842	
	>=5km	22	3859	850	192,270	1.1442	
By Spill Size							
	Small	6	58	50	253,903	0.2363	
	Medium	12	317	230	253,903	0.4726	
	Large	10	4133	4267	253,903	0.3939	
	Huge	3	16611	15576	253,903	0.1182	
By Diameter, By Spill Size							
	<10"						
		Small	4	58	50	142,892	0.2799
		Medium	7	266	135	142,892	0.4899
		Large	4	4436	4551	142,892	0.2799
		Huge	1	14423	14423	142,892	0.0700
	>=10"						
		Small	2	58	58	111,011	0.1802
		Medium	5	387	312	111,011	0.4504
		Large	6	3932	3600	111,011	0.5405
		Huge	2	17705	17705	111,011	0.1802

*14 of the 31 records have both MIN_WATER_DEPTH and MAX_WATER_DEPTH set to "0".

**Exposure comes from an analysis of PPL_MASTERS database as published on Feb 15, 2001.

**Table 1.3
Analysis of Historical Spills - Platforms**

CAUSE CLASSIFICATION	NUMBER OF SPILLS	SPILL SIZE BBL													NUMBER OF SPILLS					
		1	2	3	4	5	6	7	8	9	10	11	12	13	S	M	L	H	SM	LH
PROCESS FACILITY RLS.	13	130	50	120	104	60	1456	125	50	50	55	400	280	75	6	6	1		12	1
STORAGE TANK RLS.	3	9935	7000	435												1	2		1	2
STRUCTURAL FAILURE	1	58													1				1	
HURRICANE/STORM	2	75	66												2				2	
COLLISION	2	600	108													2			2	
ARCTIC																				
Ice Force																				
Facility Low Temperature																				
Other																				
TOTALS	21														9	9	3		18	3

Table 1.4
Distribution and frequency of Historical Spills - Platforms

CAUSE CLASSIFICATION	Small and Medium Spills				Large and Huge Spills			
	HIST. DISTRIBUTION %	NUMBER OF SPILLS	EXPOSURE [well-years]	FREQUENCY spill per 10 ⁴ well-year	HIST. DISTRIBUTION %	NUMBER OF SPILLS	EXPOSURE [well-years]	FREQUENCY spill per 10 ⁴ well-year
PROCESS FACILITY RLS.	66.67	12	119714	1.0024	33.33	1	119714	0.0835
STORAGE TANK RLS.	5.56	1		0.0835	66.67	2		0.1671
STRUCTURAL FAILURE	5.56	1		0.0835				
HURRICANE/STORM	11.11	2		0.1671				
COLLISION	11.11	2		0.1671				
ARCTIC								
Ice Force								
Facility Low Temperature								
Other								
TOTALS	100.00	18			1.5036	100.00		3

**Table 1.5
Frequency of Historical Spills - Wells**

EVENT	FREQUENCY UNIT	Small and Medium Spills	Large Spill	Small, Medium, and Large Spills	Spill ≥ 10000 < 150000 bbl	Spill ≥ 150000 bbl
		HISTORICAL FREQUENCY				
PRODUCTION WELL	spill per 10^5 well-year	0.50	3.50	4.00	1.50	1.00
EXPLORATION WELL DRILLING	spill per 10^5 wells	3.16	22.11	25.27	9.50	5.50
DEVELOPMENT WELL DRILLING	spill per 10^5 wells	1.30	9.08	10.38	3.90	3.90

**Table 1.5A
Historical Spills Data - Wells**

Event	Historical Frequency	Experience	Reference
Development drilling blowout with oil spill > 10,000 bbl	7.8 x 10 ⁻⁵ /wells drilled	worldwide, 1970 - present	SL Ross 1998
Exploration drilling blowout with oil spill > 10,000 bbl	1.5 x 10 ⁻⁴ /wells drilled	worldwide, 1970 - present	SL Ross 1998
Development drilling blowout with oil spill > 150,000 bbl	3.9 x 10 ⁻⁵ /wells drilled	worldwide, 1970 - present	SL Ross 1998
Exploration drilling blowout with oil spill > 150,000 bbl	5.5 x 10 ⁻⁵ /wells drilled	worldwide, 1970 - present	SL Ross 1998

Blowout during production and workovers involving some oil discharge >1 bbl	6.5 x 10 ⁻⁵ /well-years	U.S. OCS, 1964 - 1995	SL Ross 1998 and MMS 1997
Production/workover blowout with oil spill > 10,000 bbl	2.5 x 10 ⁻⁵ /well-year	worldwide, 1970 - present	SL Ross 1998
Production/workover blowout with oil spill > 150,000 bbl	1.0 x 10 ⁻⁵ /well-year	worldwide, 1970 - present	SL Ross 1998

**Table 2.1
Fault Tree Analysis Input Rationalization - P/L**

CAUSE CLASSIFICATION	Spill Size	Shallow	Medium	Deep	Reason	
		Frequency Change %				
CORROSION						
External	All	(50)	(50)	(50)	Low temperature and bio effects. Extra smart pigging.	
Internal	All	(30)	(30)	(30)	Extra smart pigging.	
THIRD PARTY IMPACT						
Anchor Impact	All	(90)	(90)	(90)	Low traffic.	
Jackup Rig or Spud Barge	All	(50)	(50)	(50)	Low facility density.	
Trawl/Fishing Net	All	(90)	(90)	(90)	Low fishing activity.	
OPERATION IMPACT						
Rig Anchoring	All	(20)	(20)	(20)	No marine traffic during ice season (8 months).	
Work Boat Anchoring	All	(20)	(20)	(20)	No work boat traffic during ice season (8 months).	
MECHANICAL						
Connection Failure	All					
Material Failure	All					
NATURAL HAZARD						
Mud Slide	All	(80)	(60)	(40)	Gradient low. Mud slide potential (gradient) increases with water depth.	
Storm/ Hurricane	All	(50)	(50)	(50)	Fewer severe storms.	
		Freq. Increment per 10 ⁵ km-year				
		Median	Median	Median		
		Expected	Expected	Expected		
ARCTIC						
Ice Gouging	S	0.3495	0.1747		Ice gouge failure rate calculated using exponential failure distribution for 2.5-m cover, 0.2-m average gouge depth, 4 gouges per km-yr flux. Spill size Distribution explained in text Section 2.5.2	
		0.0680	0.0340			
	M	0.6178	0.3089			
		0.1210	0.0605			
	L	1.3438	0.6719			
0.2610		0.1305				
H	0.3762	0.1881				
	0.0730	0.0365				
Strudel Scour	S	0.0021				Only in shallow water. Average frequency of 4 scours/mile ² and 100 ft of bridge length with 10% conditional P/L failure probability. The same spill size distribution as above.
		0.0012				
	M	0.0038				
		0.0020				
	L	0.0082				
0.0045						
H	0.0023					
	0.0012					
Upheaval Buckling	S	0.0004	0.0004	0.0004	All water depth. The failure frequency is 20% of that of Strudel Scour.	
		0.0002	0.0002	0.0002		
	M	0.0008	0.0008	0.0008		
		0.0004	0.0004	0.0004		
	L	0.0016	0.0016	0.0016		
0.0009		0.0009	0.0009			
H	0.0005	0.0005	0.0005			
	0.0002	0.0002	0.0002			
Thaw Settlement	S	0.0002	0.0002	0.0002		All water depth. The failure frequency is 10% of that of Strudel Scour.
		0.0001	0.0001	0.0001		
	M	0.0004	0.0004	0.0004		
		0.0002	0.0002	0.0002		
	L	0.0008	0.0008	0.0008		
0.0004		0.0004	0.0004			
H	0.0002	0.0002	0.0002			
	0.0001	0.0001	0.0001			
Other	S	0.0881	0.0438	0.0002	To be assessed as 25% of above.	
		0.0174	0.0086	0.0001		
	M	0.1557	0.0775	0.0003		
		0.0309	0.0153	0.0002		
	L	0.3386	0.1686	0.0006		
0.0667		0.0330	0.0003			
H	0.0948	0.0472	0.0002			
	0.0187	0.0092	0.0001			

**Table 2.1A
Input - Pipeline**

CAUSE CLASSIFICATION	Spill Size	Shallow			Medium			Deep		
		Frequency Change %								
		Low	Expected	High	Low	Expected	High	Low	Expected	High
CORROSION										
External	All	(25)	(50)	(75)	(25)	(50)	(75)	(25)	(50)	(75)
Internal	All	(15)	(30)	(45)	(15)	(30)	(45)	(15)	(30)	(45)
THIRD PARTY IMPACT										
Anchor Impact	All	(60)	(90)	(95)	(60)	(90)	(95)	(60)	(90)	(95)
Jackup Rig or Spud Barge	All	(25)	(50)	(75)	(25)	(50)	(75)	(25)	(50)	(75)
Trawl/Fishing Net	All	(60)	(90)	(95)	(60)	(90)	(95)	(60)	(90)	(95)
OPERATION IMPACT										
Rig Anchoring	All	(10)	(20)	(30)	(10)	(20)	(30)	(10)	(20)	(30)
Work Boat Anchoring	All	(10)	(20)	(30)	(10)	(20)	(30)	(10)	(20)	(30)
MECHANICAL										
Connection Failure	All									
Material Failure	All									
NATURAL HAZARD										
Mud Slide	All	(50)	(80)	(90)	(30)	(60)	(90)	(20)	(40)	(60)
Storm/ Hurricane	All	(25)	(50)	(75)	(25)	(50)	(75)	(25)	(50)	(75)
Frequency Increment per 10⁵km-year										
ARCTIC										
Ice Gouging	S	0.0060	0.0680	0.8290	0.0030	0.0340	0.4145			
	M	0.0090	0.1210	1.4670	0.0045	0.0605	0.7335			
	L	0.0210	0.2610	3.1900	0.0105	0.1305	1.5950			
	H	0.0060	0.0730	0.8930	0.0030	0.0365	0.4465			
Strudel Scour	S	0.0004	0.0012	0.0044						
	M	0.0006	0.0020	0.0078						
	L	0.0014	0.0045	0.0170						
	H	0.0004	0.0012	0.0048						
Upheaval Buckling	S	0.00007	0.00023	0.00088	0.00007	0.00023	0.00088	0.00007	0.00023	0.00088
	M	0.00013	0.00041	0.00156	0.00013	0.00041	0.00156	0.00013	0.00041	0.00156
	L	0.00028	0.00089	0.00340	0.00028	0.00089	0.00340	0.00028	0.00089	0.00340
	H	0.00008	0.00025	0.00095	0.00008	0.00025	0.00095	0.00008	0.00025	0.00095
Thaw Settlement	S	0.00004	0.00012	0.00044	0.00004	0.00012	0.00044	0.00004	0.00012	0.00044
	M	0.00006	0.00020	0.00078	0.00006	0.00020	0.00078	0.00006	0.00020	0.00078
	L	0.00014	0.00045	0.00170	0.00014	0.00045	0.00170	0.00014	0.00045	0.00170
	H	0.00004	0.00012	0.00048	0.00004	0.00012	0.00048	0.00004	0.00012	0.00048
Other	S	0.00162	0.01738	0.20869	0.00078	0.00859	0.10396	0.00003	0.00009	0.00033
	M	0.00246	0.03092	0.36929	0.00117	0.01528	0.18396	0.00005	0.00015	0.00059
	L	0.00571	0.06670	0.80303	0.00273	0.03296	0.40003	0.00011	0.00033	0.00128
	H	0.00163	0.01865	0.22480	0.00078	0.00922	0.11198	0.00003	0.00009	0.00036

Table 2.2
FTA Input Rationalization Platforms

CAUSE CLASSIFICATION	Spill Size	Frequency Change %			Reason
		Shallow	Medium	Deep	
PROCESS FACILITY RLS.	All	(50)	(50)	(50)	State of the art now, High QC, High Inspection and Maintenance Requirements
STORAGE TANK RLS.	All	(30)	(30)	(30)	State of the art now, High QC, High Inspection and Maintenance Requirements
STRUCTURAL FAILURE	All	(30)	(30)	(30)	High safety factor, Monitoring Programs
HURRICANE/STORM	All	(80)	(80)	(80)	Less severe storms.
COLLISION	All	(90)	(90)	(90)	Very low traffic density.
		Freq. Increment per 10 ⁴ well-year			
		Median	Median	Median	
		Expected	Expected	Expected	
ARCTIC					
Ice Force	SM	0.1447	0.2170	0.3256	Assumed 1/10000 years ice force causes spill. 85% of the spills are SM.
		0.0340	0.0510	0.0765	
	LH	0.0255	0.0383	0.0575	
		0.0060	0.0090	0.0135	
Facility Low Temperature	SM	0.1000	0.1000	0.1000	Assumed 10% of Historical Process Facilities release frequency and corresponding spill size distribution.
		0.1000	0.1000	0.1000	
	LH	0.0080	0.0080	0.0080	
		0.0080	0.0080	0.0080	
Other	SM	0.0244	0.0316	0.0424	10% of above.
		0.0134	0.0151	0.0177	
	LH	0.0033	0.0046	0.0065	
		0.0014	0.0017	0.0022	

**Table 2.2A
Input - Platforms**

CAUSE CLASSIFICATION	Spill Size	Shallow			Medium			Deep		
		Frequency Change %								
		Low	Expected	High	Low	Expected	High	Low	Expected	High
PROCESS FACILITY RLS.	AII	(30)	(50)	(80)	(30)	(50)	(80)	(30)	(50)	(80)
STORAGE TANK RLS.	AII	(20)	(30)	(40)	(20)	(30)	(40)	(20)	(30)	(40)
STRUCTURAL FAILURE	AII	(20)	(30)	(40)	(20)	(30)	(40)	(20)	(30)	(40)
HURRICANE/STORM	AII	(25)	(50)	(75)	(25)	(50)	(75)	(25)	(50)	(75)
COLLISION	AII	(60)	(90)	(95)	(60)	(90)	(95)	(60)	(90)	(95)
Frequency Increment per 10⁴ well-year										
ARCTIC										
Ice Force	SM	0.003	0.034	0.340	0.005	0.051	0.510	0.008	0.077	0.765
	LH	0.001	0.006	0.060	0.001	0.009	0.090	0.001	0.014	0.135
Facility Low Temperature	SM	0.050	0.100	0.150	0.050	0.100	0.150	0.050	0.100	0.150
	LH	0.004	0.008	0.012	0.004	0.008	0.012	0.004	0.008	0.012
Other	SM	0.005	0.013	0.049	0.006	0.015	0.066	0.006	0.018	0.092
	LH	0.000	0.001	0.007	0.000	0.002	0.010	0.001	0.002	0.015

**Table 2.3
Arctic Spill Distribution and Frequency P/L -Small Spills**

CAUSE CLASSIFICATION	HIST. DISTRIBUTION %	SMALL SPILL																			
		P/L Dia <10"									P/L Dia >=10"										
		FREQUENCY spill per 10 ⁵ km-year	Shallow			Medium			Deep			FREQUENCY spill per 10 ⁵ km-year	Shallow			Medium			Deep		
			Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %		Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
CORROSION	16.67	0.467	(0.1711)	0.2955	21.21	(0.1711)	0.2955	20.93	(0.1711)	0.2955	20.65	0.300	(0.1101)	0.1902	20.50	(0.110)	0.190	20.59	(0.110)	0.190	20.64
External	5.56	0.156	(0.0778)	0.0778	5.58	(0.0778)	0.0778	5.51	(0.0778)	0.0778	5.43	0.100	(0.0500)	0.0500	5.39	(0.050)	0.050	5.42	(0.050)	0.050	5.43
Internal	11.11	0.311	(0.0933)	0.2177	15.63	(0.0933)	0.2177	15.43	(0.0933)	0.2177	15.21	0.200	(0.0601)	0.1401	15.11	(0.060)	0.140	15.17	(0.060)	0.140	15.21
THIRD PARTY IMPACT	38.89	1.089	(0.9798)	0.1089	7.81	(0.9798)	0.1089	7.71	(0.9798)	0.1089	7.61	0.701	(0.6306)	0.0701	7.55	(0.631)	0.070	7.58	(0.631)	0.070	7.61
Anchor Impact	33.33	0.933	(0.8398)	0.0933	6.70	(0.8398)	0.0933	6.61	(0.8398)	0.0933	6.52	0.601	(0.5405)	0.0601	6.47	(0.540)	0.060	6.50	(0.540)	0.060	6.52
Jackup Rig or Spud Barge																					
Trawl/Fishing Net	5.56	0.156	(0.1400)	0.0156	1.12	(0.1400)	0.0156	1.10	(0.1400)	0.0156	1.09	0.100	(0.0901)	0.0100	1.08	(0.090)	0.010	1.08	(0.090)	0.010	1.09
OPERATION IMPACT	16.67	0.467	(0.0933)	0.3732	26.79	(0.0933)	0.3732	26.44	(0.0933)	0.3732	26.08	0.300	(0.0601)	0.2402	25.90	(0.060)	0.240	26.01	(0.060)	0.240	26.07
Rig Anchoring	5.56	0.156	(0.0311)	0.1244	8.93	(0.0311)	0.1244	8.81	(0.0311)	0.1244	8.69	0.100	(0.0200)	0.0801	8.63	(0.020)	0.080	8.67	(0.020)	0.080	8.69
Work Boat Anchoring	11.11	0.311	(0.0622)	0.2488	17.86	(0.0622)	0.2488	17.63	(0.0622)	0.2488	17.39	0.200	(0.0400)	0.1601	17.26	(0.040)	0.160	17.34	(0.040)	0.160	17.38
MECHANICAL	11.11	0.311		0.3110	22.32		0.3110	22.04		0.3110	21.73	0.200		0.2002	21.58		0.200	21.67		0.200	21.73
Connection Failure	5.56	0.156		0.1555	11.16		0.1555	11.02		0.1555	10.87	0.100		0.1001	10.79		0.100	10.84		0.100	10.86
Material Failure	5.56	0.156		0.1555	11.16		0.1555	11.02		0.1555	10.87	0.100		0.1001	10.79		0.100	10.84		0.100	10.86
NATURAL HAZARD	11.11	0.311	(0.2488)	0.0622	4.46	(0.1866)	0.1244	8.81	(0.1244)	0.1866	13.04	0.200	(0.1601)	0.0400	4.32	(0.120)	0.080	8.67	(0.080)	0.120	13.04
Mud Slide	11.11	0.311	(0.2488)	0.0622	4.46	(0.1866)	0.1244	8.81	(0.1244)	0.1866	13.04	0.200	(0.1601)	0.0400	4.32	(0.120)	0.080	8.67	(0.080)	0.120	13.04
Storm/ Hurricane																					
ARCTIC			0.0869	0.0869	6.24	0.0429	0.0429	3.04	0.0004	0.0004	0.03		0.0869	0.0869	9.37	0.043	0.043	4.65	0.000	0.000	0.05
Ice Gouging			0.0680	0.0680	4.88	0.0340	0.0340	2.41					0.0680	0.0680	7.33	0.0340	0.0340	3.68			
Strudel Scour			0.0012	0.0012	0.08								0.0012	0.0012	0.12						
Upheaval Buckling			0.0002	0.0002	0.02	0.0002	0.0002	0.02	0.0002	0.0002	0.02		0.0002	0.0002	0.02	0.0002	0.0002	0.03	0.0002	0.0002	0.03
Thaw Settlement			0.0001	0.0001	0.01	0.0001	0.0001	0.01	0.0001	0.0001	0.01		0.0001	0.0001	0.01	0.0001	0.0001	0.01	0.0001	0.0001	0.01
Other			0.0174	0.0174	1.25	0.0086	0.0086	0.61	0.0001	0.0001	0.01		0.0174	1.87	0.0086	0.0086	0.93	0.0001	0.0001	0.0001	0.01
UNKNOWN	5.56	0.156		0.1555	11.16		0.1555	11.02		0.1555	10.87	0.100		0.1001	10.79		0.100	10.84		0.100	10.86
TOTALS	100.00	2.799	(1.406)	1.393	100.00	(1.388)	1.411	100.00	(1.368)	1.431	100.00	1.802	(0.874)	0.928	100.00	(0.878)	0.924	100.00	(0.880)	0.921	100.00

**Table 2.4
Arctic Spill Distribution and Frequency P/L - Medium Spills**

CAUSE CLASSIFICATION	HIST. DISTRIBUTION %	MEDIUM SPILL																			
		P/L Dia <10"										P/L Dia >=10"									
		Shallow			Medium			Deep			Shallow			Medium			Deep				
		FREQUENCY spill per 10 ⁶ km-year	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	FREQUENCY spill per 10 ⁶ km-year	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
CORROSION	16.67	0.816	(0.2994)	0.5171	21.19	(0.2994)	0.5171	20.92	(0.2994)	0.5171	20.65	0.751	(0.2752)	0.4754	21.07	(0.2752)	0.4754	20.87	(0.2752)	0.4754	20.65
External	5.56	0.272	(0.1361)	0.1361	5.58	(0.1361)	0.1361	5.51	(0.1361)	0.1361	5.43	0.250	(0.1251)	0.1251	5.54	(0.1251)	0.1251	5.49	(0.1251)	0.1251	5.43
Internal	11.11	0.544	(0.1633)	0.3810	15.61	(0.1633)	0.3810	15.42	(0.1633)	0.3810	15.21	0.500	(0.1501)	0.3503	15.52	(0.1501)	0.3503	15.38	(0.1501)	0.3503	15.21
THIRD PARTY IMPACT	38.89	1.905	(1.7146)	0.1905	7.81	(1.7146)	0.1905	7.71	(1.7146)	0.1905	7.61	1.752	(1.5764)	0.1752	7.76	(1.5764)	0.1752	7.69	(1.5764)	0.1752	7.61
Anchor Impact	33.33	1.633	(1.4696)	0.1633	6.69	(1.4696)	0.1633	6.61	(1.4696)	0.1633	6.52	1.501	(1.3512)	0.1501	6.65	(1.3512)	0.1501	6.59	(1.3512)	0.1501	6.52
Jackup Rig or Spud Barge																					
Trawl/Fishing Net	5.56	0.272	(0.2449)	0.0272	1.12	(0.2449)	0.0272	1.10	(0.2449)	0.0272	1.09	0.250	(0.2252)	0.0250	1.11	(0.2252)	0.0250	1.10	(0.2252)	0.0250	1.09
OPERATION IMPACT	16.67	0.816	(0.1633)	0.6532	26.76	(0.1633)	0.6532	26.43	(0.1633)	0.6532	26.08	0.751	(0.1501)	0.6005	26.61	(0.1501)	0.6005	26.36	(0.1501)	0.6005	26.08
Rig Anchoring	5.56	0.272	(0.0544)	0.2177	8.92	(0.0544)	0.2177	8.81	(0.0544)	0.2177	8.69	0.250	(0.0500)	0.2002	8.87	(0.0500)	0.2002	8.79	(0.0500)	0.2002	8.69
Work Boat Anchoring	11.11	0.544	(0.1089)	0.4354	17.84	(0.1089)	0.4354	17.62	(0.1089)	0.4354	17.39	0.500	(0.1001)	0.4004	17.74	(0.1001)	0.4004	17.57	(0.1001)	0.4004	17.39
MECHANICAL	11.11	0.544		0.5443	22.30		0.5443	22.02		0.5443	21.73	0.500		0.5005	22.18		0.5005	21.97		0.5005	21.73
Connection Failure	5.56	0.272		0.2722	11.15		0.2722	11.01		0.2722	10.87	0.250		0.2502	11.09		0.2502	10.98		0.2502	10.87
Material Failure	5.56	0.272		0.2722	11.15		0.2722	11.01		0.2722	10.87	0.250		0.2502	11.09		0.2502	10.98		0.2502	10.87
NATURAL HAZARD	11.11	0.544	(0.4354)	0.1089	4.46	(0.3266)	0.2177	8.81	(0.2177)	0.3266	13.04	0.500	(0.4004)	0.1001	4.44	(0.3003)	0.2002	8.79	(0.2002)	0.3003	13.04
Mud Slide	11.11	0.544	(0.4354)	0.1089	4.46	(0.3266)	0.2177	8.81	(0.2177)	0.3266	13.04	0.500	(0.4004)	0.1001	4.44	(0.3003)	0.2002	8.79	(0.2002)	0.3003	13.04
Storm/ Hurricane																					
ARCTIC			0.1546	0.1546	6.33	0.0764	0.0764	3.09	0.0008	0.0008	0.03		0.1546	0.1546	6.85	0.0764	0.0764	3.35	0.0008	0.0008	0.03
Ice Gouging			0.1210	0.1210	4.96	0.0605	0.0605	2.45					0.1210	0.1210	5.36	0.0605	0.0605	2.66			
Strudel Scour			0.0020	0.0020	0.08								0.0020	0.0020	0.09						
Upheaval Buckling			0.0004	0.0004	0.02	0.0004	0.0004	0.02	0.0004	0.0004	0.02		0.0004	0.0004	0.02	0.0004	0.0004	0.02	0.0004	0.0004	0.02
Thaw Settlement			0.0002	0.0002	0.01	0.0002	0.0002	0.01	0.0002	0.0002	0.01		0.0002	0.0002	0.01	0.0002	0.0002	0.01	0.0002	0.0002	0.01
Other			0.0309	0.0309	1.27	0.0153	0.0153	0.62	0.0002	0.0002	0.01		0.0309	0.0309	1.37	0.0153	0.0153	0.67	0.0002	0.0002	0.01
UNKNOWN	5.56	0.272		0.2722	11.15		0.2722	11.01		0.2722	10.87	0.250		0.2502	11.09		0.2502	10.98		0.2502	10.87
TOTALS	100.00	4.899	(2.458)	2.441	100.00	(2.427)	2.471	100.00	(2.394)	2.505	100.00	4.504	(2.248)	2.256	100.00	(2.226)	2.278	100.00	(2.201)	2.303	100.00

**Table 2.5
Arctic Spill Distribution and Frequency P/L - Large Spills**

CAUSE CLASSIFICATION	HIST. DISTRIBUTION %	LARGE SPILL																			
		P/L Dia <10"									P/L Dia >=10"										
		FREQUENCY spill per 10 ⁵ km-year	Shallow			Medium			Deep			FREQUENCY spill per 10 ⁵ km-year	Shallow			Medium			Deep		
			Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %		Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
CORROSION	7.69	0.215	(0.065)	0.151	13.86	(0.065)	0.151	15.68	(0.065)	0.151	17.91	0.416	(0.125)	0.291	16.27	(0.125)	0.291	17.09	(0.125)	0.291	17.93
External																					
Internal	7.69	0.215	(0.065)	0.151	13.86	(0.065)	0.151	15.68	(0.065)	0.151	17.91	0.416	(0.125)	0.291	16.27	(0.125)	0.291	17.09	(0.125)	0.291	17.93
THIRD PARTY IMPACT	69.23	1.938	(1.658)	0.280	25.75	(1.658)	0.280	29.11	(1.658)	0.280	33.27	3.742	(3.201)	0.540	30.22	(3.201)	0.540	31.74	(3.201)	0.540	33.30
Anchor Impact	30.77	0.861	(0.775)	0.086	7.92	(0.775)	0.086	8.96	(0.775)	0.086	10.24	1.663	(1.497)	0.166	9.30	(1.497)	0.166	9.76	(1.497)	0.166	10.25
Jackup Rig or Spud Barge	7.69	0.215	(0.108)	0.108	9.90	(0.108)	0.108	11.20	(0.108)	0.108	12.80	0.416	(0.208)	0.208	11.62	(0.208)	0.208	12.21	(0.208)	0.208	12.81
Trawl/Fishing Net	30.77	0.861	(0.775)	0.086	7.92	(0.775)	0.086	8.96	(0.775)	0.086	10.24	1.663	(1.497)	0.166	9.30	(1.497)	0.166	9.76	(1.497)	0.166	10.25
OPERATION IMPACT	7.69	0.215	(0.043)	0.172	15.85	(0.043)	0.172	17.92	(0.043)	0.172	20.47	0.416	(0.083)	0.333	18.60	(0.083)	0.333	19.53	(0.083)	0.333	20.49
Rig Anchoring																					
Work Boat Anchoring	7.69	0.215	(0.043)	0.172	15.85	(0.043)	0.172	17.92	(0.043)	0.172	20.47	0.416	(0.083)	0.333	18.60	(0.083)	0.333	19.53	(0.083)	0.333	20.49
MECHANICAL																					
Connection Failure																					
Material Failure																					
NATURAL HAZARD	15.38	0.431	(0.280)	0.151	13.86	(0.237)	0.194	20.16	(0.194)	0.237	28.15	0.832	(0.540)	0.291	16.27	(0.457)	0.374	21.97	(0.374)	0.457	28.18
Mud Slide	7.69	0.215	(0.172)	0.043	3.96	(0.129)	0.086	8.96	(0.086)	0.129	15.35	0.416	(0.333)	0.083	4.65	(0.249)	0.166	9.76	(0.166)	0.249	15.37
Storm/ Hurricane	7.69	0.215	(0.108)	0.108	9.90	(0.108)	0.108	11.20	(0.108)	0.108	12.80	0.416	(0.208)	0.208	11.62	(0.208)	0.208	12.21	(0.208)	0.208	12.81
ARCTIC			0.333	0.333	30.68	0.165	0.165	17.14	0.002	0.002	0.20		0.333	0.333	18.64	0.165	0.165	9.68	0.002	0.002	0.10
Ice Gouging			0.2610	0.2610	24.01	0.1305	0.1305	13.57					0.2610	0.2610	14.59	0.1305	0.1305	7.66			
Strudel Scour			0.0045	0.0045	0.41								0.0045	0.0045	0.25						
Upheaval Buckling			0.0009	0.0009	0.08	0.0009	0.0009	0.09	0.0009	0.0009	0.11		0.0009	0.0009	0.05	0.0009	0.0009	0.05	0.0009	0.0009	0.05
Thaw Settlement			0.0004	0.0004	0.04	0.0004	0.0004	0.05	0.0004	0.0004	0.05		0.0004	0.0004	0.02	0.0004	0.0004	0.03	0.0004	0.0004	0.03
Other			0.0667	0.0667	6.14	0.0330	0.0330	3.43	0.0003	0.0003	0.04		0.0667	0.0667	3.73	0.0330	0.0330	1.94	0.0003	0.0003	0.02
UNKNOWN																					
TOTALS	100.00	2.799	(1.712)	1.087	100.00	(1.838)	0.962	100.00	(1.958)	0.841	100.00	5.405	(3.616)	1.789	100.00	(3.702)	1.703	100.00	(3.782)	1.623	100.00

**Table 2.6
Arctic Spill Distribution and Frequency P/L - Huge Spills**

CAUSE CLASSIFICATION	HIST. DISTRIBUTION %	HUGE SPILL																			
		P/L Dia <10"									P/L Dia >=10"										
		FREQUENCY spill per 10 ⁵ km-year	Shallow			Medium			Deep			FREQUENCY spill per 10 ⁵ km-year	Shallow			Medium			Deep		
			Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %		Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
CORROSION	7.69	0.054	(0.016)	0.038	13.38	(0.016)	0.038	15.36	(0.016)	0.038	17.91	0.139	(0.042)	0.097	16.77	(0.042)	0.097	17.36	(0.042)	0.097	17.93
External																					
Internal	7.69	0.054	(0.016)	0.038	13.38	(0.016)	0.038	15.36	(0.016)	0.038	17.91	0.139	(0.042)	0.097	16.77	(0.042)	0.097	17.36	(0.042)	0.097	17.93
THIRD PARTY IMPACT	69.23	0.484	(0.415)	0.070	24.84	(0.415)	0.070	28.53	(0.415)	0.070	33.26	1.247	(1.067)	0.180	31.15	(1.067)	0.180	32.24	(1.067)	0.180	33.30
Anchor Impact	30.77	0.215	(0.194)	0.022	7.64	(0.194)	0.022	8.78	(0.194)	0.022	10.23	0.554	(0.499)	0.055	9.59	(0.499)	0.055	9.92	(0.499)	0.055	10.25
Jackup Rig or Spud Barge	7.69	0.054	(0.027)	0.027	9.56	(0.027)	0.027	10.97	(0.027)	0.027	12.79	0.139	(0.069)	0.069	11.98	(0.069)	0.069	12.40	(0.069)	0.069	12.81
Trawl/Fishing Net	30.77	0.215	(0.194)	0.022	7.64	(0.194)	0.022	8.78	(0.194)	0.022	10.23	0.554	(0.499)	0.055	9.59	(0.499)	0.055	9.92	(0.499)	0.055	10.25
OPERATION IMPACT	7.69	0.054	(0.011)	0.043	15.29	(0.011)	0.043	17.56	(0.011)	0.043	20.47	0.139	(0.028)	0.111	19.17	(0.028)	0.111	19.84	(0.028)	0.111	20.50
Rig Anchoring																					
Work Boat Anchoring	7.69	0.054	(0.011)	0.043	15.29	(0.011)	0.043	17.56	(0.011)	0.043	20.47	0.139	(0.028)	0.111	19.17	(0.028)	0.111	19.84	(0.028)	0.111	20.50
MECHANICAL																					
Connection Failure																					
Material Failure																					
NATURAL HAZARD	15.38	0.108	(0.070)	0.038	13.38	(0.059)	0.048	19.75	(0.048)	0.059	28.14	0.277	(0.180)	0.097	16.77	(0.152)	0.125	22.32	(0.125)	0.152	28.18
Mud Slide	7.69	0.054	(0.043)	0.011	3.82	(0.032)	0.022	8.78	(0.022)	0.032	15.35	0.139	(0.111)	0.028	4.79	(0.083)	0.055	9.92	(0.055)	0.083	15.37
Storm/ Hurricane	7.69	0.054	(0.027)	0.027	9.56	(0.027)	0.027	10.97	(0.027)	0.027	12.79	0.139	(0.069)	0.069	11.98	(0.069)	0.069	12.40	(0.069)	0.069	12.81
ARCTIC			0.093	0.093	33.11	0.046	0.046	18.79	0.000	0.000	0.22		0.093	0.093	16.13	0.046	0.046	8.25	0.000	0.000	0.09
Ice Gouging			0.0730	0.0730	25.92	0.0365	0.0365	14.88					0.0730	0.0730	12.62	0.0365	0.0365	6.53			
Strudel Scour			0.0012	0.0012	0.44								0.0012	0.0012	0.22						
Upheaval Buckling			0.0002	0.0002	0.09	0.0002	0.0002	0.10	0.0002	0.0002	0.12		0.0002	0.0002	0.04	0.0002	0.0002	0.04	0.0002	0.0002	0.05
Thaw Settlement			0.0001	0.0001	0.04	0.0001	0.0001	0.05	0.0001	0.0001	0.06		0.0001	0.0001	0.02	0.0001	0.0001	0.02	0.0001	0.0001	0.02
Other			0.0187	0.0187	6.62	0.0092	0.0092	3.76	0.0001	0.0001	0.04		0.0187	0.0187	3.23	0.0092	0.0092	1.65	0.0001	0.0001	0.02
UNKNOWN																					
TOTALS	100.00	0.700	(0.418)	0.282	100.00	(0.455)	0.245	100.00	(0.489)	0.210	100.00	1.802	(1.223)	0.578	100.00	(1.243)	0.559	100.00	(1.261)	0.541	100.00

**Table 2.7
Arctic Spill Distribution and Frequency Platforms -Small and Medium Spills**

CAUSE CLASSIFICATION	HIST. DISTRIBUTION %	SMALL AND MEDIUM SPILLS									
		FREQUENCY spill per 10 ⁴ well-year	Shallow			Medium			Deep		
			Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
PROCESS FACILITY RLS.	66.67	1.002	(0.501)	0.501	57.89	(0.501)	0.5012	56.67	(0.501)	0.5012	54.92
STORAGE TANK RLS.	5.56	0.084	(0.025)	0.058	6.75	(0.025)	0.0585	6.61	(0.025)	0.0585	6.41
STRUCTURAL FAILURE	5.56	0.084	(0.025)	0.058	6.75	(0.025)	0.0585	6.61	(0.025)	0.0585	6.41
HURRICANE/STORM	11.11	0.167	(0.084)	0.084	9.65	(0.084)	0.0835	9.44	(0.084)	0.0835	9.15
COLLISION	11.11	0.167	(0.150)	0.017	1.93	(0.150)	0.0167	1.89	(0.150)	0.0167	1.83
ARCTIC			0.147	0.147	17.03	0.166	0.1661	18.78	0.194	0.1942	21.28
Ice Force			0.034	0.034	3.93	0.051	0.0510	5.77	0.077	0.0765	8.38
Facility Low Temperature			0.100	0.100	11.55	0.100	0.1000	11.31	0.100	0.1000	10.96
Other			0.013	0.013	1.55	0.015	0.0151	1.71	0.018	0.0177	1.93
TOTALS	100.00	1.504	(0.638)	0.866	100.00	(0.619)	0.8845	100.00	(0.591)	0.9125	100.00

Table 2.8
Arctic Spill Distribution and Frequency Platforms -Large and Huge Spills

CAUSE CLASSIFICATION	HIST. DISTRIBUTION %	LARGE AND HUGE SPILLS									
		FREQUENCY spill per 10 ⁴ well-year	Shallow			Medium			Deep		
			Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %	Frequency Change	New Frequency	New Distribution %
PROCESS FACILITY RLS.	33.33	0.0835	(0.042)	0.0418	23.99	(0.042)	0.0418	23.54	(0.042)	0.0418	22.90
STORAGE TANK RLS.	66.67	0.1671	(0.050)	0.1169	67.17	(0.050)	0.1169	65.92	(0.050)	0.1169	64.13
STRUCTURAL FAILURE											
HURRICANE/STORM											
COLLISION											
ARCTIC			0.015	0.0154	8.84	0.019	0.0187	10.54	0.024	0.0237	12.97
Ice Force			0.006	0.0060	3.45	0.009	0.0090	5.07	0.014	0.0135	7.40
Facility Low Temperature			0.008	0.0080	4.59	0.008	0.0080	4.51	0.008	0.0080	4.39
Other			0.001	0.0014	0.80	0.002	0.0017	0.96	0.002	0.0022	1.18
TOTALS	100.00	0.2506	(0.076)	0.1741	100.00	(0.073)	0.1774	100.00	(0.068)	0.1824	100.00

**Table 2.9
Arctic Frequency - Wells**

EVENT	FREQUENCY UNIT	Small and Medium Spills						Large Spill						Spill >=10000 <150000 bbl						Spill >=150000 bbl												
		HISTORICAL FREQUENCY	Shallow		Medium		Deep		HISTORICAL FREQUENCY	Shallow		Medium		Deep		HISTORICAL FREQUENCY	Shallow		Medium		Deep		HISTORICAL FREQUENCY	Shallow		Medium		Deep				
			Frequency Change	New Frequency	Frequency Change	New Frequency	Frequency Change	New Frequency		Frequency Change	New Frequency	Frequency Change	New Frequency	Frequency Change	New Frequency		Frequency Change	New Frequency	Frequency Change	New Frequency	Frequency Change	New Frequency		Frequency Change	New Frequency	Frequency Change	New Frequency	Frequency Change	New Frequency			
PRODUCTION WELL	spill per 10 ⁵ well-year	0.500		0.500		0.500		0.500		3.500		3.500		3.500		3.500		1.500		1.500		1.500		1.500		1.000		1.000		1.000		1.000
EXPLORATION WELL DRILLING	spill per 10 ⁵ wells	3.160		3.160		3.160		3.160		22.110		22.110		22.110		22.110		9.500		9.500		9.500		9.500		5.500		5.500		5.500		5.500
DEVELOPMENT WELL DRILLING	spill per 10 ⁵ wells	1.300		1.300		1.300		1.300		9.080		9.080		9.080		9.080		3.900		3.900		3.900		3.900		3.900		3.900		3.900		3.900

**Table 2.10
Average Spill Distribution**

PIPELINE SPILLS																
Spill Size	Small Spill				Medium Spill				Large Spill				Huge Spill			
Spill Expectation	Low	Most Likely	High	Expected	Low	Expected	High	Expected	Low	Most Likely	High	Expected	Low	Most Likely	High	Expected
P/L Dia <10" Spill	1	58	99	52	100	226	999	485	1000	4436	9999	5279	10000	14423	20000	14880
P/L Dia > 10" Spill	1	58	99	52	100	387	999	516	1000	3932	9999	5176	10000	17705	20000	15552
PLATFORM SPILLS																
Spill Size	Small and Medium Spills				Large and Huge Spills											
Spill Expectation	Low	Most Likely	High	Expected	Low	Most Likely	High	Expected								
Platform Spill	1	158	999	431	1000	6130	10000	5631								
WELL BLOWOUT SPILLS																
Spill Size	Small and Medium Spills				Large Spill				Spill >=10000 <150000 bbl				Spill >=150000 bbl			
Spill Expectation	Low	Most Likely	High	Expected	Low	Most Likely	High	Expected	Low	Most Likely	High	Expected	Low	Most Likely	High	Expected
Well Blowout Spill	1	500	999	500	1000	4500	9999	5292	10000	20000	150000	68349	150000	200000	250000	200000

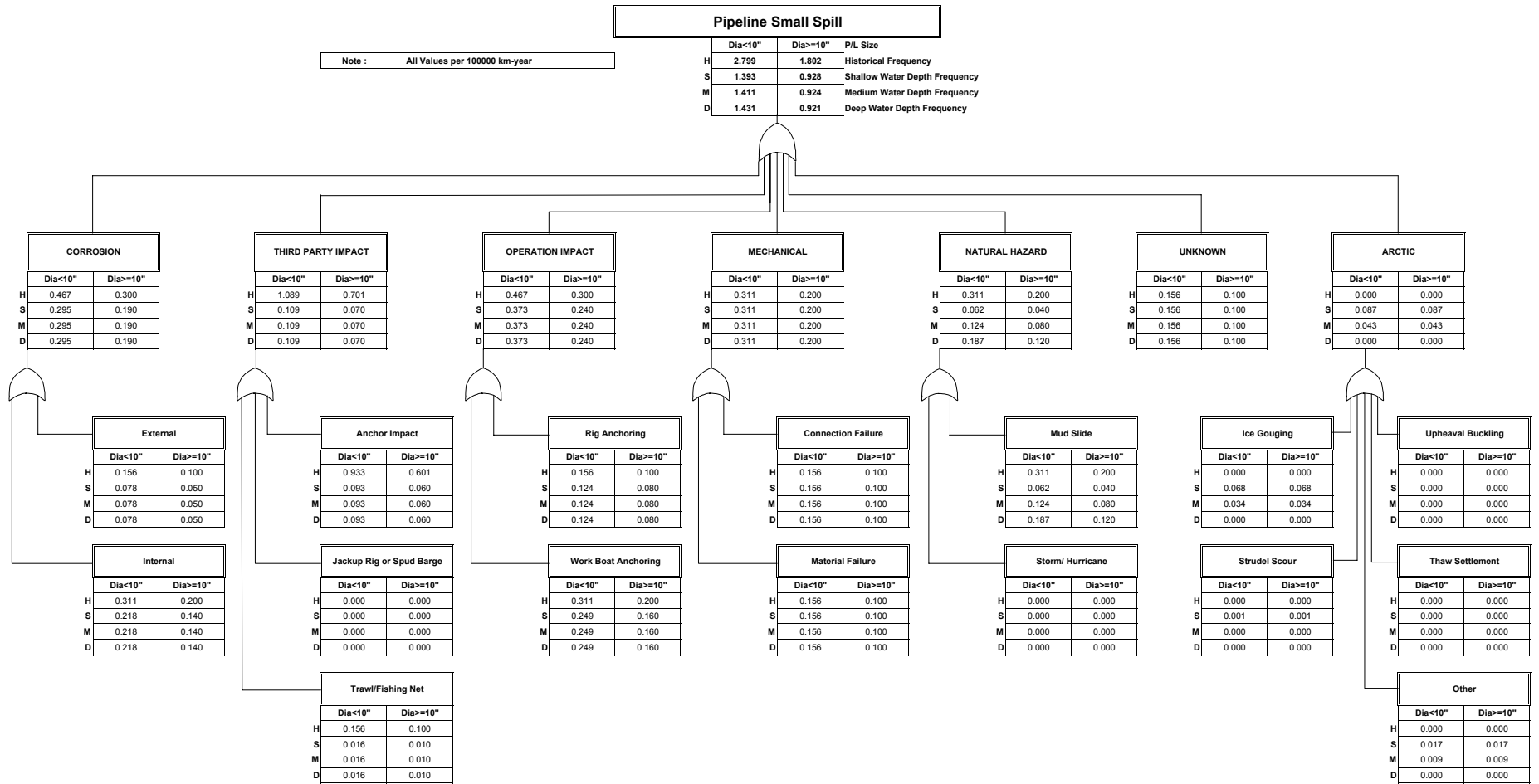


Figure 2.1 Fault Tree - Pipeline - Small Spill

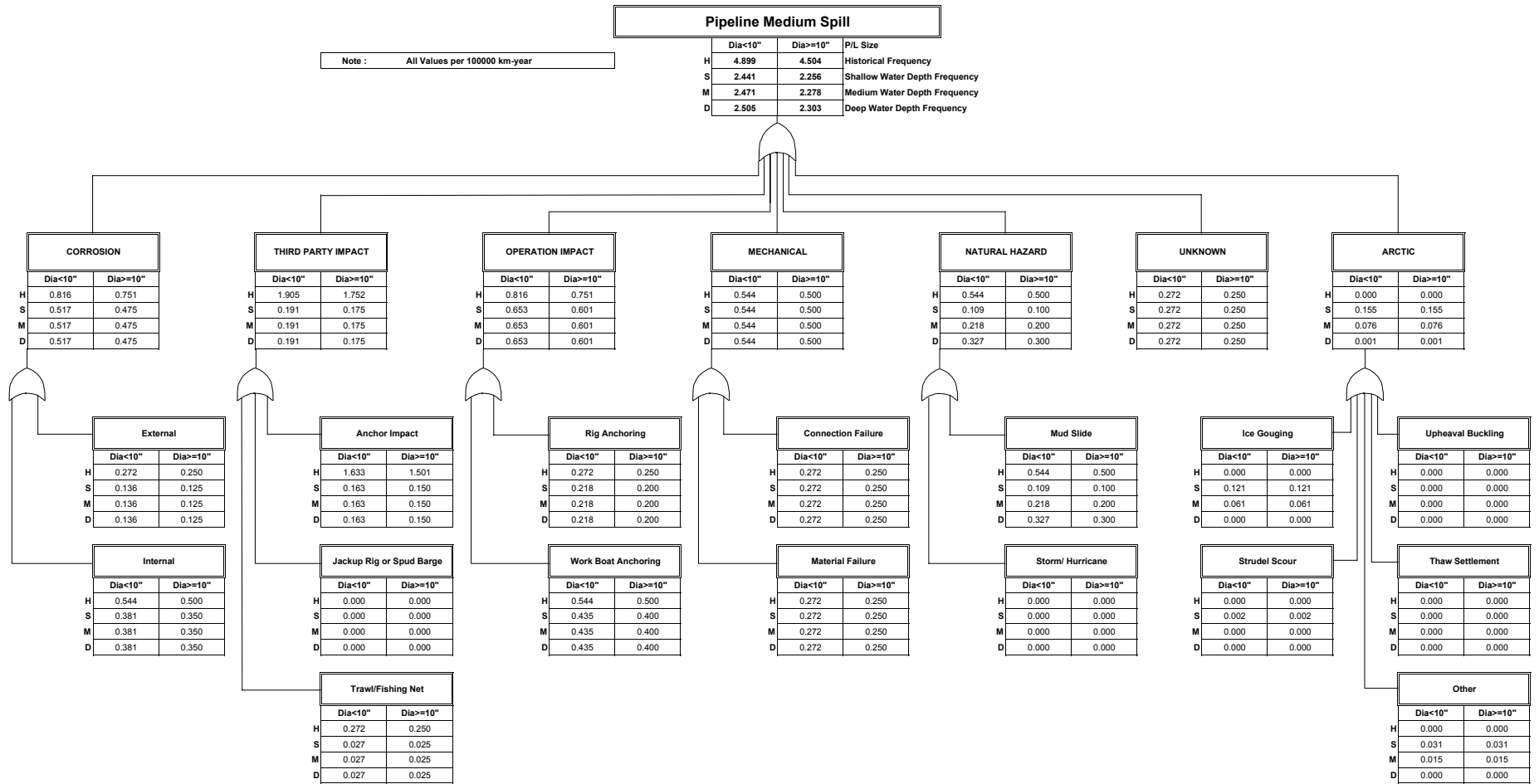


Figure 2.2 Fault Tree - Pipeline - Medium Spill

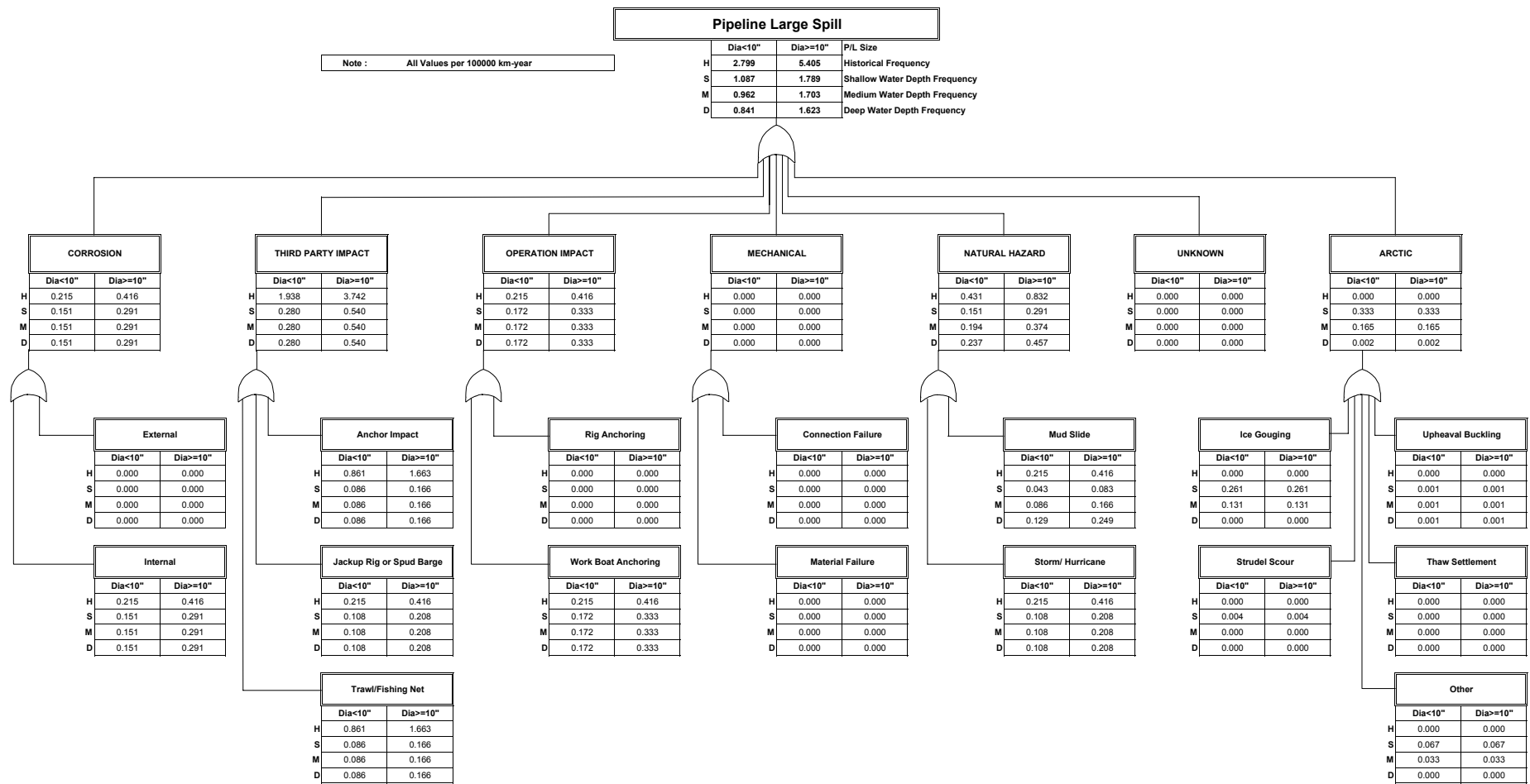


Figure 2.3 Fault Tree - Pipeline - Large Spill

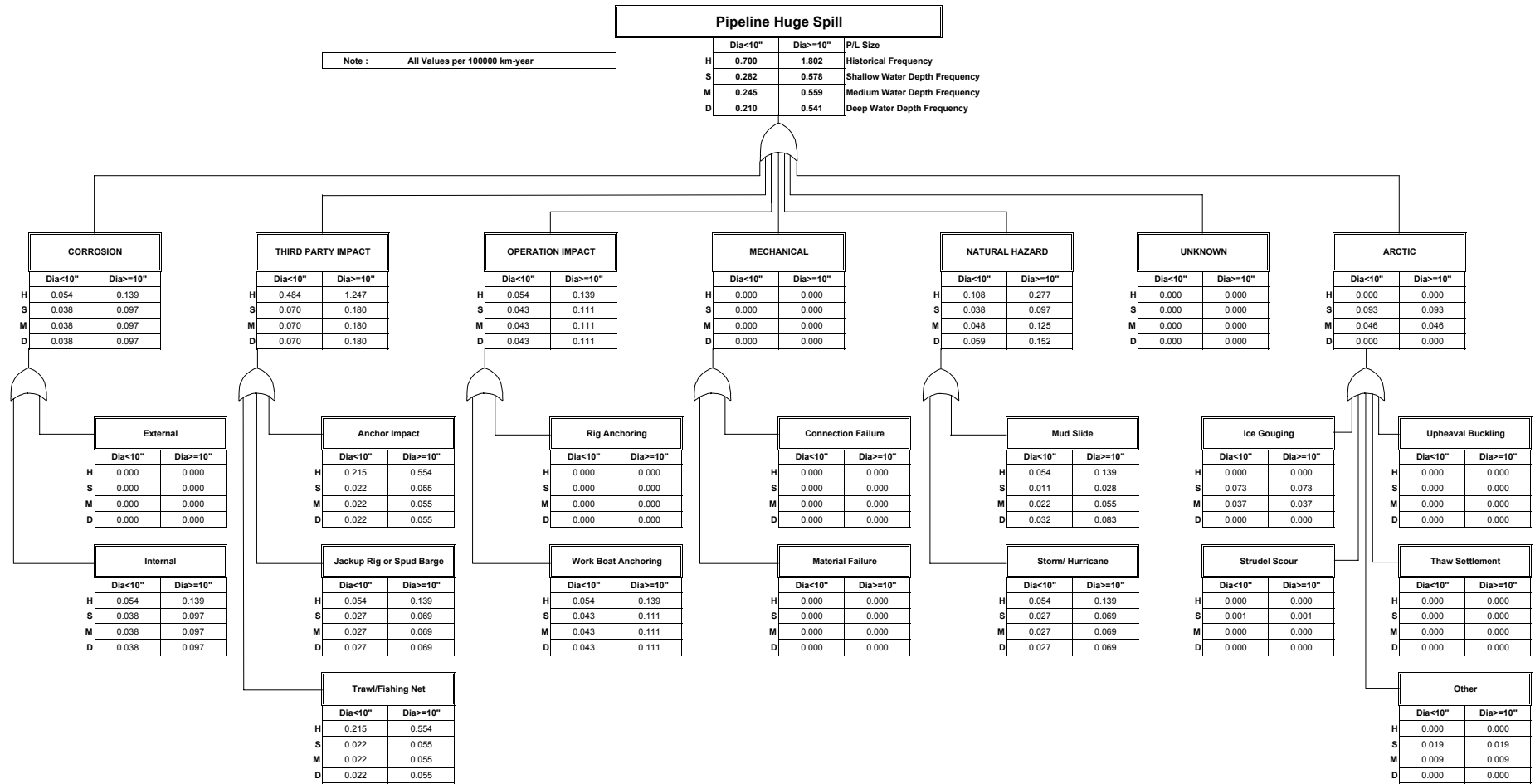


Figure 2.4 Fault Tree - Pipeline - Huge Spill

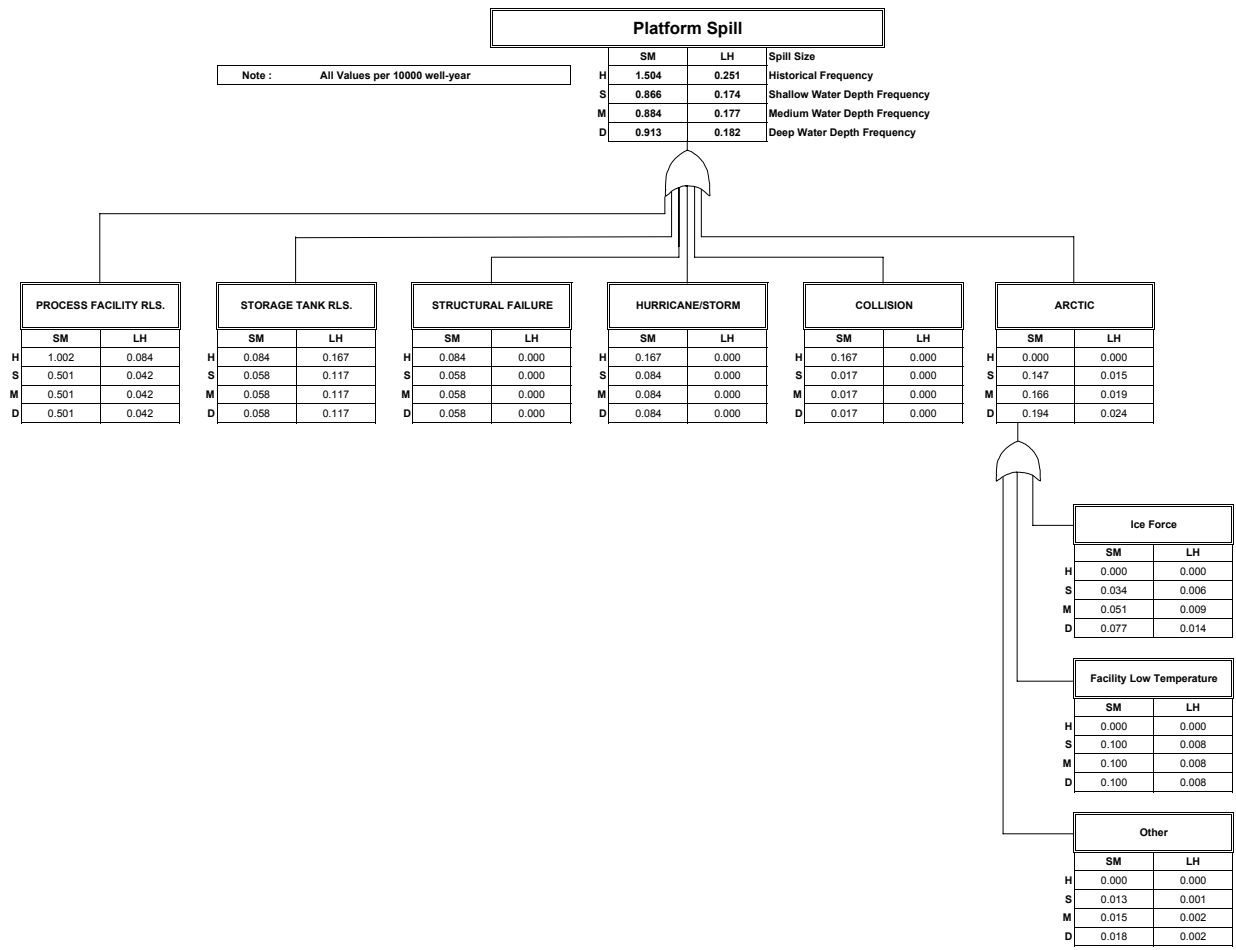


Figure 2.5 Fault Tree - Platform Spill

**Table 3.1
Beaufort Sea Sale 1 2004-2038**

Year	Water Depth	Exploration Wells	Delineation Wells	Expl./Del. Rigs	Production Platforms		Production Wells		Service Wells		Production Rigs	In-use Pipeline Length [miles]						Production MMbbl
					Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		Sum<10"		Sum >=10"		Sum All		
												Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2004	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2005	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2006	Shallow	1	2	2														
	Medium																	
	Deep																	
	Total	1	2	2														
2007	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2008	Shallow		2	1														
	Medium	1																
	Deep																	
	Total	1	2	1														
2009	Shallow				1	1	3	3	3	3	1							
	Medium	1		1														
	Deep																	
	Total	1		1	1	1	3	3	3	3	1							
2010	Shallow				1	10	13	4	7	1			10	10	10	10		10.9
	Medium		2	1														
	Deep																	
	Total		2	1	1	10	13	4	7	1			10	10	10	10		10.9
2011	Shallow				1	2	13	26	7	14	2			10		10		19.9
	Medium																	
	Deep																	
	Total				1	2	13	26	7	14	2			10		10		19.9
2012	Shallow				2	10	36	4	18	1			10	20	10	20		30.8
	Medium																	
	Deep																	
	Total				2	10	36	4	18	1			10	20	10	20		30.8
2013	Shallow				2	10	46	4	22	1				20		20		39.8
	Medium																	
	Deep																	
	Total				2	10	46	4	22	1				20		20		39.8
2014	Shallow				2		46		22					20		20		36.3
	Medium				1	1	3	3	3	3	1							
	Deep																	
	Total				1	3	3	49	3	25	1			20		20		36.3
2015	Shallow				2		46		22				10	30	10	30		33.4
	Medium				1	10	13	4	7	1			10	10	10	10		10.9
	Deep																	
	Total				3	10	59	4	29	1			20	40	20	40		44.3
2016	Shallow				2		46		22					30		30		27.6
	Medium				1	10	23	4	11	1			10		10		19.9	
	Deep																	
	Total				3	10	69	4	33	1			40		40		47.5	
2017	Shallow				2		46		22					30		30		22.7
	Medium				1		23		11				10		10		19.9	
	Deep																	
	Total				3		69		33				40		40		42.6	
2018	Shallow				2		46		22					30		30		18.8
	Medium				1		23		11				10		10		19.9	
	Deep																	
	Total				3		69		33				40		40		38.7	
2019	Shallow				2		46		22					30		30		15.5
	Medium				1		23		11				10		10		16.4	
	Deep																	
	Total				3		69		33				40		40		31.9	
2020	Shallow				2		46		22					30		30		12.8
	Medium				1		23		11				10		10		13.5	
	Deep																	
	Total				3		69		33				40		40		26.3	
2021	Shallow				2		46		22					30		30		10.5
	Medium				1		23		11				10		10		11.2	
	Deep																	
	Total				3		69		33				40		40		21.7	
2022	Shallow				2		46		22					30		30		8.7
	Medium				1		23		11				10		10		9.2	
	Deep																	
	Total				3		69		33				40		40		17.9	

**Table 3.1
Beaufort Sea Sale 1 2004-2038**

Year	Water Depth	Exploration Wells	Delineation Wells	Expl./Del. Rigs	Production Platforms		Production Wells		Service Wells		Production Rigs	In-use Pipeline Length [miles]						Production MMbbl
					Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		Sum <10"		Sum >=10"		Sum All		
												Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2023	Shallow					2	46	22						30	30	7.3		
	Medium					1	23	11						10	10	7.6		
	Deep																	
	Total					3	69	33						40	40	14.9		
2024	Shallow					2	46	22						30	30	6.1		
	Medium					1	23	11						10	10	6.3		
	Deep																	
	Total					3	69	33						40	40	12.4		
2025	Shallow					-1	1	-23	23	-11	11			-10	20	3.0		
	Medium					1	1	23	11	11				10	10	5.2		
	Deep																	
	Total					-1	2	-23	46	-11	22			-10	30	8.2		
2026	Shallow						1	23	11	11				20	20	2.6		
	Medium					1	1	23	11	11				10	10	4.3		
	Deep																	
	Total					2	2	46	22	22				30	30	6.9		
2027	Shallow					-1	1	-23	23	-11	11			-10	10	3.5		
	Medium					1	1	23	11	11				10	10	3.5		
	Deep																	
	Total					-1	1	-23	23	-11	11			-10	20	3.5		
2028	Shallow													10	10			
	Medium					1	1	23	11	11				10	10	3.0		
	Deep																	
	Total					1	1	23	11	11				20	20	3.0		
2029	Shallow													10	10			
	Medium					1	1	23	11	11				10	10	2.6		
	Deep																	
	Total					1	1	23	11	11				20	20	2.6		
2030	Shallow													-10	-10			
	Medium					-1	1	-23	23	-11	11			-10	-10			
	Deep																	
	Total					-1	1	-23	23	-11	11			-20	-20			
2031	Shallow																	
	Medium																	
	Deep																	
	Total																	
2032	Shallow																	
	Medium																	
	Deep																	
	Total																	
2033	Shallow																	
	Medium																	
	Deep																	
	Total																	
2034	Shallow																	
	Medium																	
	Deep																	
	Total																	
2035	Shallow																	
	Medium																	
	Deep																	
	Total																	
2036	Shallow																	
	Medium																	
	Deep																	
	Total																	
2037	Shallow																	
	Medium																	
	Deep																	
	Total																	
2038	Shallow																	
	Medium																	
	Deep																	
	Total																	

**Table 3.2
Beaufort Sea Sale 2 2004-2038**

Year	Water Depth	Exploration Wells	Delineation Wells	Expl./Del. Rigs	Production Platforms		Production Wells		Service Wells		Production Rigs	In-use Pipeline Length [miles]						Production MMbbl
					Incr. Cum.		Incr. Cum.		Incr. Cum.			Sum<10"		Sum >=10"		Sum All		
					Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2004	Shallow																	
	Medium																	
	Deep																	
	Total																	
2005	Shallow																	
	Medium																	
	Deep																	
	Total																	
2006	Shallow																	
	Medium																	
	Deep																	
	Total																	
2007	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2008	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2009	Shallow		2	1														
	Medium																	
	Deep																	
	Total		2	1														
2010	Shallow																	
	Medium	1		1														
	Deep																	
	Total	1		1														
2011	Shallow																	
	Medium																	
	Deep																	
	Total																	
2012	Shallow				1	1	3	3	3	3	1							
	Medium	1		1														
	Deep	1		1														
	Total	2		2	1	1	3	3	3	3	1							
2013	Shallow					1	10	13	4	7	1			15	15	15	15	10.9
	Medium		2	1														
	Deep	1		1														
	Total	1	2	2		1	10	13	4	7	1			15	15	15	15	10.9
2014	Shallow					1	10	23	4	11	1				15	15	15	19.9
	Medium		2	1														
	Deep																	
	Total		2	1		1	10	23	4	11	1			15	15	15	19.9	
2015	Shallow					1	23	23	11	11					15	15	15	19.9
	Medium																	
	Deep																	
	Total					1	23	23	11	11				15	15	15	19.9	
2016	Shallow					1	1	3	3	3	1							
	Medium																	
	Deep																	
	Total					1	2	3	26	3	14	1			15	15	15	19.9
2017	Shallow					1	2	23	11	11				10	25	10	25	16.4
	Medium					1	2	13	16	7	10	2	5	5	10	10	15	18.4
	Deep																	
	Total					1	3	13	39	7	21	2	5	5	20	35	25	40
2018	Shallow						1	23	11	11					25	25	25	13.5
	Medium						2	20	36	8	18	2	5	10	10	15	30.7	
	Deep																	
	Total						3	20	59	8	29	2	5	10	35	25	40	44.2
2019	Shallow						1	23	11	11					25	25	25	11.2
	Medium						2	10	46	4	22	1	5	10	10	15	30.7	
	Deep																	
	Total						3	10	69	4	33	1	5	10	35	25	40	41.9
2020	Shallow						1	23	11	11					25	25	25	9.2
	Medium						2	46	22	22			5	10	10	15	30.7	
	Deep																	
	Total						3	69	33	33			5	10	35	25	40	39.9
2021	Shallow						1	23	11	11					25	25	25	7.6
	Medium						2	46	22	22			5	10	10	15	30.7	
	Deep																	
	Total						3	69	33	33			5	10	35	25	40	38.3
2022	Shallow						1	23	11	11					25	25	25	6.3
	Medium						2	46	22	22			5	10	10	15	26.4	
	Deep																	
	Total						3	69	33	33			5	10	35	25	40	32.7

**Table 3.2
Beaufort Sea Sale 2 2004-2038**

Year	Water Depth	Exploration Wells	Delineation Wells	Expl./Del. Rigs	Production Platforms		Production Wells		Service Wells		Production Rigs	In-use Pipeline Length [miles]			Production MMbbl	
					Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		Sum <10"	Sum >=10"	Sum All		
												Incr.	Cum.	Incr.		Cum.
2023	Shallow					1	23		11				25	25	5.2	
	Medium					2	46		22			5	10	15	22.7	
	Deep															
	Total					3	69		33			5	35	40	27.9	
2024	Shallow					1	23		11				25	25	4.3	
	Medium					2	46		22			5	10	15	19.5	
	Deep															
	Total					3	69		33			5	35	40	23.8	
2025	Shallow					1	23		11				25	25	3.5	
	Medium					2	46		22			5	10	15	16.8	
	Deep															
	Total					3	69		33			5	35	40	20.3	
2026	Shallow					1	23		11				25	25	2.9	
	Medium					2	46		22			5	10	15	14.4	
	Deep															
	Total					3	69		33			5	35	40	17.3	
2027	Shallow					1	23		11				25	25	2.4	
	Medium					2	46		22			5	10	15	12.4	
	Deep															
	Total					3	69		33			5	35	40	14.8	
2028	Shallow					-1	-23		-11				-15	10	-15	10
	Medium					2	46		22			5	10	15	10.7	
	Deep															
	Total					-1	2	-23	46	-11	22	5	-15	20	-15	25
2029	Shallow												10	10		
	Medium					2	46		22			5	10	15	9.2	
	Deep															
	Total					2	46		22			5	20	25	9.2	
2030	Shallow												10	10		
	Medium					2	46		22			5	10	15	7.9	
	Deep															
	Total					2	46		22			5	20	25	7.9	
2031	Shallow												10	10		
	Medium					2	46		22			5	10	15	6.8	
	Deep															
	Total					2	46		22			5	20	25	6.8	
2032	Shallow												10	10		
	Medium					2	46		22			5	10	15	5.8	
	Deep															
	Total					2	46		22			5	20	25	5.8	
2033	Shallow												10	10		
	Medium					2	46		22			5	10	15	5.0	
	Deep															
	Total					2	46		22			5	20	25	5.0	
2034	Shallow												10	10		
	Medium					2	46		22			5	10	15	4.3	
	Deep															
	Total					2	46		22			5	20	25	4.3	
2035	Shallow												10	10		
	Medium					2	46		22			5	10	15	3.7	
	Deep															
	Total					2	46		22			5	20	25	3.7	
2036	Shallow												-10	-10		
	Medium					-2	-46		-22			-5	-10	-15		
	Deep															
	Total					-2	-46		-22			-5	-20	-25		
2037	Shallow															
	Medium															
	Deep															
	Total															
2038	Shallow															
	Medium															
	Deep															
	Total															

**Table 3.3
Beaufort Sea Sale 3 2004-2038**

Year	Water Depth	Exploration Wells	Delineation Wells	Expl./Del. Rigs	Production Platforms		Production Wells		Service Wells		Production Rigs	In-use Pipeline Length [miles]						Production MMbbl
												Sum<10"		Sum >=10"		Sum All		
					Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2004	Shallow																	
	Medium																	
	Deep																	
	Total																	
2005	Shallow																	
	Medium																	
	Deep																	
	Total																	
2006	Shallow																	
	Medium																	
	Deep																	
	Total																	
2007	Shallow																	
	Medium																	
	Deep																	
	Total																	
2008	Shallow																	
	Medium																	
	Deep																	
	Total																	
2009	Shallow																	
	Medium																	
	Deep																	
	Total																	
2010	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2011	Shallow																	
	Medium																	
	Deep																	
	Total																	
2012	Shallow																	
	Medium	1		1														
	Deep																	
	Total	1		1														
2013	Shallow																	
	Medium	1	1	1														
	Deep																	
	Total	1	1	1														
2014	Shallow																	
	Medium		2	1														
	Deep																	
	Total		2	1														
2015	Shallow																	
	Medium		2	1														
	Deep	1		1														
	Total	1	2	2														
2016	Shallow																	
	Medium																	
	Deep																	
	Total																	
2017	Shallow																	
	Medium																	
	Deep	1		1														
	Total	1		1														
2018	Shallow																	
	Medium				1	1	4	4	4	4	1							
	Deep	1		1														
	Total	1		1	1	1	4	4	4	4	1							
2019	Shallow													15	15	15	15	
	Medium				1	2	14	18	8	12	2	5	5	15	15	20	20	30.8
	Deep																	
	Total				1	2	14	18	8	12	2	5	5	30	30	35	35	30.8
2020	Shallow													15		15		
	Medium					2	20	38	8	20	2		5	15		20		38.6
	Deep																	
	Total					2	20	38	8	20	2		5		30		35	38.6
2021	Shallow													15		15		
	Medium					2	20	58	9	29	2		5	15		20		38.6
	Deep																	
	Total					2	20	58	9	29	2		5		30		35	38.6
2022	Shallow													15		15		
	Medium					2	10	68	5	34	1		5	15		20		38.6
	Deep																	
	Total					2	10	68	5	34	1		5		30		35	38.6

**Table 3.3
Beaufort Sea Sale 3 2004-2038**

2023	Shallow												15	15	
	Medium				2	68	34					5	15	20	38.6
	Deep														
	Total				2	68	34					5	30	35	38.6
2024	Shallow												15	15	
	Medium				2	68	34					5	15	20	38.6
	Deep														
	Total				2	68	34					5	30	35	38.6
2025	Shallow												15	15	
	Medium				2	68	34					5	15	20	34.0
	Deep														
	Total				2	68	34					5	30	35	34.0
2026	Shallow												15	15	
	Medium				2	68	34					5	15	20	29.9
	Deep														
	Total				2	68	34					5	30	35	29.9
2027	Shallow												15	15	
	Medium				2	68	34					5	15	20	26.3
	Deep														
	Total				2	68	34					5	30	35	26.3
2028	Shallow												15	15	
	Medium				2	68	34					5	15	20	23.2
	Deep														
	Total				2	68	34					5	30	35	23.2
2029	Shallow												15	15	
	Medium				2	68	34					5	15	20	20.4
	Deep														
	Total				2	68	34					5	30	35	20.4
2030	Shallow												15	15	
	Medium				2	68	34					5	15	20	17.9
	Deep														
	Total				2	68	34					5	30	35	17.9
2031	Shallow												15	15	
	Medium				2	68	34					5	15	20	15.8
	Deep														
	Total				2	68	34					5	30	35	15.8
2032	Shallow												15	15	
	Medium				2	68	34					5	15	20	13.9
	Deep														
	Total				2	68	34					5	30	35	13.9
2033	Shallow												15	15	
	Medium				2	68	34					5	15	20	12.2
	Deep														
	Total				2	68	34					5	30	35	12.2
2034	Shallow												15	15	
	Medium				2	68	34					5	15	20	10.8
	Deep														
	Total				2	68	34					5	30	35	10.8
2035	Shallow												15	15	
	Medium				2	68	34					5	15	20	9.5
	Deep														
	Total				2	68	34					5	30	35	9.5
2036	Shallow												15	15	
	Medium				2	68	34					5	15	20	8.3
	Deep														
	Total				2	68	34					5	30	35	8.3
2037	Shallow												15	15	
	Medium				2	68	34					5	15	20	7.3
	Deep														
	Total				2	68	34					5	30	35	7.3
2038	Shallow												15	15	
	Medium				2	68	34					5	15	20	6.5
	Deep														
	Total				2	68	34					5	30	35	6.5

**Table 3.4
Beaufort Sea All Sales 2004-2038**

Year	Water Depth	Exploration Wells	Delineation Wells	Expl./Del. Rigs	Production Platforms		Production Wells		Service Wells		Production Rigs	In-use Pipeline Length [miles]						Production MMbbl
					Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		Sum<10"		Sum >=10"		Sum All		
												Incr.	Cum.	Incr.	Cum.	Incr.	Cum.	
2004	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2005	Shallow	1		1														
	Medium																	
	Deep																	
	Total	1		1														
2006	Shallow	1	2	2														
	Medium																	
	Deep																	
	Total	1	2	2														
2007	Shallow	2		2														
	Medium																	
	Deep																	
	Total	2		2														
2008	Shallow	1	2	2														
	Medium	1																
	Deep																	
	Total	2	2	2														
2009	Shallow		2	1	1	1	3	3	3	3	1							
	Medium	1		1														
	Deep																	
	Total	1	2	2	1	1	3	3	3	3	1							
2010	Shallow	1		1		1	10	13	4	7	1		10	10	10	10		10.9
	Medium	1	2	2														
	Deep																	
	Total	2	2	3		1	10	13	4	7	1		10	10	10	10		10.9
2011	Shallow				1	2	13	26	7	14	2			10	10			19.9
	Medium																	
	Deep																	
	Total				1	2	13	26	7	14	2			10	10	10		19.9
2012	Shallow				1	3	13	39	7	21	2		10	20	10	20		30.8
	Medium	2		2														
	Deep	1		1														
	Total	3		3	1	3	13	39	7	21	2		10	20	10	20		30.8
2013	Shallow					3	20	59	8	29	2		15	35	15	35		50.7
	Medium	1	3	2														
	Deep	1		1														
	Total	2	3	3		3	20	59	8	29	2		15	35	15	35		50.7
2014	Shallow					3	10	69	4	33	1			35		35		56.2
	Medium		4	2	1	1	3	3	3	3	1							
	Deep																	
	Total		4	2	1	4	13	72	7	36	2			35		35		56.2
2015	Shallow					3		69		33			10	45	10	45		53.3
	Medium		2	1		1	10	13	4	7	1		10	10	10	10		10.9
	Deep	1		1														
	Total	1	2	2		4	10	82	4	40	1		20	55	20	55		64.2
2016	Shallow					3		69		33				45		45		47.5
	Medium				1	2	13	26	7	14	2			10		10		19.9
	Deep																	
	Total				1	5	13	95	7	47	2			55		55		67.4
2017	Shallow					3		69		33			10	55	10	55		39.1
	Medium				1	3	13	39	7	21	2	5	5	10	20	15	25	38.3
	Deep	1		1														
	Total	1		1	1	6	13	108	7	54	2	5	5	20	75	25	80	77.4
2018	Shallow					3		69		33				55		55		32.3
	Medium				1	4	24	63	12	33	3		5	20		25		50.6
	Deep	1		1														
	Total	1		1	1	7	24	132	12	66	3		5		75		80	82.9
2019	Shallow					3		69		33				15	70	15	70	26.7
	Medium				1	5	24	87	12	45	3	5	10	15	35	20	45	77.9
	Deep																	
	Total				1	8	24	156	12	78	3	5	10	30	105	35	115	104.6
2020	Shallow					3		69		33				70		70		22.0
	Medium					5	20	107	8	53	2		10	35		45		82.8
	Deep																	
	Total					8	20	176	8	86	2		10		105		115	104.8
2021	Shallow					3		69		33				70		70		18.1
	Medium					5	20	127	9	62	2		10	35		45		80.5
	Deep																	
	Total					8	20	196	9	95	2		10		105		115	98.6
2022	Shallow					3		69		33				70		70		15.0
	Medium					5	10	137	5	67	1		10	35		45		74.2
	Deep																	
	Total					8	10	206	5	100	1		10		105		115	89.2

**Table 3.4
Beaufort Sea All Sales 2004-2038**

Year	Water Depth	Exploration Wells	Delineation Wells	Expl./Del. Rigs	Production Platforms		Production Wells		Service Wells		Production Rigs	In-use Pipeline Length [miles]						Production MMbbl	
					Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		Sum <10"		Sum >=10"		Sum All			
												Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		
2023	Shallow					3		69		33					70		70	12.5	
	Medium					5		137		67		10		35		45	68.9		
	Deep																		
	Total					8		206		100		10		105		115	81.4		
2024	Shallow					3		69		33				70		70	10.4		
	Medium					5		137		67		10		35		45	64.4		
	Deep																		
	Total					8		206		100		10		105		115	74.8		
2025	Shallow					-1	2	-23	46	-11	22			-10	60	-10	60	6.5	
	Medium					5		137		67		10		35		45	56.0		
	Deep																		
	Total					-1	7	-23	183	-11	89		10	-10	95	-10	105	62.5	
2026	Shallow						2		46		22			60		60	5.5		
	Medium					5		137		67		10		35		45	48.6		
	Deep																		
	Total					7		183		89		10		95		105	54.1		
2027	Shallow					-1	1	-23	23	-11	11			-10	50	-10	50	2.4	
	Medium					5		137		67		10		35		45	42.2		
	Deep																		
	Total					-1	6	-23	160	-11	78		10	-10	85	-10	95	44.6	
2028	Shallow					-1		-23		-11				-15	35	-15	35		
	Medium					5		137		67		10		35		45	36.9		
	Deep																		
	Total					-1	5	-23	137	-11	67		10	-15	70	-15	80	36.9	
2029	Shallow													35		35			
	Medium					5		137		67		10		35		45	32.2		
	Deep																		
	Total					5		137		67		10		70		80	32.2		
2030	Shallow													-10	25	-10	25		
	Medium					-1	4	-23	114	-11	56		10	-10	25	-10	35	25.8	
	Deep																		
	Total					-1	4	-23	114	-11	56		10	-20	50	-20	60	25.8	
2031	Shallow													25		25			
	Medium					4		114		56		10		25		35	22.6		
	Deep																		
	Total					4		114		56		10		50		60	22.6		
2032	Shallow													25		25			
	Medium					4		114		56		10		25		35	19.7		
	Deep																		
	Total					4		114		56		10		50		60	19.7		
2033	Shallow													25		25			
	Medium					4		114		56		10		25		35	17.2		
	Deep																		
	Total					4		114		56		10		50		60	17.2		
2034	Shallow													25		25			
	Medium					4		114		56		10		25		35	15.1		
	Deep																		
	Total					4		114		56		10		50		60	15.1		
2035	Shallow													25		25			
	Medium					4		114		56		10		25		35	13.2		
	Deep																		
	Total					4		114		56		10		50		60	13.2		
2036	Shallow													-10	15	-10	15		
	Medium					-2	2	-46	68	-22	34		-5	5	-10	15	-15	20	8.3
	Deep																		
	Total					-2	2	-46	68	-22	34		-5	5	-20	30	-25	35	8.3
2037	Shallow													15		15			
	Medium					2		68		34		5		15		20	7.3		
	Deep																		
	Total					2		68		34		5		30		35	7.3		
2038	Shallow													15		15			
	Medium					2		68		34		5		15		20	6.5		
	Deep																		
	Total					2		68		34		5		30		35	6.5		

**Table T.3.5
Chukchi Sea Base Case 1998-2010**

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Prod./Serv. Wells		Pipeline Length [miles]						Production MMbbl	
				Incr.	Cum.	Incr.	Cum.	Sum<10"		Sum >=10"		Sum All			
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		
1998	Shallow														
	Medium														
	Deep	2	2												
	Total	2	2												0
1999	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep									135	135	135	135		
	Total									200	200	200	200		0
2000	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep			2	2	8	8			135	135	135	135		
	Total			2	2	8	8			200	200	200	200		0
2001	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep			2	4	40	48			135	135	135	135		
	Total			2	4	40	48			200	200	200	200		0
2002	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep			2	6	60	108			135	135	135	135		
	Total			2	6	60	108			200	200	200	200		101
2003	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	80	188			135	135	135	135		
	Total				6	80	188			200	200	200	200		135
2004	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	26	214			135	135	135	135		
	Total				6	26	214			200	200	200	200		135
2005	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	214	214			135	135	135	135		
	Total				6	214	214			200	200	200	200		135
2006	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	214	214			135	135	135	135		
	Total				6	214	214			200	200	200	200		135
2007	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	214	214			135	135	135	135		
	Total				6	214	214			200	200	200	200		135
2008	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	214	214			135	135	135	135		
	Total				6	214	214			200	200	200	200		119
2009	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	214	214			135	135	135	135		
	Total				6	214	214			200	200	200	200		103
2010	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep				6	214	214			135	135	135	135		
	Total				6	214	214			200	200	200	200		92

**Table T.3.6
Chukchi Sea High Case 1998-2010**

Year	Water Depth	Exploration Wells	Delineation Wells	Production Platforms		Prod./Serv. Wells		Pipeline Length [miles]						Production MMbbl	
				Incr.	Cum.	Incr.	Cum.	Sum<10"		Sum >=10"		Sum All			
								Incr.	Cum.	Incr.	Cum.	Incr.	Cum.		
1998	Shallow														
	Medium														
	Deep	3	1												
	Total	3	1												0
1999	Shallow														
	Medium														
	Deep	2	1												
	Total	2	1												0
2000	Shallow									5	5	5	5		
	Medium									60	60	60	60		
	Deep	2		2	2					135	135	135	135		
	Total	2		2	2					200	200	200	200		0
2001	Shallow										5		5		
	Medium										60		60		
	Deep			6	8	50	50					135		135	
	Total			6	8	50	50					200		200	0
2002	Shallow										5		5		
	Medium										60		60		
	Deep			4	12	80	130					135		135	
	Total			4	12	80	130					200		200	0
2003	Shallow										5		5		
	Medium										60		60		
	Deep				12	140	270					135		135	
	Total				12	140	270					200		200	223
2004	Shallow										5		5		
	Medium										60		60		
	Deep				12	140	410					135		135	
	Total				12	140	410					200		200	297
2005	Shallow										5		5		
	Medium										60		60		
	Deep				12	72	482					135		135	
	Total				12	72	482					200		200	297
2006	Shallow										5		5		
	Medium										60		60		
	Deep				12		482					135		135	
	Total				12		482					200		200	297
2007	Shallow										5		5		
	Medium										60		60		
	Deep				12		482					135		135	
	Total				12		482					200		200	297
2008	Shallow										5		5		
	Medium										60		60		
	Deep				12		482					135		135	
	Total				12		482					200		200	297
2009	Shallow										5		5		
	Medium										60		60		
	Deep				12		482					135		135	
	Total				12		482					200		200	262
2010	Shallow										5		5		
	Medium										60		60		
	Deep				12		482					135		135	
	Total				12		482					200		200	227

**Table 4.1.1
Arctic Spill Occurrence Beaufort Sea Sale 1 P/L**

Year	Water Depth	P/L Dia <10"												P/L Dia >= 10"													
		P/L [miles]	Small Spills			Medium Spills			Large Spills			Huge Spills			P/L [miles]	Small Spills			Medium Spills			Large Spills			Huge Spills		
			Average Spill [bbl] =	58		Average Spill [bbl] =	266		Average Spill [bbl] =	4436		Average Spill [bbl] =	14423			Average Spill [bbl] =	58		Average Spill [bbl] =	387		Average Spill [bbl] =	3932		Average Spill [bbl] =		
			Cumm.	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years		Spill Index bbl	Cumm.	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year
2004	Shallow																										
	Medium																										
	Deep																										
	Total																										
2005	Shallow																										
	Medium																										
	Deep																										
	Total																										
2006	Shallow																										
	Medium																										
	Deep																										
	Total																										
2007	Shallow																										
	Medium																										
	Deep																										
	Total																										
2008	Shallow																										
	Medium																										
	Deep																										
	Total																										
2009	Shallow																										
	Medium																										
	Deep																										
	Total																										
2010	Shallow																										
	Medium																										
	Deep																										
	Total																										
2011	Shallow																										
	Medium																										
	Deep																										
	Total																										
2012	Shallow																										
	Medium																										
	Deep																										
	Total																										
2013	Shallow																										
	Medium																										
	Deep																										
	Total																										
2014	Shallow																										
	Medium																										
	Deep																										
	Total																										
2015	Shallow																										
	Medium																										
	Deep																										
	Total																										
2016	Shallow																										
	Medium																										
	Deep																										
	Total																										
2017	Shallow																										
	Medium																										
	Deep																										
	Total																										
2018	Shallow																										
	Medium																										
	Deep																										
	Total																										
2019	Shallow																										
	Medium																										
	Deep																										
	Total																										
2020	Shallow																										
	Medium																										
	Deep																										
	Total																										
2021	Shallow																										
	Medium																										
	Deep																										
	Total																										

**Table 4.1.1
Arctic Spill Occurrence Beaufort Sea Sale 1 P/L**

Year	Water Depth	P/L Dia <10"												P/L Dia >= 10"													
		P/L [miles]	Small Spills			Medium Spills			Large Spills			Huge Spills			P/L [miles]	Small Spills			Medium Spills			Large Spills			Huge Spills		
			Average Spill [bbl] =	58		Average Spill [bbl] =	266		Average Spill [bbl] =	4436		Average Spill [bbl] =	14423			Average Spill [bbl] =	58		Average Spill [bbl] =	387		Average Spill [bbl] =	3932		Average Spill [bbl] =		
			Cumm.	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years		Spill Index bbl	Cumm.	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ³ km-year
2022	Shallow	1.393			2.441			1.087			0.282			30	0.928	0.448	0.03	2.256	1.089	0.42	1.789	0.863	3.39	0.578	0.279		
	Medium	1.411			2.471			0.962			0.245			10	0.924	0.149	0.01	2.278	0.367	0.14	1.703	0.274	1.08	0.559	0.090		
	Deep	1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541			
	Total												40		0.596	0.03		1.456	0.56		1.137	4.47		0.369			
2023	Shallow	1.393			2.441			1.087			0.282			30	0.928	0.448	0.03	2.256	1.089	0.42	1.789	0.863	3.39	0.578	0.279		
	Medium	1.411			2.471			0.962			0.245			10	0.924	0.149	0.01	2.278	0.367	0.14	1.703	0.274	1.08	0.559	0.090		
	Deep	1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541			
	Total												40		0.596	0.03		1.456	0.56		1.137	4.47		0.369			
2024	Shallow	1.393			2.441			1.087			0.282			30	0.928	0.448	0.03	2.256	1.089	0.42	1.789	0.863	3.39	0.578	0.279		
	Medium	1.411			2.471			0.962			0.245			10	0.924	0.149	0.01	2.278	0.367	0.14	1.703	0.274	1.08	0.559	0.090		
	Deep	1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541			
	Total												40		0.596	0.03		1.456	0.56		1.137	4.47		0.369			
2025	Shallow	1.393			2.441			1.087			0.282			20	0.928	0.299	0.02	2.256	0.726	0.28	1.789	0.863	3.39	0.578	0.186		
	Medium	1.411			2.471			0.962			0.245			10	0.924	0.149	0.01	2.278	0.367	0.14	1.703	0.274	1.08	0.559	0.090		
	Deep	1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541			
	Total												30		0.447	0.03		1.093	0.42		0.850	3.34		0.276			
2026	Shallow	1.393			2.441			1.087			0.282			20	0.928	0.299	0.02	2.256	0.726	0.28	1.789	0.863	3.39	0.578	0.186		
	Medium	1.411			2.471			0.962			0.245			10	0.924	0.149	0.01	2.278	0.367	0.14	1.703	0.274	1.08	0.559	0.090		
	Deep	1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541			
	Total												30		0.447	0.03		1.093	0.42		0.850	3.34		0.276			
2027	Shallow	1.393			2.441			1.087			0.282			10	0.928	0.149	0.01	2.256	0.363	0.14	1.789	0.576	2.26	0.578	0.093		
	Medium	1.411			2.471			0.962			0.245			10	0.924	0.149	0.01	2.278	0.367	0.14	1.703	0.274	1.08	0.559	0.090		
	Deep	1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541			
	Total												20		0.298	0.02		0.730	0.28		0.562	2.21		0.183			
2028	Shallow	1.393			2.441			1.087			0.282			10	0.928	0.149	0.01	2.256	0.363	0.14	1.789	0.576	2.26	0.578	0.093		
	Medium	1.411			2.471			0.962			0.245			10	0.924	0.149	0.01	2.278	0.367	0.14	1.703	0.274	1.08	0.559	0.090		
	Deep	1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541			
	Total												20		0.298	0.02		0.730	0.28		0.562	2.21		0.183			
2029	Shallow	1.393			2.441			1.087			0.282			10	0.928	0.149	0.01	2.256	0.363	0.14	1.789	0.576	2.26	0.578	0.093		
	Medium	1.411			2.471			0.962			0.245			10	0.924	0.149	0.01	2.278	0.367	0.14	1.703	0.274	1.08	0.559	0.090		
	Deep	1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541			
	Total												20		0.298	0.02		0.730	0.28		0.562	2.21		0.183			
2030	Shallow	1.393			2.441			1.087			0.282				0.928			2.256			1.789			0.578			
	Medium	1.411			2.471			0.962			0.245				0.924			2.278			1.703			0.559			
	Deep	1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541			
	Total																										
2031	Shallow	1.393			2.441			1.087			0.282				0.928			2.256			1.789			0.578			
	Medium	1.411			2.471			0.962			0.245				0.924			2.278			1.703			0.559			
	Deep	1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541			
	Total																										
2032	Shallow	1.393			2.441			1.087			0.282				0.928			2.256			1.789			0.578			
	Medium	1.411			2.471			0.962			0.245				0.924			2.278			1.703			0.559			
	Deep	1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541			
	Total																										
2033	Shallow	1.393			2.441			1.087			0.282				0.928			2.256			1.789			0.578			
	Medium	1.411			2.471			0.962			0.245				0.924			2.278			1.703			0.559			
	Deep	1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541			
	Total																										
2034	Shallow	1.393			2.441			1.087			0.282				0.928			2.256			1.789			0.578			
	Medium	1.411			2.471			0.962			0.245				0.924			2.278			1.703			0.559			
	Deep	1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541			
	Total																										
2035	Shallow	1.393			2.441			1.087			0.282				0.928			2.256			1.789			0.578			
	Medium	1.411			2.471			0.962			0.245				0.924			2.278			1.703			0.559			
	Deep	1.431			2.505			0.841			0.210				0.921			2.303			1.623			0.541			
	Total																										
2036	Shallow	1.393			2.441			1.087			0.282				0.928			2.256			1.789			0.578			
	Medium	1.411			2.471			0.962			0.245				0.924			2.278			1.703			0.559			
	Deep	1.431</																									

**Table 4.1.2
Arctic Spill Occurrence Beaufort Sea Sale 1 P/L Summary**

Year	Production [MMbbl]	Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]
2004																			
2005																			
2006																			
2007																			
2008																			
2009																			
2010	10.9	0.149	0.014	0.009	0.363	0.033	0.141	0.512	0.047	0.149	0.288	0.026	1.132	0.093	0.009	1.648	0.893	0.082	2.928
2011	19.9	0.149	0.008	0.009	0.363	0.018	0.141	0.512	0.026	0.149	0.288	0.014	1.132	0.093	0.005	1.648	0.893	0.045	2.928
2012	30.8	0.299	0.010	0.017	0.726	0.024	0.281	1.025	0.033	0.298	0.576	0.019	2.263	0.186	0.006	3.295	1.786	0.058	5.857
2013	39.8	0.299	0.008	0.017	0.726	0.018	0.281	1.025	0.026	0.298	0.576	0.014	2.263	0.186	0.005	3.295	1.786	0.045	5.857
2014	36.3	0.299	0.008	0.017	0.726	0.020	0.281	1.025	0.028	0.298	0.576	0.016	2.263	0.186	0.005	3.295	1.786	0.049	5.857
2015	44.3	0.596	0.013	0.035	1.456	0.033	0.563	2.052	0.046	0.598	1.137	0.026	4.472	0.369	0.008	6.535	3.559	0.080	11.605
2016	47.5	0.596	0.013	0.035	1.456	0.031	0.563	2.052	0.043	0.598	1.137	0.024	4.472	0.369	0.008	6.535	3.559	0.075	11.605
2017	42.6	0.596	0.014	0.035	1.456	0.034	0.563	2.052	0.048	0.598	1.137	0.027	4.472	0.369	0.009	6.535	3.559	0.084	11.605
2018	38.7	0.596	0.015	0.035	1.456	0.038	0.563	2.052	0.053	0.598	1.137	0.029	4.472	0.369	0.010	6.535	3.559	0.092	11.605
2019	31.9	0.596	0.019	0.035	1.456	0.046	0.563	2.052	0.064	0.598	1.137	0.036	4.472	0.369	0.012	6.535	3.559	0.112	11.605
2020	26.3	0.596	0.023	0.035	1.456	0.055	0.563	2.052	0.078	0.598	1.137	0.043	4.472	0.369	0.014	6.535	3.559	0.135	11.605
2021	21.7	0.596	0.027	0.035	1.456	0.067	0.563	2.052	0.095	0.598	1.137	0.052	4.472	0.369	0.017	6.535	3.559	0.164	11.605
2022	17.9	0.596	0.033	0.035	1.456	0.081	0.563	2.052	0.115	0.598	1.137	0.064	4.472	0.369	0.021	6.535	3.559	0.199	11.605
2023	14.9	0.596	0.040	0.035	1.456	0.098	0.563	2.052	0.138	0.598	1.137	0.076	4.472	0.369	0.025	6.535	3.559	0.239	11.605
2024	12.4	0.596	0.048	0.035	1.456	0.117	0.563	2.052	0.165	0.598	1.137	0.092	4.472	0.369	0.030	6.535	3.559	0.287	11.605
2025	8.2	0.447	0.055	0.026	1.093	0.133	0.423	1.540	0.188	0.449	0.850	0.104	3.341	0.276	0.034	4.887	2.666	0.325	8.677
2026	6.9	0.447	0.065	0.026	1.093	0.158	0.423	1.540	0.223	0.449	0.850	0.123	3.341	0.276	0.040	4.887	2.666	0.386	8.677
2027	3.5	0.298	0.085	0.017	0.730	0.208	0.282	1.028	0.294	0.300	0.562	0.161	2.209	0.183	0.052	3.240	1.772	0.506	5.748
2028	3.0	0.298	0.099	0.017	0.730	0.243	0.282	1.028	0.343	0.300	0.562	0.187	2.209	0.183	0.061	3.240	1.772	0.591	5.748
2029	2.6	0.298	0.115	0.017	0.730	0.281	0.282	1.028	0.395	0.300	0.562	0.216	2.209	0.183	0.070	3.240	1.772	0.682	5.748
2030																			
2031																			
2032																			
2033																			
2034																			
2035																			
2036																			
2037																			
2038																			

**Table 4.1.3
Arctic Spill Occurrence Beaufort Sea Sale 1 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2005	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2006	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2007	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2008	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2009	Shallow	1	3	0.866	0.260	0.04	0.174	0.052	0.32
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	1	3		0.260	0.04		0.052	0.32
2010	Shallow	1	13	0.866	1.126	0.18	0.174	0.226	1.39
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	1	13		1.126	0.18		0.226	1.39
2011	Shallow	2	26	0.866	2.251	0.36	0.174	0.453	2.77
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	2	26		2.251	0.36		0.453	2.77
2012	Shallow	2	36	0.866	3.117	0.49	0.174	0.627	3.84
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	2	36		3.117	0.49		0.627	3.84
2013	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	2	46		3.983	0.63		0.801	4.91
2014	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	3	0.884	0.265	0.04	0.177	0.053	0.33
	Deep			0.913			0.182		
	Total	3	49		4.248	0.67		0.854	5.24
2015	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	13	0.884	1.150	0.18	0.177	0.231	1.41
	Deep			0.913			0.182		
	Total	3	59		5.132	0.81		1.032	6.32
2016	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	3	69		6.017	0.95		1.209	7.41
2017	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	3	69		6.017	0.95		1.209	7.41

**Table 4.1.3
Arctic Spill Occurrence Beaufort Sea Sale 1 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	3	69		6.017	0.95		1.209	7.41
2019	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	3	69		6.017	0.95		1.209	7.41
2020	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	3	69		6.017	0.95		1.209	7.41
2021	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	3	69		6.017	0.95		1.209	7.41
2022	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	3	69		6.017	0.95		1.209	7.41
2023	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	3	69		6.017	0.95		1.209	7.41
2024	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	3	69		6.017	0.95		1.209	7.41
2025	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	2	46		4.026	0.64		0.809	4.96
2026	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	2	46		4.026	0.64		0.809	4.96
2027	Shallow			0.866			0.174		
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	1	23		2.034	0.32		0.408	2.50
2028	Shallow			0.866			0.174		
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	1	23		2.034	0.32		0.408	2.50
2029	Shallow			0.866			0.174		
	Medium	1	23	0.884	2.034	0.32	0.177	0.408	2.50
	Deep			0.913			0.182		
	Total	1	23		2.034	0.32		0.408	2.50
2030	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2031	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								

**Table 4.1.3
Arctic Spill Occurrence Beaufort Sea Sale 1 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2033	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2034	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2035	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2036	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2037	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2038	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								

**Table 4.1.4
Arctic Spill Occurrence Beaufort Sea Sale 1 Platforms Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004										
2005										
2006										
2007										
2008										
2009		0.260		0.041	0.052		0.320	0.312		0.361
2010	10.9	1.126	0.103	0.178	0.226	0.021	1.387	1.352	0.124	1.565
2011	19.9	2.251	0.113	0.356	0.453	0.023	2.775	2.704	0.136	3.131
2012	30.8	3.117	0.101	0.492	0.627	0.020	3.842	3.744	0.122	4.335
2013	39.8	3.983	0.100	0.629	0.801	0.020	4.910	4.783	0.120	5.539
2014	36.3	4.248	0.117	0.671	0.854	0.024	5.236	5.102	0.141	5.907
2015	44.3	5.132	0.116	0.811	1.032	0.023	6.323	6.164	0.139	7.134
2016	47.5	6.017	0.127	0.951	1.209	0.025	7.411	7.226	0.152	8.362
2017	42.6	6.017	0.141	0.951	1.209	0.028	7.411	7.226	0.170	8.362
2018	38.7	6.017	0.155	0.951	1.209	0.031	7.411	7.226	0.187	8.362
2019	31.9	6.017	0.189	0.951	1.209	0.038	7.411	7.226	0.227	8.362
2020	26.3	6.017	0.229	0.951	1.209	0.046	7.411	7.226	0.275	8.362
2021	21.7	6.017	0.277	0.951	1.209	0.056	7.411	7.226	0.333	8.362
2022	17.9	6.017	0.336	0.951	1.209	0.068	7.411	7.226	0.404	8.362
2023	14.9	6.017	0.404	0.951	1.209	0.081	7.411	7.226	0.485	8.362
2024	12.4	6.017	0.485	0.951	1.209	0.097	7.411	7.226	0.583	8.362
2025	8.2	4.026	0.491	0.636	0.809	0.099	4.956	4.834	0.590	5.592
2026	6.9	4.026	0.583	0.636	0.809	0.117	4.956	4.834	0.701	5.592
2027	3.5	2.034	0.581	0.321	0.408	0.117	2.501	2.442	0.698	2.823
2028	3.0	2.034	0.678	0.321	0.408	0.136	2.501	2.442	0.814	2.823
2029	2.6	2.034	0.782	0.321	0.408	0.157	2.501	2.442	0.939	2.823
2030										
2031										
2032										
2033										
2034										
2035										
2036										
2037										
2038										

**Table 4.1.5
Arctic Spill Occurrence Beaufort Sea Sale 1 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2009	Shallow	3	0.500	0.015	0.01	3.500	0.105	0.47	1.500	0.045	0.90	1.000	0.030	6.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	3		0.015	0.01		0.105	0.47		0.045	0.90		0.030	6.00
2010	Shallow	13	0.500	0.065	0.03	3.500	0.455	2.05	1.500	0.195	3.90	1.000	0.130	26.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	13		0.065	0.03		0.455	2.05		0.195	3.90		0.130	26.00
2011	Shallow	26	0.500	0.130	0.07	3.500	0.910	4.10	1.500	0.390	7.80	1.000	0.260	52.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	26		0.130	0.07		0.910	4.10		0.390	7.80		0.260	52.00
2012	Shallow	36	0.500	0.180	0.09	3.500	1.260	5.67	1.500	0.540	10.80	1.000	0.360	72.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	36		0.180	0.09		1.260	5.67		0.540	10.80		0.360	72.00
2013	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2014	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	3	0.500	0.015	0.01	3.500	0.105	0.47	1.500	0.045	0.90	1.000	0.030	6.00
	Deep		0.500			3.500			1.500			1.000		
	Total	49		0.245	0.12		1.715	7.72		0.735	14.70		0.490	98.00
2015	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	13	0.500	0.065	0.03	3.500	0.455	2.05	1.500	0.195	3.90	1.000	0.130	26.00
	Deep		0.500			3.500			1.500			1.000		
	Total	59		0.295	0.15		2.065	9.29		0.885	17.70		0.590	118.00
2016	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2017	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00

**Table 4.1.5
Arctic Spill Occurrence Beaufort Sea Sale 1 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2019	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2020	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2021	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2022	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2023	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2024	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2025	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2026	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2027	Shallow		0.500			3.500			1.500			1.000		
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	23		0.115	0.06		0.805	3.62		0.345	6.90		0.230	46.00
2028	Shallow		0.500			3.500			1.500			1.000		
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	23		0.115	0.06		0.805	3.62		0.345	6.90		0.230	46.00
2029	Shallow		0.500			3.500			1.500			1.000		
	Medium	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Deep		0.500			3.500			1.500			1.000		
	Total	23		0.115	0.06		0.805	3.62		0.345	6.90		0.230	46.00
2030	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2031	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													

**Table 4.1.5
Arctic Spill Occurrence Beaufort Sea Sale 1 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2033	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2034	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2035	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2036	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2037	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2038	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													

Table 4.1.6

Arctic Spill Occurrence Beaufort Sea Sale 1 Production Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009		0.015		0.008	0.045		0.473	0.075		6.900	0.135		7.380
2010	10.9	0.065	0.006	0.033	0.195	0.018	2.048	0.325	0.030	29.900	0.585	0.054	31.980
2011	19.9	0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
2012	30.8	0.180	0.006	0.090	0.540	0.018	5.670	0.900	0.029	82.800	1.620	0.053	88.560
2013	39.8	0.230	0.006	0.115	0.690	0.017	7.245	1.150	0.029	105.800	2.070	0.052	113.160
2014	36.3	0.245	0.007	0.123	0.735	0.020	7.718	1.225	0.034	112.700	2.205	0.061	120.540
2015	44.3	0.295	0.007	0.148	0.885	0.020	9.293	1.475	0.033	135.700	2.655	0.060	145.140
2016	47.5	0.345	0.007	0.173	1.035	0.022	10.868	1.725	0.036	158.700	3.105	0.065	169.740
2017	42.6	0.345	0.008	0.173	1.035	0.024	10.868	1.725	0.040	158.700	3.105	0.073	169.740
2018	38.7	0.345	0.009	0.173	1.035	0.027	10.868	1.725	0.045	158.700	3.105	0.080	169.740
2019	31.9	0.345	0.011	0.173	1.035	0.032	10.868	1.725	0.054	158.700	3.105	0.097	169.740
2020	26.3	0.345	0.013	0.173	1.035	0.039	10.868	1.725	0.066	158.700	3.105	0.118	169.740
2021	21.7	0.345	0.016	0.173	1.035	0.048	10.868	1.725	0.079	158.700	3.105	0.143	169.740
2022	17.9	0.345	0.019	0.173	1.035	0.058	10.868	1.725	0.096	158.700	3.105	0.173	169.740
2023	14.9	0.345	0.023	0.173	1.035	0.069	10.868	1.725	0.116	158.700	3.105	0.208	169.740
2024	12.4	0.345	0.028	0.173	1.035	0.083	10.868	1.725	0.139	158.700	3.105	0.250	169.740
2025	8.2	0.230	0.028	0.115	0.690	0.084	7.245	1.150	0.140	105.800	2.070	0.252	113.160
2026	6.9	0.230	0.033	0.115	0.690	0.100	7.245	1.150	0.167	105.800	2.070	0.300	113.160
2027	3.5	0.115	0.033	0.058	0.345	0.099	3.623	0.575	0.164	52.900	1.035	0.296	56.580
2028	3.0	0.115	0.038	0.058	0.345	0.115	3.623	0.575	0.192	52.900	1.035	0.345	56.580
2029	2.6	0.115	0.044	0.058	0.345	0.133	3.623	0.575	0.221	52.900	1.035	0.398	56.580
2030													
2031													
2032													
2033													
2034													
2035													
2036													
2037													
2038													

**Table 4.1.7
Artic Spill Occurrence Beaufort Sea Sale 1 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2005	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2006	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2007	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2008	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2010	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2011	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2012	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2013	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2014	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2015	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2016	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2017	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

**Table 4.1.7
Arctic Spill Occurrence Beaufort Sea Sale 1 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2019	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2020	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2021	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2022	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2023	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2024	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2025	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2026	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2027	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2028	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2029	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2030	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2031	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

**Table 4.1.7
Arctic Spill Occurrence Beaufort Sea Sale 1 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2033	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2034	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2035	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2036	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2037	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2038	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.1.8

Arctic Spill Occurrence Beaufort Sea Sale 1 Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2005		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2006		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2007		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2008		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2009		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2010	10.9												
2011	19.9												
2012	30.8												
2013	39.8												
2014	36.3												
2015	44.3												
2016	47.5												
2017	42.6												
2018	38.7												
2019	31.9												
2020	26.3												
2021	21.7												
2022	17.9												
2023	14.9												
2024	12.4												
2025	8.2												
2026	6.9												
2027	3.5												
2028	3.0												
2029	2.6												
2030													
2031													
2032													
2033													
2034													
2035													
2036													
2037													
2038													

**Table 4.1.9
Arctic Spill Occurrence Beaufort Sea Sale 1 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2009	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2011	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2012	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2013	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2014	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2015	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2016	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2017	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.1.9
Arctic Spill Occurrence Beaufort Sea Sale 1 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] = 500		Spill Index bbl	Average Spill [bbl] = 4500		Spill Index bbl	Average Spill [bbl] = 20000		Spill Index bbl	Average Spill [bbl] = 200000		Spill Index bbl
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2019	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2020	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2021	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2022	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2023	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2024	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2025	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2026	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2027	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2028	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2029	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2030	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2031	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.1.9
Arctic Spill Occurrence Beaufort Sea Sale 1 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2033	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2034	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2035	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2036	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2037	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2038	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.1.10

Arctic Spill Occurrence Beaufort Sea Sale 1 Development Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004													
2005													
2006		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2007													
2008		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2009													
2010	10.9	0.026	0.002	0.013	0.078	0.007	0.817	0.156	0.014	17.160	0.260	0.024	17.990
2011	19.9												
2012	30.8												
2013	39.8												
2014	36.3												
2015	44.3												
2016	47.5												
2017	42.6												
2018	38.7												
2019	31.9												
2020	26.3												
2021	21.7												
2022	17.9												
2023	14.9												
2024	12.4												
2025	8.2												
2026	6.9												
2027	3.5												
2028	3.0												
2029	2.6												
2030													
2031													
2032													
2033													
2034													
2035													
2036													
2037													
2038													

**Table 4.1.11
Arctic Spill Occurrence Beaufort Sea Sale 1 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
	Total		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2005	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
	Total		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2006	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
	Total		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901
2007	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
	Total		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2008	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
	Total		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901
2009	Pipeline													
	Platforms		0.260		0.041	0.052		0.320				0.312		0.361
	Production Wells		0.015		0.008	0.045		0.473	0.075		6.900	0.135		7.380
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
	Total		0.306		0.064	0.192		1.788	0.225		19.800	0.724		21.652
2010	Pipeline	10.9	0.512	0.047	0.149	0.288	0.026	1.132	0.093	0.009	1.648	0.893	0.082	2.928
	Platforms		1.126	0.103	0.178	0.226	0.021	1.387				1.352	0.124	1.565
	Production Wells		0.065	0.006	0.033	0.195	0.018	2.048	0.325	0.030	29.900	0.585	0.054	31.980
	Exploration Wells													
	Development Wells		0.026	0.002	0.013	0.078	0.007	0.817	0.156	0.014	17.160	0.260	0.024	17.990
	Total		1.729	0.159	0.372	0.787	0.072	5.384	0.574	0.053	48.708	3.090	0.283	54.464
2011	Pipeline	19.9	0.512	0.026	0.149	0.288	0.014	1.132	0.093	0.005	1.648	0.893	0.045	2.928
	Platforms		2.251	0.113	0.356	0.453	0.023	2.775				2.704	0.136	3.131
	Production Wells		0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
	Exploration Wells													
	Development Wells													
	Total		2.893	0.145	0.570	1.130	0.057	8.002	0.743	0.037	61.448	4.767	0.240	70.019
2012	Pipeline	30.8	1.025	0.033	0.298	0.576	0.019	2.263	0.186	0.006	3.295	1.786	0.058	5.857
	Platforms		3.117	0.101	0.492	0.627	0.020	3.842				3.744	0.122	4.335
	Production Wells		0.180	0.006	0.090	0.540	0.018	5.670	0.900	0.029	82.800	1.620	0.053	88.560
	Exploration Wells													
	Development Wells													
	Total		4.321	0.140	0.881	1.742	0.057	11.775	1.086	0.035	86.095	7.150	0.232	98.751
2013	Pipeline	39.8	1.025	0.026	0.298	0.576	0.014	2.263	0.186	0.005	3.295	1.786	0.045	5.857
	Platforms		3.983	0.100	0.629	0.801	0.020	4.910				4.783	0.120	5.539
	Production Wells		0.230	0.006	0.115	0.690	0.017	7.245	1.150	0.029	105.800	2.070	0.052	113.160
	Exploration Wells													
	Development Wells													
	Total		5.237	0.132	1.043	2.066	0.052	14.418	1.336	0.034	109.095	8.640	0.217	124.555

**Table 4.1.11
Arctic Spill Occurrence Beaufort Sea Sale 1 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2014	Pipeline	36.3	1.025	0.028	0.298	0.576	0.016	2.263	0.186	0.005	3.295	1.786	0.049	5.857
	Platforms		4.248	0.117	0.671	0.854	0.024	5.236				5.102	0.141	5.907
	Production Wells		0.245	0.007	0.123	0.735	0.020	7.718	1.225	0.034	112.700	2.205	0.061	120.540
	Exploration Wells													
	Development Wells													
	Total		5.518	0.152	1.092	2.165	0.060	15.217	1.411	0.039	115.995	9.093	0.251	132.304
2015	Pipeline	44.3	2.052	0.046	0.598	1.137	0.026	4.472	0.369	0.008	6.535	3.559	0.080	11.605
	Platforms		5.132	0.116	0.811	1.032	0.023	6.323				6.164	0.139	7.134
	Production Wells		0.295	0.007	0.148	0.885	0.020	9.293	1.475	0.033	135.700	2.655	0.060	145.140
	Exploration Wells													
	Development Wells													
	Total		7.480	0.169	1.556	3.054	0.069	20.088	1.844	0.042	142.235	12.378	0.279	163.879
2016	Pipeline	47.5	2.052	0.043	0.598	1.137	0.024	4.472	0.369	0.008	6.535	3.559	0.075	11.605
	Platforms		6.017	0.127	0.951	1.209	0.025	7.411				7.226	0.152	8.362
	Production Wells		0.345	0.007	0.173	1.035	0.022	10.868	1.725	0.036	158.700	3.105	0.065	169.740
	Exploration Wells													
	Development Wells													
	Total		8.414	0.177	1.721	3.381	0.071	22.751	2.094	0.044	165.235	13.890	0.292	189.706
2017	Pipeline	42.6	2.052	0.048	0.598	1.137	0.027	4.472	0.369	0.009	6.535	3.559	0.084	11.605
	Platforms		6.017	0.141	0.951	1.209	0.028	7.411				7.226	0.170	8.362
	Production Wells		0.345	0.008	0.173	1.035	0.024	10.868	1.725	0.040	158.700	3.105	0.073	169.740
	Exploration Wells													
	Development Wells													
	Total		8.414	0.198	1.721	3.381	0.079	22.751	2.094	0.049	165.235	13.890	0.326	189.706
2018	Pipeline	38.7	2.052	0.053	0.598	1.137	0.029	4.472	0.369	0.010	6.535	3.559	0.092	11.605
	Platforms		6.017	0.155	0.951	1.209	0.031	7.411				7.226	0.187	8.362
	Production Wells		0.345	0.009	0.173	1.035	0.027	10.868	1.725	0.045	158.700	3.105	0.080	169.740
	Exploration Wells													
	Development Wells													
	Total		8.414	0.217	1.721	3.381	0.087	22.751	2.094	0.054	165.235	13.890	0.359	189.706
2019	Pipeline	31.9	2.052	0.064	0.598	1.137	0.036	4.472	0.369	0.012	6.535	3.559	0.112	11.605
	Platforms		6.017	0.189	0.951	1.209	0.038	7.411				7.226	0.227	8.362
	Production Wells		0.345	0.011	0.173	1.035	0.032	10.868	1.725	0.054	158.700	3.105	0.097	169.740
	Exploration Wells													
	Development Wells													
	Total		8.414	0.264	1.721	3.381	0.106	22.751	2.094	0.066	165.235	13.890	0.435	189.706
2020	Pipeline	26.3	2.052	0.078	0.598	1.137	0.043	4.472	0.369	0.014	6.535	3.559	0.135	11.605
	Platforms		6.017	0.229	0.951	1.209	0.046	7.411				7.226	0.275	8.362
	Production Wells		0.345	0.013	0.173	1.035	0.039	10.868	1.725	0.066	158.700	3.105	0.118	169.740
	Exploration Wells													
	Development Wells													
	Total		8.414	0.320	1.721	3.381	0.129	22.751	2.094	0.080	165.235	13.890	0.528	189.706
2021	Pipeline	21.7	2.052	0.095	0.598	1.137	0.052	4.472	0.369	0.017	6.535	3.559	0.164	11.605
	Platforms		6.017	0.277	0.951	1.209	0.056	7.411				7.226	0.333	8.362
	Production Wells		0.345	0.016	0.173	1.035	0.048	10.868	1.725	0.079	158.700	3.105	0.143	169.740
	Exploration Wells													
	Development Wells													
	Total		8.414	0.388	1.721	3.381	0.156	22.751	2.094	0.097	165.235	13.890	0.640	189.706
2022	Pipeline	17.9	2.052	0.115	0.598	1.137	0.064	4.472	0.369	0.021	6.535	3.559	0.199	11.605
	Platforms		6.017	0.336	0.951	1.209	0.068	7.411				7.226	0.404	8.362
	Production Wells		0.345	0.019	0.173	1.035	0.058	10.868	1.725	0.096	158.700	3.105	0.173	169.740
	Exploration Wells													
	Development Wells													
	Total		8.414	0.470	1.721	3.381	0.189	22.751	2.094	0.117	165.235	13.890	0.776	189.706
2023	Pipeline	14.9	2.052	0.138	0.598	1.137	0.076	4.472	0.369	0.025	6.535	3.559	0.239	11.605
	Platforms		6.017	0.404	0.951	1.209	0.081	7.411				7.226	0.485	8.362
	Production Wells		0.345	0.023	0.173	1.035	0.069	10.868	1.725	0.116	158.700	3.105	0.208	169.740
	Exploration Wells													
	Development Wells													
	Total		8.414	0.565	1.721	3.381	0.227	22.751	2.094	0.141	165.235	13.890	0.932	189.706

**Table 4.1.11
Arctic Spill Occurrence Beaufort Sea Sale 1 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
2024	Pipeline	12.4	2.052	0.165	0.598	1.137	0.092	4.472	0.369	0.030	6.535	3.559	0.287	11.605
	Platforms		6.017	0.485	0.951	1.209	0.097	7.411				7.226	0.583	8.362
	Production Wells		0.345	0.028	0.173	1.035	0.083	10.868	1.725	0.139	158.700	3.105	0.250	169.740
	Exploration Wells													
	Development Wells													
	Total		8.414	0.679	1.721	3.381	0.273	22.751	2.094	0.169	165.235	13.890	1.120	189.706
2025	Pipeline	8.2	1.540	0.188	0.449	0.850	0.104	3.341	0.276	0.034	4.887	2.666	0.325	8.677
	Platforms		4.026	0.491	0.636	0.809	0.099	4.956				4.834	0.590	5.592
	Production Wells		0.230	0.028	0.115	0.690	0.084	7.245	1.150	0.140	105.800	2.070	0.252	113.160
	Exploration Wells													
	Development Wells													
	Total		5.795	0.707	1.200	2.348	0.286	15.542	1.426	0.174	110.687	9.570	1.167	127.429
2026	Pipeline	6.9	1.540	0.223	0.449	0.850	0.123	3.341	0.276	0.040	4.887	2.666	0.386	8.677
	Platforms		4.026	0.583	0.636	0.809	0.117	4.956				4.834	0.701	5.592
	Production Wells		0.230	0.033	0.115	0.690	0.100	7.245	1.150	0.167	105.800	2.070	0.300	113.160
	Exploration Wells													
	Development Wells													
	Total		5.795	0.840	1.200	2.348	0.340	15.542	1.426	0.207	110.687	9.570	1.387	127.429
2027	Pipeline	3.5	1.028	0.294	0.300	0.562	0.161	2.209	0.183	0.052	3.240	1.772	0.506	5.748
	Platforms		2.034	0.581	0.321	0.408	0.117	2.501				2.442	0.698	2.823
	Production Wells		0.115	0.033	0.058	0.345	0.099	3.623	0.575	0.164	52.900	1.035	0.296	56.580
	Exploration Wells													
	Development Wells													
	Total		3.177	0.908	0.679	1.315	0.376	8.333	0.758	0.217	56.140	5.250	1.500	65.151
2028	Pipeline	3.0	1.028	0.343	0.300	0.562	0.187	2.209	0.183	0.061	3.240	1.772	0.591	5.748
	Platforms		2.034	0.678	0.321	0.408	0.136	2.501				2.442	0.814	2.823
	Production Wells		0.115	0.038	0.058	0.345	0.115	3.623	0.575	0.192	52.900	1.035	0.345	56.580
	Exploration Wells													
	Development Wells													
	Total		3.177	1.059	0.679	1.315	0.438	8.333	0.758	0.253	56.140	5.250	1.750	65.151
2029	Pipeline	2.6	1.028	0.395	0.300	0.562	0.216	2.209	0.183	0.070	3.240	1.772	0.682	5.748
	Platforms		2.034	0.782	0.321	0.408	0.157	2.501				2.442	0.939	2.823
	Production Wells		0.115	0.044	0.058	0.345	0.133	3.623	0.575	0.221	52.900	1.035	0.398	56.580
	Exploration Wells													
	Development Wells													
	Total		3.177	1.222	0.679	1.315	0.506	8.333	0.758	0.292	56.140	5.250	2.019	65.151
2030	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2031	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2032	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2033	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													

**Table 4.1.11
Arctic Spill Occurrence Beaufort Sea Sale 1 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
2034	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2035	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2036	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2037	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2038	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													

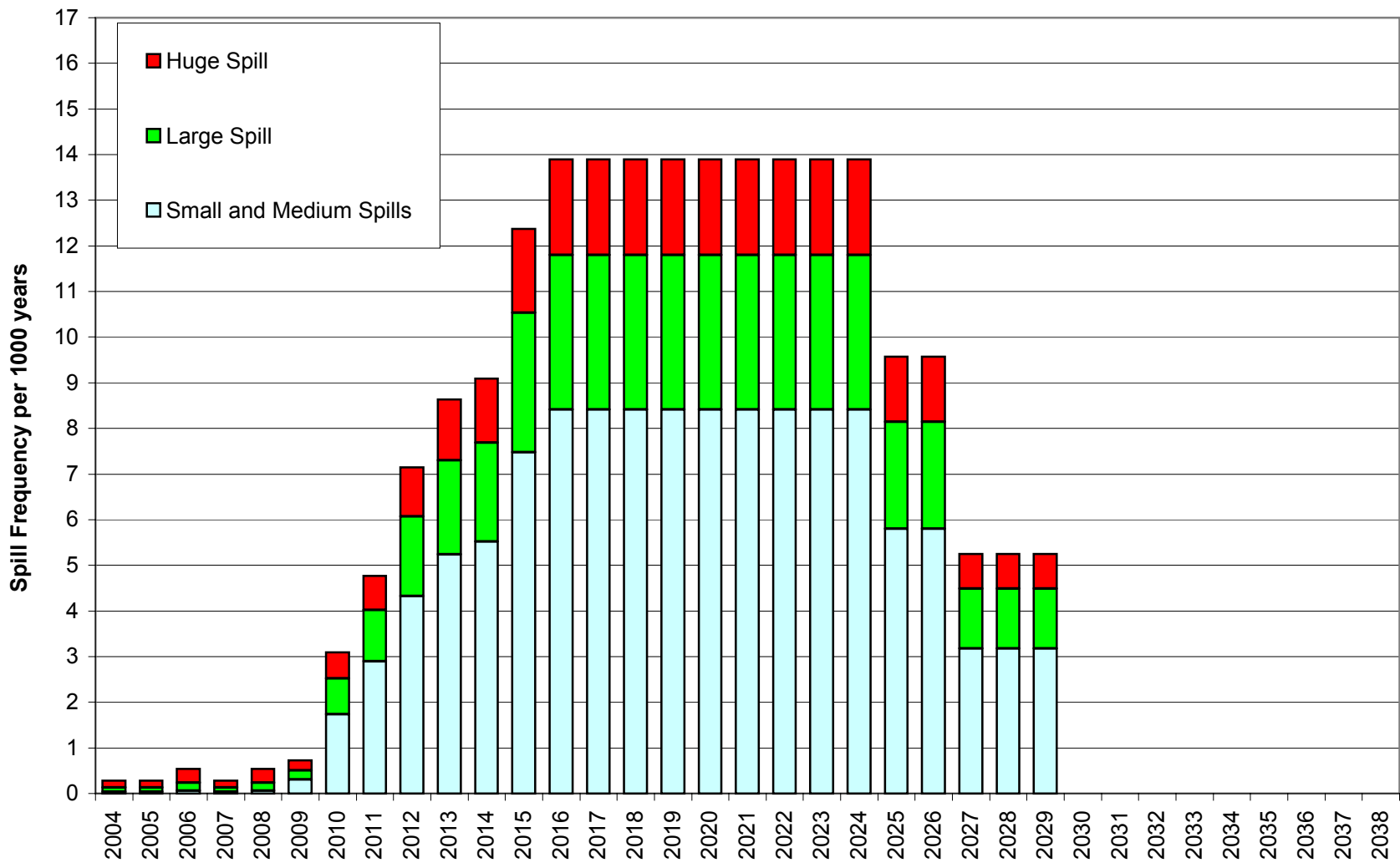
**Table 4.1.12
Arctic Spill Occurrence Beaufort Sea Sale 1 Annual Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2005		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2006		0.06		0.029	0.17		1.812	0.306		30.06	0.537		31.901
2007		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2008		0.06		0.029	0.17		1.812	0.306		30.06	0.537		31.901
2009		0.31		0.064	0.19		1.788	0.225		19.80	0.724		21.652
2010	10.9	1.73	0.159	0.372	0.79	0.072	5.384	0.574	0.053	48.71	3.090	0.283	54.464
2011	19.9	2.89	0.145	0.570	1.13	0.057	8.002	0.743	0.037	61.45	4.767	0.240	70.019
2012	30.8	4.32	0.140	0.881	1.74	0.057	11.775	1.086	0.035	86.10	7.150	0.232	98.751
2013	39.8	5.24	0.132	1.043	2.07	0.052	14.418	1.336	0.034	109.10	8.640	0.217	124.555
2014	36.3	5.52	0.152	1.092	2.16	0.060	15.217	1.411	0.039	116.00	9.093	0.251	132.304
2015	44.3	7.48	0.169	1.556	3.05	0.069	20.088	1.844	0.042	142.23	12.378	0.279	163.879
2016	47.5	8.41	0.177	1.721	3.38	0.071	22.751	2.094	0.044	165.23	13.890	0.292	189.706
2017	42.6	8.41	0.198	1.721	3.38	0.079	22.751	2.094	0.049	165.23	13.890	0.326	189.706
2018	38.7	8.41	0.217	1.721	3.38	0.087	22.751	2.094	0.054	165.23	13.890	0.359	189.706
2019	31.9	8.41	0.264	1.721	3.38	0.106	22.751	2.094	0.066	165.23	13.890	0.435	189.706
2020	26.3	8.41	0.320	1.721	3.38	0.129	22.751	2.094	0.080	165.23	13.890	0.528	189.706
2021	21.7	8.41	0.388	1.721	3.38	0.156	22.751	2.094	0.097	165.23	13.890	0.640	189.706
2022	17.9	8.41	0.470	1.721	3.38	0.189	22.751	2.094	0.117	165.23	13.890	0.776	189.706
2023	14.9	8.41	0.565	1.721	3.38	0.227	22.751	2.094	0.141	165.23	13.890	0.932	189.706
2024	12.4	8.41	0.679	1.721	3.38	0.273	22.751	2.094	0.169	165.23	13.890	1.120	189.706
2025	8.2	5.80	0.707	1.200	2.35	0.286	15.542	1.426	0.174	110.69	9.570	1.167	127.429
2026	6.9	5.80	0.840	1.200	2.35	0.340	15.542	1.426	0.207	110.69	9.570	1.387	127.429
2027	3.5	3.18	0.908	0.679	1.31	0.376	8.333	0.758	0.217	56.14	5.250	1.500	65.151
2028	3.0	3.18	1.059	0.679	1.31	0.438	8.333	0.758	0.253	56.14	5.250	1.750	65.151
2029	2.6	3.18	1.222	0.679	1.31	0.506	8.333	0.758	0.292	56.14	5.250	2.019	65.151
2030													
2031													
2032													
2033													
2034													
2035													
2036													
2037													
2038													

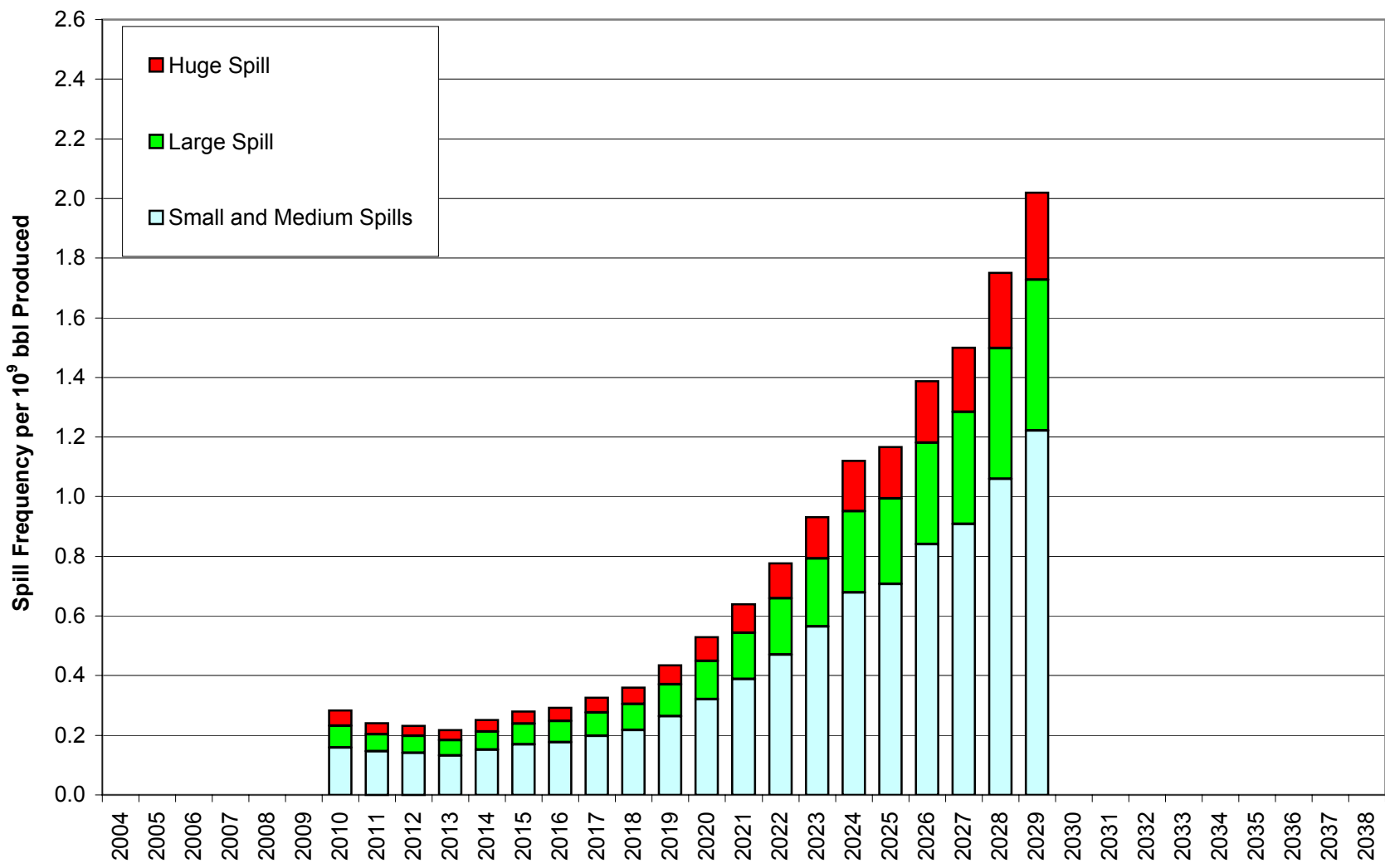
**Table 4.1.13
Arctic Spill Occurrence Beaufort Sea Sale 1 Wells Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2005		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2006		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901
2007		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2008		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901
2009		0.047		0.023	0.140		1.467	0.225		19.800	0.412		21.291
2010	10.9	0.091	0.008	0.046	0.273	0.025	2.865	0.481	0.044	47.060	0.845	0.078	49.970
2011	19.9	0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
2012	30.8	0.180	0.006	0.090	0.540	0.018	5.670	0.900	0.029	82.800	1.620	0.053	88.560
2013	39.8	0.230	0.006	0.115	0.690	0.017	7.245	1.150	0.029	105.800	2.070	0.052	113.160
2014	36.3	0.245	0.007	0.123	0.735	0.020	7.718	1.225	0.034	112.700	2.205	0.061	120.540
2015	44.3	0.295	0.007	0.148	0.885	0.020	9.293	1.475	0.033	135.700	2.655	0.060	145.140
2016	47.5	0.345	0.007	0.173	1.035	0.022	10.868	1.725	0.036	158.700	3.105	0.065	169.740
2017	42.6	0.345	0.008	0.173	1.035	0.024	10.868	1.725	0.040	158.700	3.105	0.073	169.740
2018	38.7	0.345	0.009	0.173	1.035	0.027	10.868	1.725	0.045	158.700	3.105	0.080	169.740
2019	31.9	0.345	0.011	0.173	1.035	0.032	10.868	1.725	0.054	158.700	3.105	0.097	169.740
2020	26.3	0.345	0.013	0.173	1.035	0.039	10.868	1.725	0.066	158.700	3.105	0.118	169.740
2021	21.7	0.345	0.016	0.173	1.035	0.048	10.868	1.725	0.079	158.700	3.105	0.143	169.740
2022	17.9	0.345	0.019	0.173	1.035	0.058	10.868	1.725	0.096	158.700	3.105	0.173	169.740
2023	14.9	0.345	0.023	0.173	1.035	0.069	10.868	1.725	0.116	158.700	3.105	0.208	169.740
2024	12.4	0.345	0.028	0.173	1.035	0.083	10.868	1.725	0.139	158.700	3.105	0.250	169.740
2025	8.2	0.230	0.028	0.115	0.690	0.084	7.245	1.150	0.140	105.800	2.070	0.252	113.160
2026	6.9	0.230	0.033	0.115	0.690	0.100	7.245	1.150	0.167	105.800	2.070	0.300	113.160
2027	3.5	0.115	0.033	0.058	0.345	0.099	3.623	0.575	0.164	52.900	1.035	0.296	56.580
2028	3.0	0.115	0.038	0.058	0.345	0.115	3.623	0.575	0.192	52.900	1.035	0.345	56.580
2029	2.6	0.115	0.044	0.058	0.345	0.133	3.623	0.575	0.221	52.900	1.035	0.398	56.580
2030													
2031													
2032													
2033													
2034													
2035													
2036													
2037													
2038													

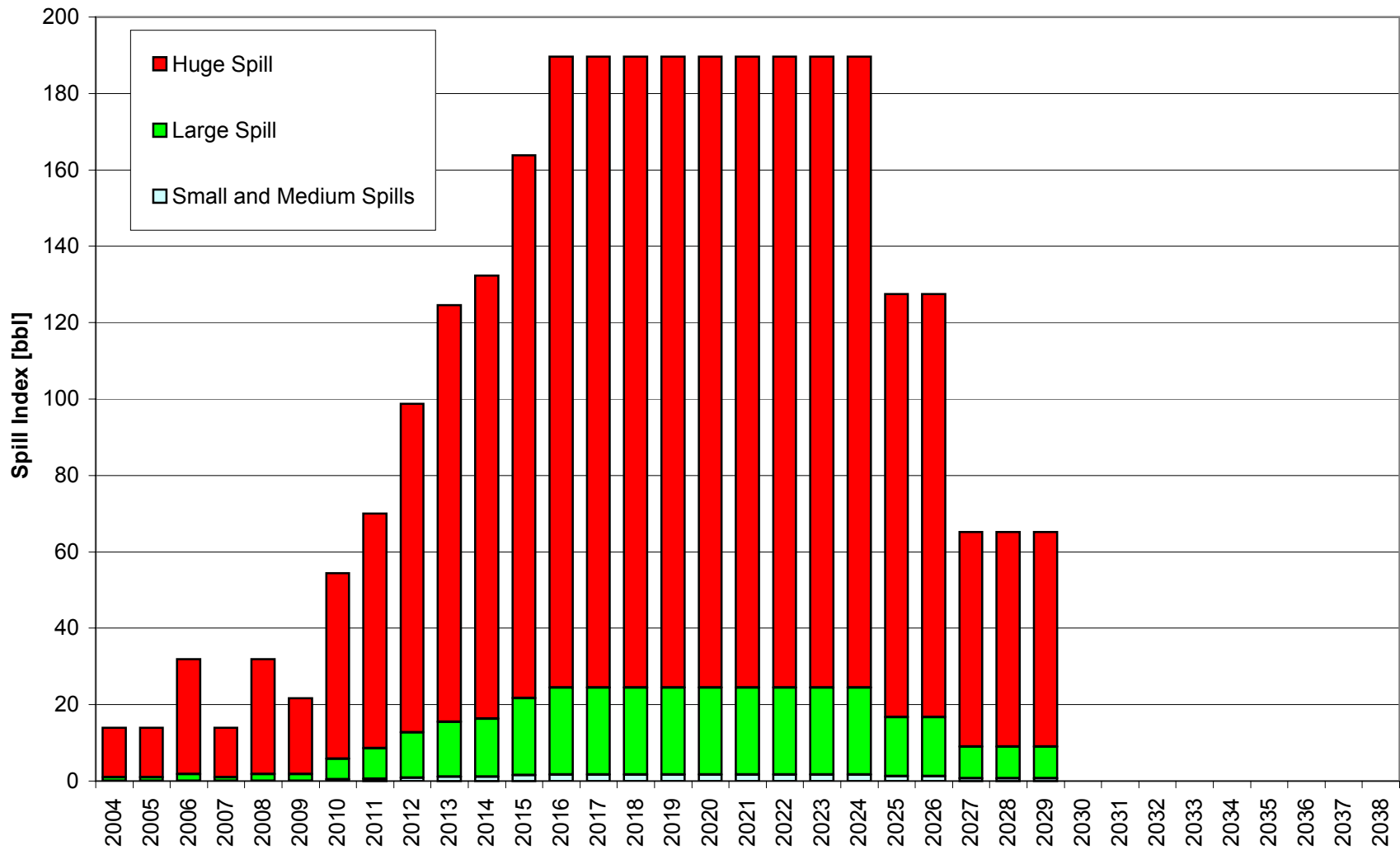
Beaufort Sea Sale 1 Spill Frequency



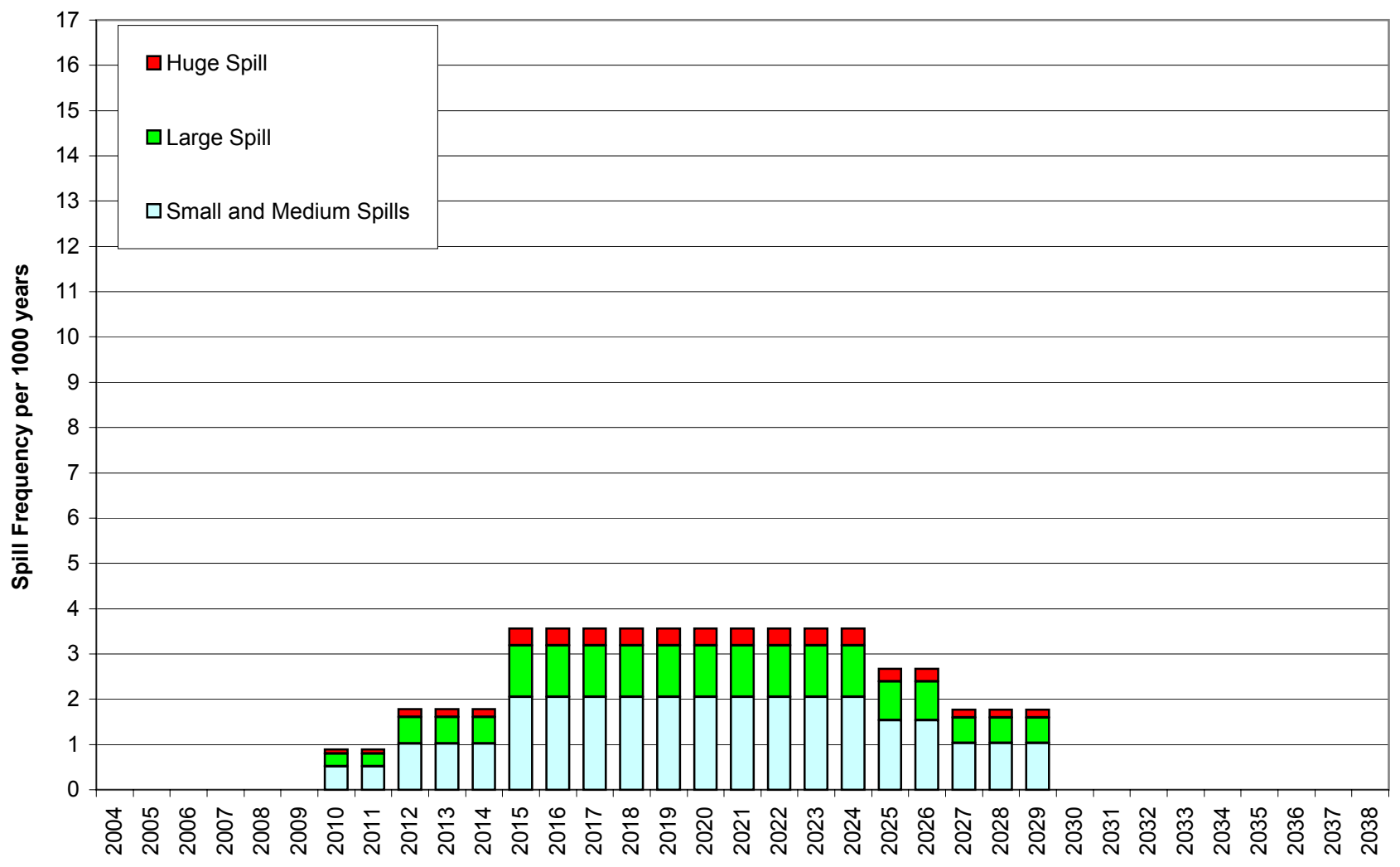
Beaufort Sea Sale 1 Spill Frequency per 10⁹ bbl Produced



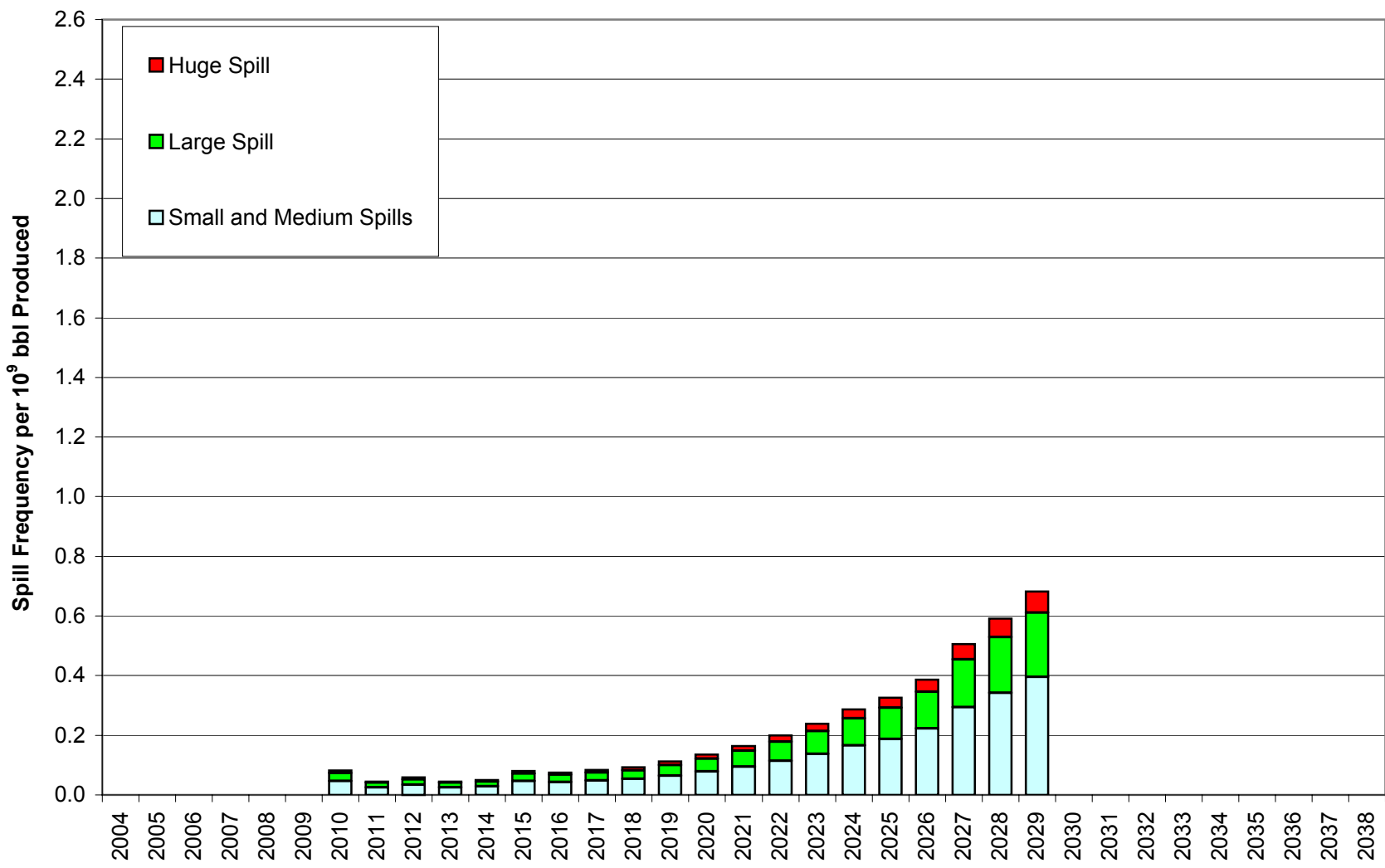
Beaufort Sea Sale 1 Spill Index



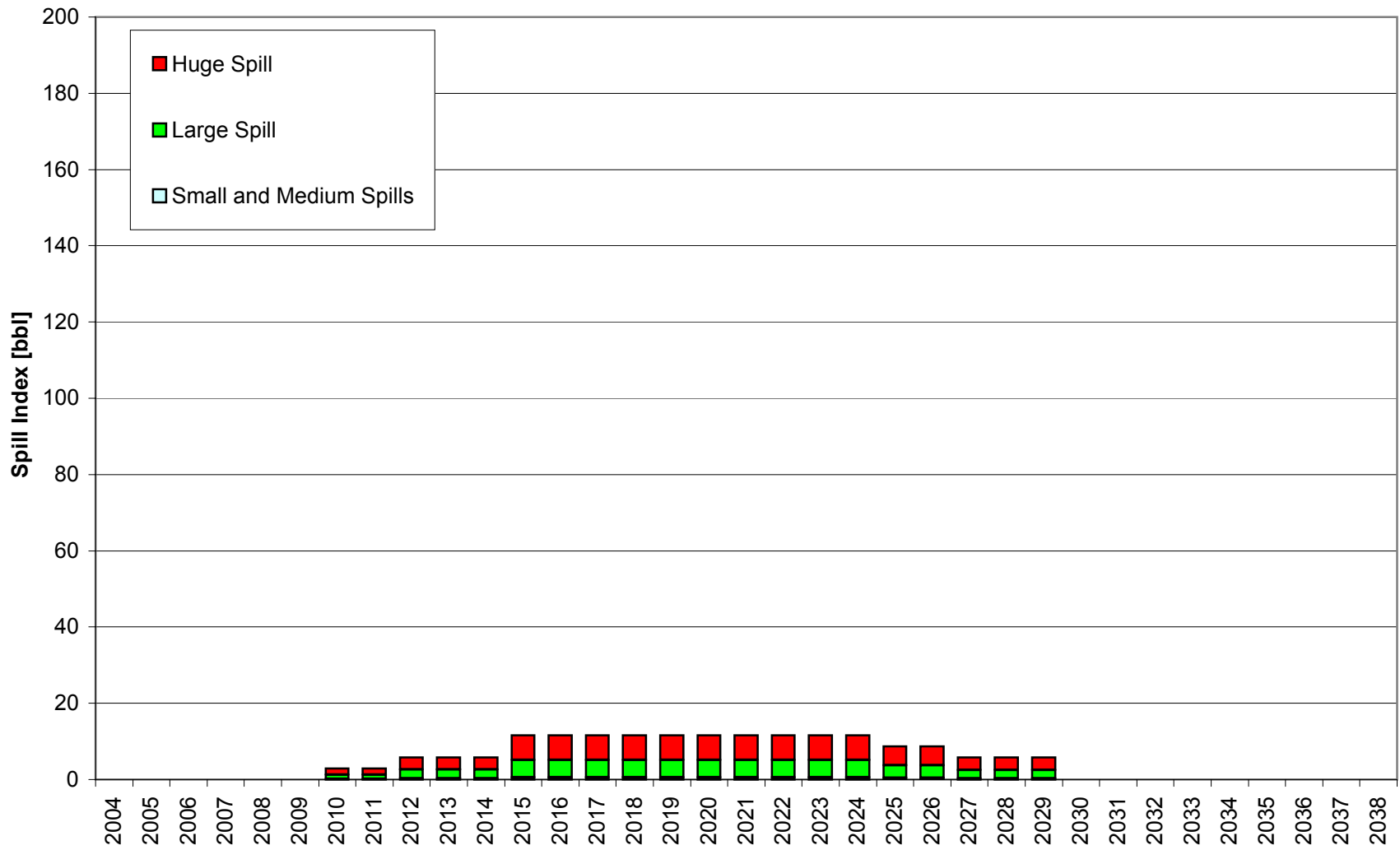
Beaufort Sea Sale 1 Spill Frequency - P/L



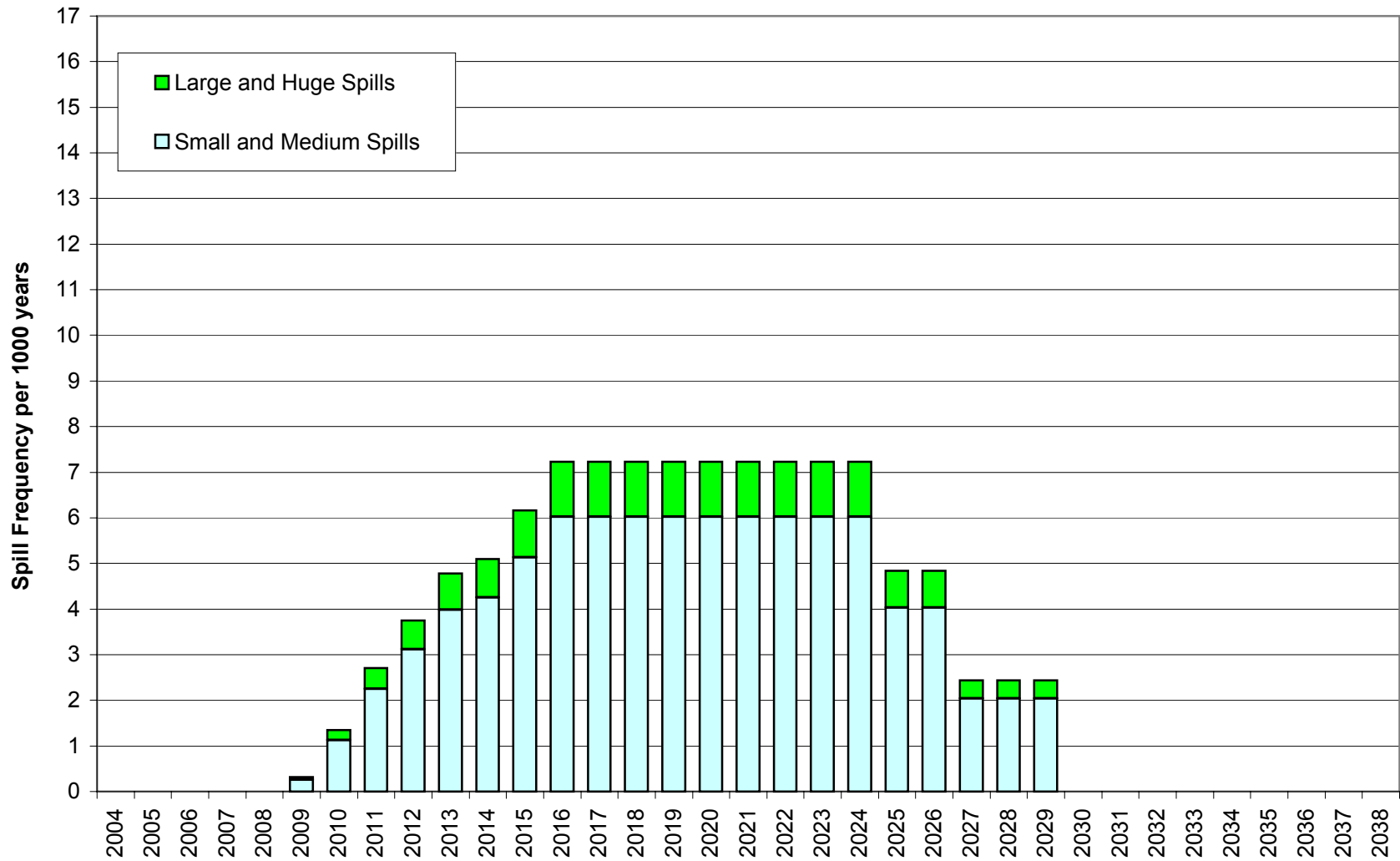
Beaufort Sea Sale 1 Spill Frequency per 10⁹ bbl Produced - P/L



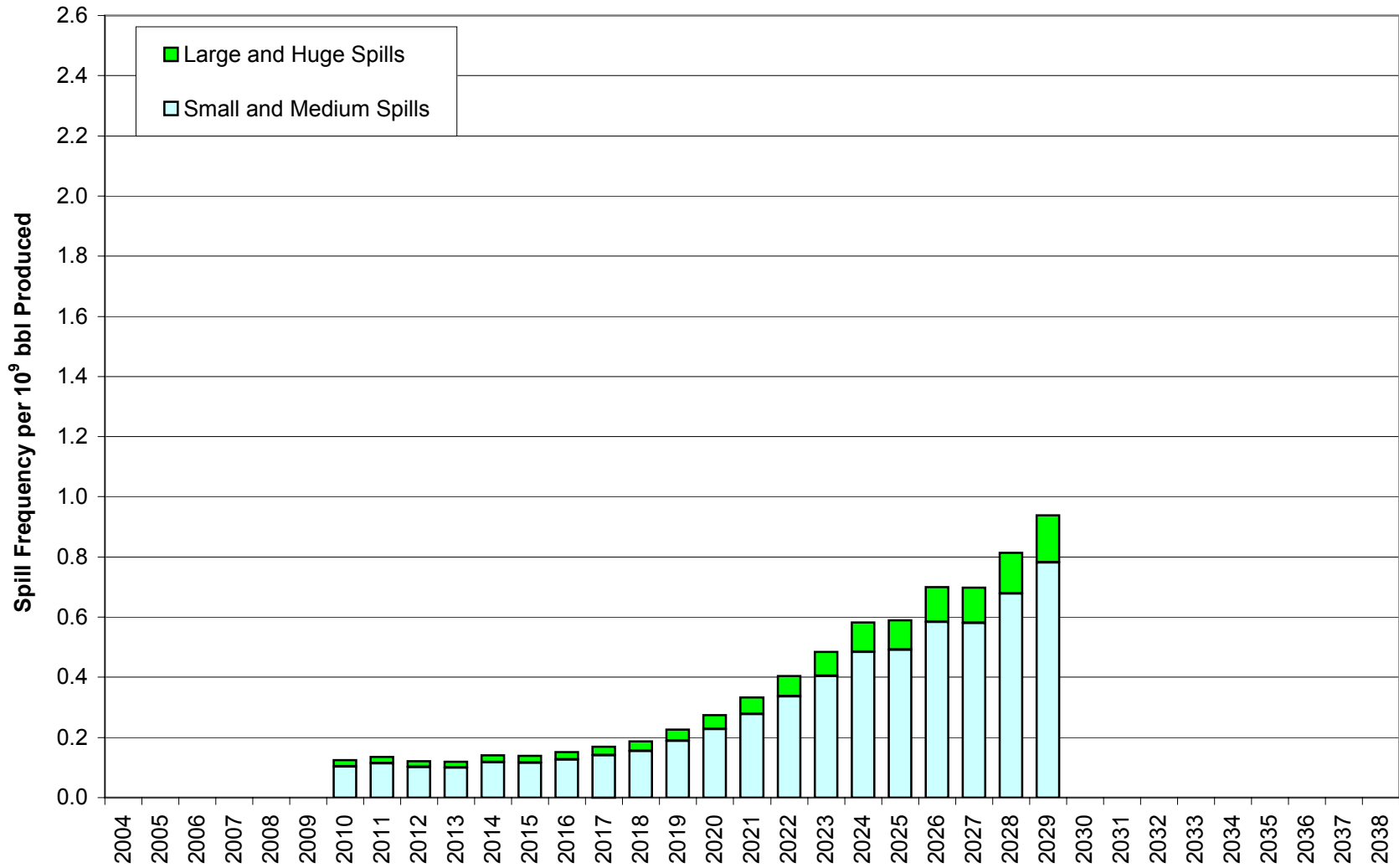
Beaufort Sea Sale 1 Spill Index - P/L



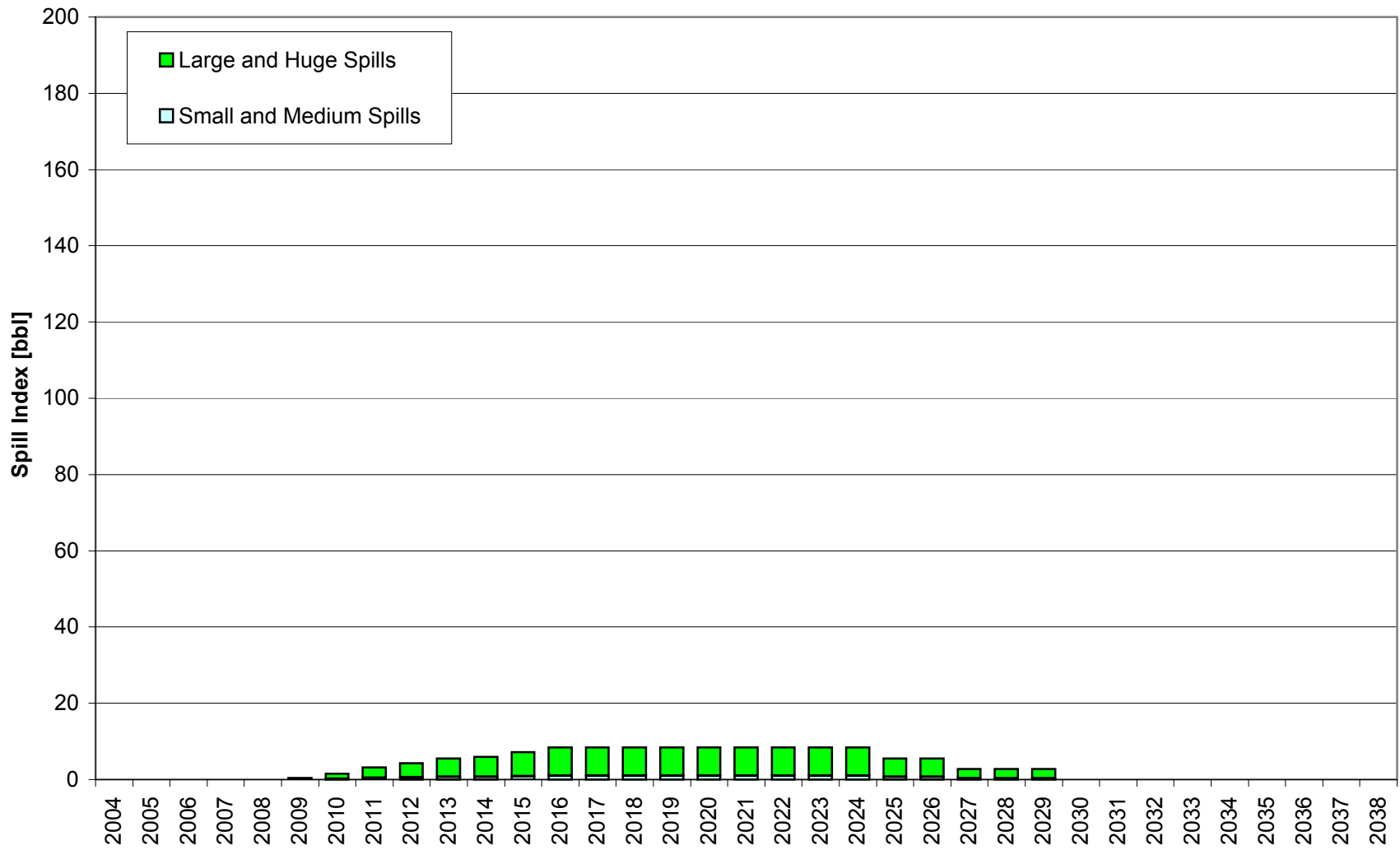
Beaufort Sea Sale 1 Spill Frequency - Platforms



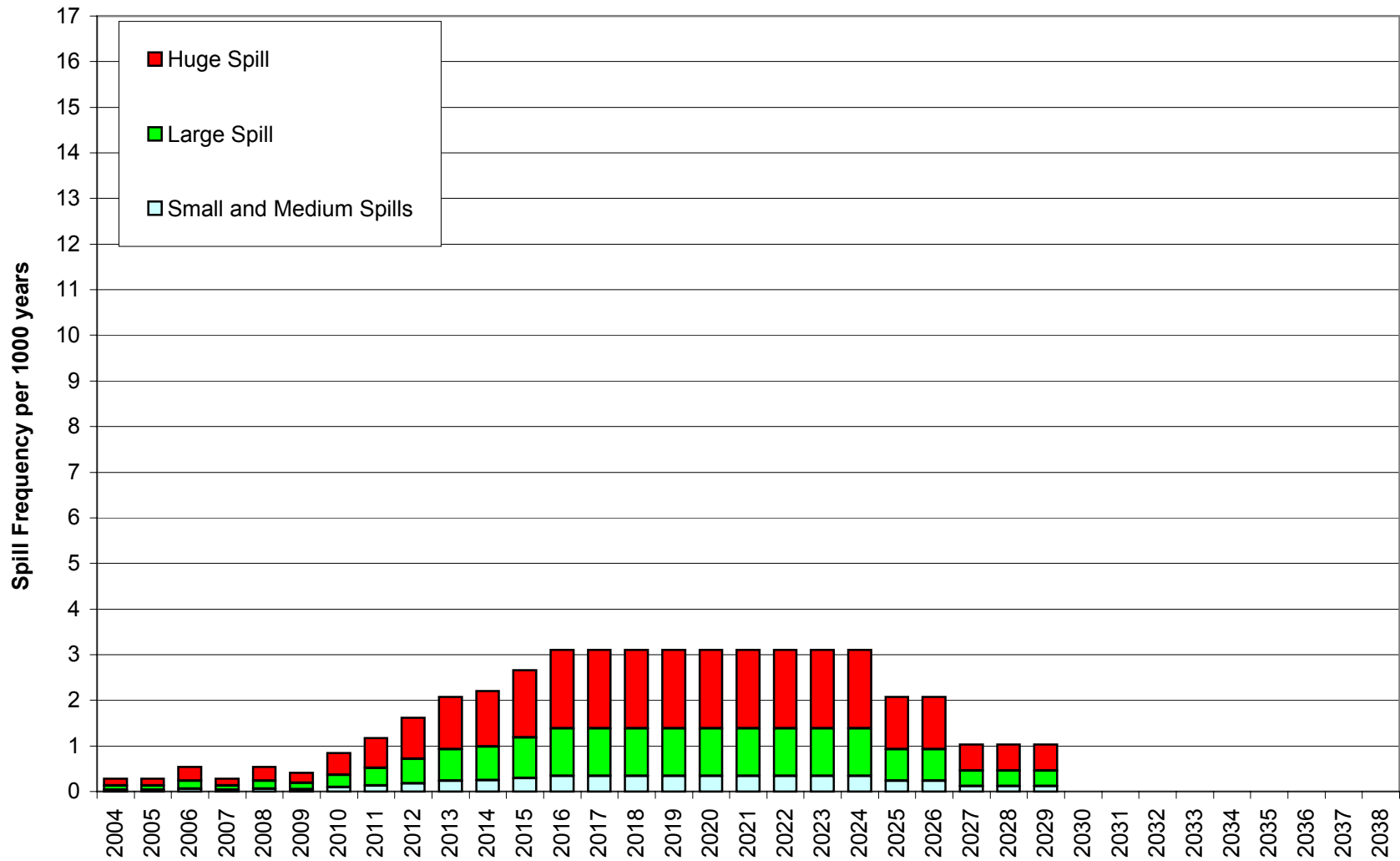
Beaufort Sea Sale 1 Spill Frequency per 10⁹ bbl Produced - Platforms



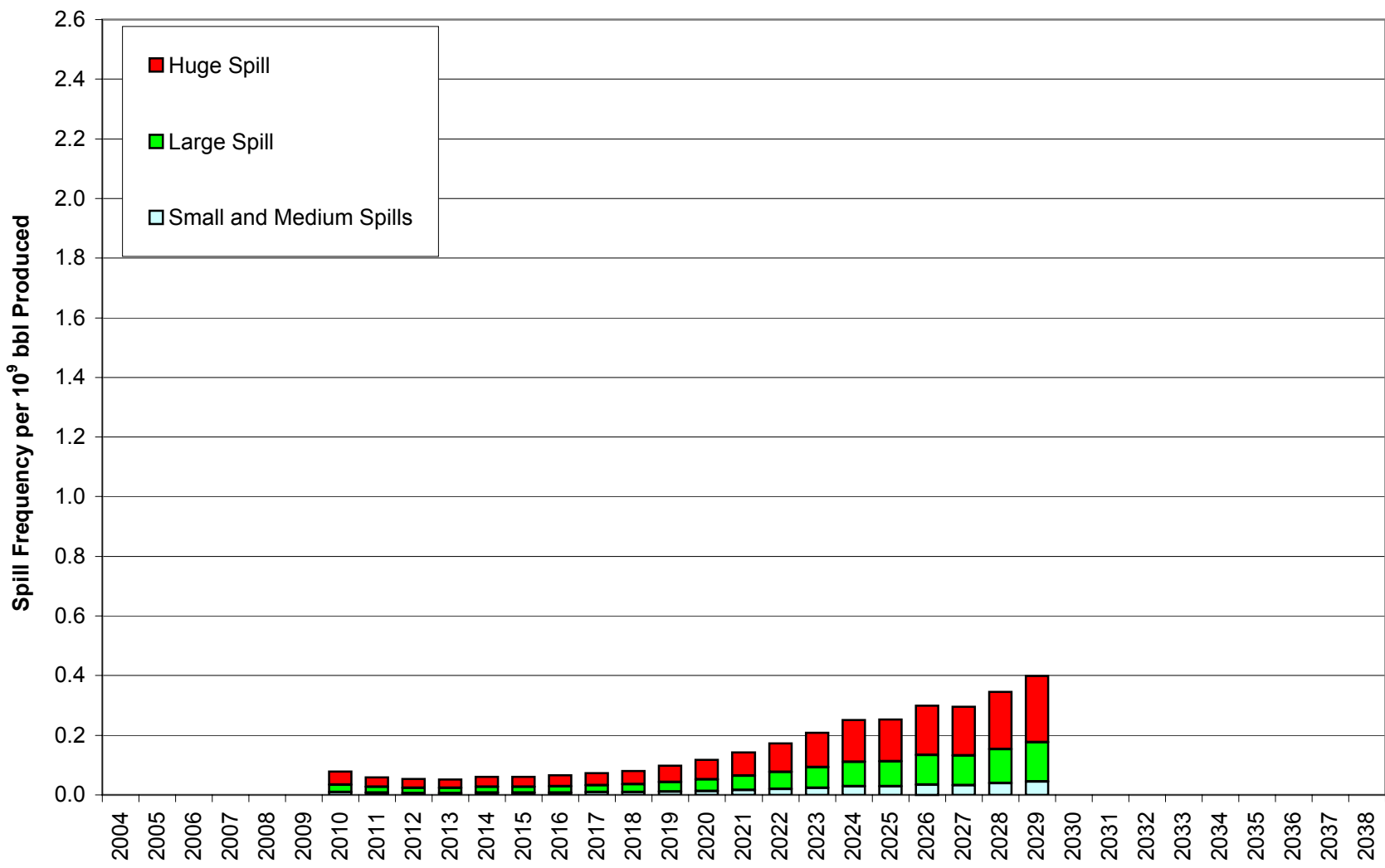
Beaufort Sea Sale 1 Spill Index - Platforms



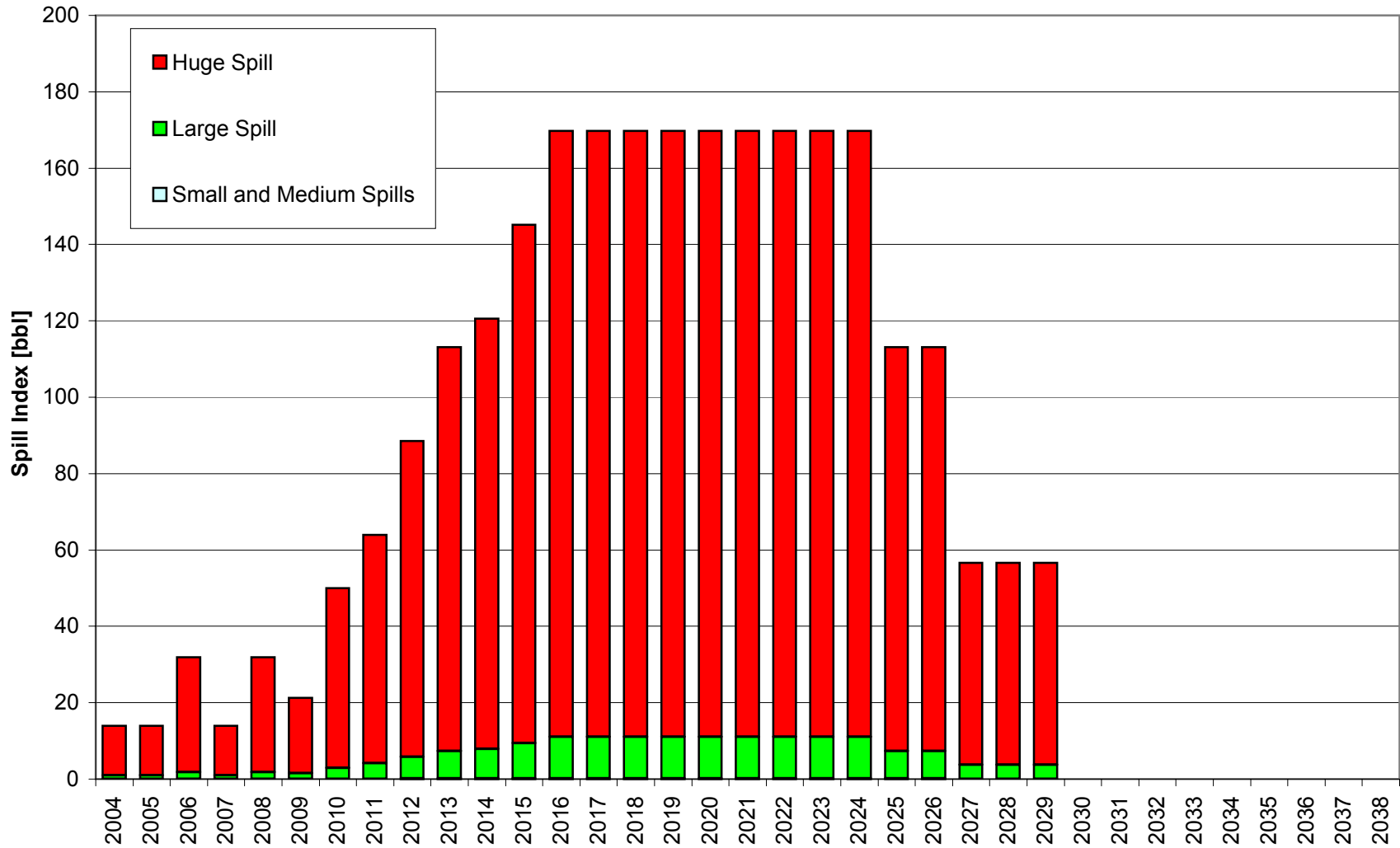
Beaufort Sea Sale 1 Spill Frequency - Wells



Beaufort Sea Sale 1 Spill Frequency per 10⁹ bbl Produced - Wells



Beaufort Sea Sale 1 Spill Index - Wells



**Table 4.2.2
Arctic Spill Occurrence Beaufort Sea Sale 2 P/L Summary**

Year	Production [MMbbl]	Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004																			
2005																			
2006																			
2007																			
2008																			
2009																			
2010																			
2011																			
2012																			
2013	10.9	0.224	0.021	0.013	0.545	0.050	0.211	0.768	0.071	0.224	0.432	0.040	1.697	0.140	0.013	2.471	1.340	0.123	4.392
2014	19.9	0.224	0.011	0.013	0.545	0.027	0.211	0.768	0.039	0.224	0.432	0.022	1.697	0.140	0.007	2.471	1.340	0.067	4.392
2015	19.9	0.224	0.011	0.013	0.545	0.027	0.211	0.768	0.039	0.224	0.432	0.022	1.697	0.140	0.007	2.471	1.340	0.067	4.392
2016	19.9	0.224	0.011	0.013	0.545	0.027	0.211	0.768	0.039	0.224	0.432	0.022	1.697	0.140	0.007	2.471	1.340	0.067	4.392
2017	34.8	0.635	0.018	0.037	1.473	0.042	0.546	2.108	0.061	0.583	1.071	0.031	4.250	0.342	0.010	5.995	3.522	0.101	10.828
2018	44.2	0.635	0.014	0.037	1.473	0.033	0.546	2.108	0.048	0.583	1.071	0.024	4.250	0.342	0.008	5.995	3.522	0.080	10.828
2019	41.9	0.635	0.015	0.037	1.473	0.035	0.546	2.108	0.050	0.583	1.071	0.026	4.250	0.342	0.008	5.995	3.522	0.084	10.828
2020	39.9	0.635	0.016	0.037	1.473	0.037	0.546	2.108	0.053	0.583	1.071	0.027	4.250	0.342	0.009	5.995	3.522	0.088	10.828
2021	38.3	0.635	0.017	0.037	1.473	0.038	0.546	2.108	0.055	0.583	1.071	0.028	4.250	0.342	0.009	5.995	3.522	0.092	10.828
2022	32.7	0.635	0.019	0.037	1.473	0.045	0.546	2.108	0.064	0.583	1.071	0.033	4.250	0.342	0.010	5.995	3.522	0.108	10.828
2023	27.9	0.635	0.023	0.037	1.473	0.053	0.546	2.108	0.076	0.583	1.071	0.038	4.250	0.342	0.012	5.995	3.522	0.126	10.828
2024	23.8	0.635	0.027	0.037	1.473	0.062	0.546	2.108	0.089	0.583	1.071	0.045	4.250	0.342	0.014	5.995	3.522	0.148	10.828
2025	20.3	0.635	0.031	0.037	1.473	0.073	0.546	2.108	0.104	0.583	1.071	0.053	4.250	0.342	0.017	5.995	3.522	0.173	10.828
2026	17.3	0.635	0.037	0.037	1.473	0.085	0.546	2.108	0.122	0.583	1.071	0.062	4.250	0.342	0.020	5.995	3.522	0.204	10.828
2027	14.8	0.635	0.043	0.037	1.473	0.100	0.546	2.108	0.142	0.583	1.071	0.072	4.250	0.342	0.023	5.995	3.522	0.238	10.828
2028	10.7	0.411	0.038	0.024	0.928	0.087	0.335	1.340	0.125	0.359	0.639	0.060	2.552	0.203	0.019	3.524	2.182	0.204	6.436
2029	9.2	0.411	0.045	0.024	0.928	0.101	0.335	1.340	0.146	0.359	0.639	0.069	2.552	0.203	0.022	3.524	2.182	0.237	6.436
2030	7.9	0.411	0.052	0.024	0.928	0.118	0.335	1.340	0.170	0.359	0.639	0.081	2.552	0.203	0.026	3.524	2.182	0.276	6.436
2031	6.8	0.411	0.061	0.017	0.928	0.137	0.282	1.340	0.197	0.300	0.639	0.094	2.209	0.203	0.030	3.240	2.182	0.321	5.748
2032	5.8	0.411	0.071	0.024	0.928	0.160	0.335	1.340	0.231	0.359	0.639	0.110	2.552	0.203	0.035	3.524	2.182	0.376	6.436
2033	5.0	0.411	0.082	0.024	0.928	0.186	0.335	1.340	0.268	0.359	0.639	0.128	2.552	0.203	0.041	3.524	2.182	0.436	6.436
2034	4.3	0.411	0.096	0.024	0.928	0.216	0.335	1.340	0.312	0.359	0.639	0.149	2.552	0.203	0.047	3.524	2.182	0.507	6.436
2035	3.7	0.411	0.111	0.024	0.928	0.251	0.335	1.340	0.362	0.359	0.639	0.173	2.552	0.203	0.055	3.524	2.182	0.590	6.436
2036																			
2037																			
2038																			

**Table 4.2.3
Arctic Spill Occurrence Beaufort Sea Sale 2 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2005	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2006	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2007	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2008	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2009	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2010	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2011	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2012	Shallow	1	3	0.866	0.260	0.04	0.174	0.052	0.32
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	1	3		0.260	0.04		0.052	0.32
2013	Shallow	1	13	0.866	1.126	0.18	0.174	0.226	1.39
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	1	13		1.126	0.18		0.226	1.39
2014	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	1	23		1.991	0.31		0.400	2.45
2015	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	1	23		1.991	0.31		0.400	2.45
2016	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	1	3	0.884	0.265	0.04	0.177	0.053	0.33
	Deep			0.913			0.182		
	Total	2	26		2.257	0.36		0.454	2.78
2017	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	16	0.884	1.415	0.22	0.177	0.284	1.74
	Deep			0.913			0.182		
	Total	3	39		3.406	0.54		0.684	4.19

**Table 4.2.3
Arctic Spill Occurrence Beaufort Sea Sale 2 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	36	0.884	3.184	0.50	0.177	0.639	3.92
	Deep			0.913			0.182		
	Total	3	59		5.175	0.82		1.039	6.37
2019	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	3	69		6.060	0.96		1.217	7.46
2020	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	3	69		6.060	0.96		1.217	7.46
2021	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	3	69		6.060	0.96		1.217	7.46
2022	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	3	69		6.060	0.96		1.217	7.46
2023	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	3	69		6.060	0.96		1.217	7.46
2024	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	3	69		6.060	0.96		1.217	7.46
2025	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	3	69		6.060	0.96		1.217	7.46
2026	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	3	69		6.060	0.96		1.217	7.46
2027	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	3	69		6.060	0.96		1.217	7.46
2028	Shallow			0.866			0.174		
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	2	46		4.069	0.64		0.816	5.00
2029	Shallow			0.866			0.174		
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	2	46		4.069	0.64		0.816	5.00
2030	Shallow			0.866			0.174		
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	2	46		4.069	0.64		0.816	5.00
2031	Shallow			0.866			0.174		
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	2	46		4.069	0.64		0.816	5.00

**Table 4.2.3
Arctic Spill Occurrence Beaufort Sea Sale 2 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow			0.866			0.174		
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	2	46		4.069	0.64		0.816	5.00
2033	Shallow			0.866			0.174		
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	2	46		4.069	0.64		0.816	5.00
2034	Shallow			0.866			0.174		
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	2	46		4.069	0.64		0.816	5.00
2035	Shallow			0.866			0.174		
	Medium	2	46	0.884	4.069	0.64	0.177	0.816	5.00
	Deep			0.913			0.182		
	Total	2	46		4.069	0.64		0.816	5.00
2036	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2037	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2038	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								

**Table 4.2.4
Arctic Spill Occurrence Beaufort Sea Sale 2 Platforms Summary**

Year	Production [MMbbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004										
2005										
2006										
2007										
2008										
2009										
2010										
2011										
2012		0.260		0.041	0.052		0.320	0.312		0.361
2013	10.9	1.126	0.103	0.178	0.226	0.021	1.387	1.352	0.124	1.565
2014	19.9	1.991	0.100	0.315	0.400	0.020	2.455	2.392	0.120	2.769
2015	19.9	1.991	0.100	0.315	0.400	0.020	2.455	2.392	0.120	2.769
2016	19.9	2.257	0.113	0.357	0.454	0.023	2.781	2.710	0.136	3.138
2017	34.8	3.406	0.098	0.538	0.684	0.020	4.195	4.091	0.118	4.733
2018	44.2	5.175	0.117	0.818	1.039	0.024	6.370	6.215	0.141	7.188
2019	41.9	6.060	0.145	0.957	1.217	0.029	7.457	7.276	0.174	8.415
2020	39.9	6.060	0.152	0.957	1.217	0.030	7.457	7.276	0.182	8.415
2021	38.3	6.060	0.158	0.957	1.217	0.032	7.457	7.276	0.190	8.415
2022	32.7	6.060	0.185	0.957	1.217	0.037	7.457	7.276	0.223	8.415
2023	27.9	6.060	0.217	0.957	1.217	0.044	7.457	7.276	0.261	8.415
2024	23.8	6.060	0.255	0.957	1.217	0.051	7.457	7.276	0.306	8.415
2025	20.3	6.060	0.299	0.957	1.217	0.060	7.457	7.276	0.358	8.415
2026	17.3	6.060	0.350	0.957	1.217	0.070	7.457	7.276	0.421	8.415
2027	14.8	6.060	0.409	0.957	1.217	0.082	7.457	7.276	0.492	8.415
2028	10.7	4.069	0.380	0.643	0.816	0.076	5.003	4.885	0.457	5.645
2029	9.2	4.069	0.442	0.643	0.816	0.089	5.003	4.885	0.531	5.645
2030	7.9	4.069	0.515	0.643	0.816	0.103	5.003	4.885	0.618	5.645
2031	6.8	4.069	0.598	0.643	0.816	0.120	5.003	4.885	0.718	5.645
2032	5.8	4.069	0.701	0.643	0.816	0.141	5.003	4.885	0.842	5.645
2033	5.0	4.069	0.814	0.643	0.816	0.163	5.003	4.885	0.977	5.645
2034	4.3	4.069	0.946	0.643	0.816	0.190	5.003	4.885	1.136	5.645
2035	3.7	4.069	1.100	0.643	0.816	0.221	5.003	4.885	1.320	5.645
2036										
2037										
2038										

**Table 4.2.5
Arctic Spill Occurrence Beaufort Sea Sale 2 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2009	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2010	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2011	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2012	Shallow	3	0.500	0.015	0.01	3.500	0.105	0.47	1.500	0.045	0.90	1.000	0.030	6.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	3		0.015	0.01		0.105	0.47		0.045	0.90		0.030	6.00
2013	Shallow	13	0.500	0.065	0.03	3.500	0.455	2.05	1.500	0.195	3.90	1.000	0.130	26.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	13		0.065	0.03		0.455	2.05		0.195	3.90		0.130	26.00
2014	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	23		0.115	0.06		0.805	3.62		0.345	6.90		0.230	46.00
2015	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	23		0.115	0.06		0.805	3.62		0.345	6.90		0.230	46.00
2016	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	3	0.500	0.015	0.01	3.500	0.105	0.47	1.500	0.045	0.90	1.000	0.030	6.00
	Deep		0.500			3.500			1.500			1.000		
	Total	26		0.130	0.07		0.910	4.10		0.390	7.80		0.260	52.00
2017	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	16	0.500	0.080	0.04	3.500	0.560	2.52	1.500	0.240	4.80	1.000	0.160	32.00
	Deep		0.500			3.500			1.500			1.000		
	Total	39		0.195	0.10		1.365	6.14		0.585	11.70		0.390	78.00

**Table 4.2.5
Arctic Spill Occurrence Beaufort Sea Sale 2 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	36	0.500	0.180	0.09	3.500	1.260	5.67	1.500	0.540	10.80	1.000	0.360	72.00
	Deep		0.500			3.500			1.500			1.000		
	Total	59		0.295	0.15		2.065	9.29		0.885	17.70		0.590	118.00
2019	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2020	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2021	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2022	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2023	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2024	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2025	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2026	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2027	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	69		0.345	0.17		2.415	10.87		1.035	20.70		0.690	138.00
2028	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2029	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2030	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2031	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00

**Table 4.2.5
Arctic Spill Occurrence Beaufort Sea Sale 2 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2033	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2034	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2035	Shallow		0.500			3.500			1.500			1.000		
	Medium	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Deep		0.500			3.500			1.500			1.000		
	Total	46		0.230	0.12		1.610	7.25		0.690	13.80		0.460	92.00
2036	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2037	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2038	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													

**Table 4.2.6
Arctic Spill Occurrence Beaufort Sea Sale 2 Production Wells Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009													
2010													
2011													
2012		0.015		0.008	0.045		0.473	0.075		6.900	0.135		7.380
2013	10.9	0.065	0.006	0.033	0.195	0.018	2.048	0.325	0.030	29.900	0.585	0.054	31.980
2014	19.9	0.115	0.006	0.058	0.345	0.017	3.623	0.575	0.029	52.900	1.035	0.052	56.580
2015	19.9	0.115	0.006	0.058	0.345	0.017	3.623	0.575	0.029	52.900	1.035	0.052	56.580
2016	19.9	0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
2017	34.8	0.195	0.006	0.098	0.585	0.017	6.143	0.975	0.028	89.700	1.755	0.050	95.940
2018	44.2	0.295	0.007	0.148	0.885	0.020	9.293	1.475	0.033	135.700	2.655	0.060	145.140
2019	41.9	0.345	0.008	0.173	1.035	0.025	10.868	1.725	0.041	158.700	3.105	0.074	169.740
2020	39.9	0.345	0.009	0.173	1.035	0.026	10.868	1.725	0.043	158.700	3.105	0.078	169.740
2021	38.3	0.345	0.009	0.173	1.035	0.027	10.868	1.725	0.045	158.700	3.105	0.081	169.740
2022	32.7	0.345	0.011	0.173	1.035	0.032	10.868	1.725	0.053	158.700	3.105	0.095	169.740
2023	27.9	0.345	0.012	0.173	1.035	0.037	10.868	1.725	0.062	158.700	3.105	0.111	169.740
2024	23.8	0.345	0.014	0.173	1.035	0.043	10.868	1.725	0.072	158.700	3.105	0.130	169.740
2025	20.3	0.345	0.017	0.173	1.035	0.051	10.868	1.725	0.085	158.700	3.105	0.153	169.740
2026	17.3	0.345	0.020	0.173	1.035	0.060	10.868	1.725	0.100	158.700	3.105	0.179	169.740
2027	14.8	0.345	0.023	0.173	1.035	0.070	10.868	1.725	0.117	158.700	3.105	0.210	169.740
2028	10.7	0.230	0.021	0.115	0.690	0.064	7.245	1.150	0.107	105.800	2.070	0.193	113.160
2029	9.2	0.230	0.025	0.115	0.690	0.075	7.245	1.150	0.125	105.800	2.070	0.225	113.160
2030	7.9	0.230	0.029	0.115	0.690	0.087	7.245	1.150	0.146	105.800	2.070	0.262	113.160
2031	6.8	0.230	0.034	0.115	0.690	0.101	7.245	1.150	0.169	105.800	2.070	0.304	113.160
2032	5.8	0.230	0.040	0.115	0.690	0.119	7.245	1.150	0.198	105.800	2.070	0.357	113.160
2033	5.0	0.230	0.046	0.115	0.690	0.138	7.245	1.150	0.230	105.800	2.070	0.414	113.160
2034	4.3	0.230	0.053	0.115	0.690	0.160	7.245	1.150	0.267	105.800	2.070	0.481	113.160
2035	3.7	0.230	0.062	0.115	0.690	0.186	7.245	1.150	0.311	105.800	2.070	0.559	113.160
2036													
2037													
2038													

Table 4.2.7
Artic Spill Occurrence Beaufort Sea Sale 2 Exploration Wells

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2005	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2006	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2007	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2008	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2010	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2011	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2012	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2013	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2014	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2015	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2016	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2017	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

**Table 4.2.7
Arctic Spill Occurrence Beaufort Sea Sale 2 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2019	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2020	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2021	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2022	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2023	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2024	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2025	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2026	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2027	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2028	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2029	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2030	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2031	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

**Table 4.2.7
Arctic Spill Occurrence Beaufort Sea Sale 2 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2033	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2034	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2035	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2036	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2037	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2038	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.2.8

Arctic Spill Occurrence Beaufort Sea Sale 2 Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2008		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2009													
2010		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2011													
2012		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2013	10.9	0.032	0.003	0.016	0.095	0.009	0.995	0.150	0.014	12.900	0.277	0.025	13.911
2014	19.9												
2015	19.9												
2016	19.9												
2017	34.8												
2018	44.2												
2019	41.9												
2020	39.9												
2021	38.3												
2022	32.7												
2023	27.9												
2024	23.8												
2025	20.3												
2026	17.3												
2027	14.8												
2028	10.7												
2029	9.2												
2030	7.9												
2031	6.8												
2032	5.8												
2033	5.0												
2034	4.3												
2035	3.7												
2036													
2037													
2038													

**Table 4.2.9
Arctic Spill Occurrence Beaufort Sea Sale 2 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2009	Shallow	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2011	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2012	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2013	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2014	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2015	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2016	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2017	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.2.9
Arctic Spill Occurrence Beaufort Sea Sale 2 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] = 500		Spill Index bbl	Average Spill [bbl] = 4500		Spill Index bbl	Average Spill [bbl] = 20000		Spill Index bbl	Average Spill [bbl] = 200000		Spill Index bbl
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2019	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2020	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2021	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2022	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2023	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2024	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2025	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2026	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2027	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2028	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2029	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2030	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2031	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.2.9
Arctic Spill Occurrence Beaufort Sea Sale 2 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2033	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2034	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2035	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2036	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2037	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2038	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.2.10

Arctic Spill Occurrence Beaufort Sea Sale 2 Development Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2010													
2011													
2012													
2013	10.9	0.026	0.002	0.013	0.078	0.007	0.817	0.156	0.014	17.160	0.260	0.024	17.990
2014	19.9	0.026	0.001	0.013	0.078	0.004	0.817	0.156	0.008	17.160	0.260	0.013	17.990
2015	19.9												
2016	19.9												
2017	34.8												
2018	44.2												
2019	41.9												
2020	39.9												
2021	38.3												
2022	32.7												
2023	27.9												
2024	23.8												
2025	20.3												
2026	17.3												
2027	14.8												
2028	10.7												
2029	9.2												
2030	7.9												
2031	6.8												
2032	5.8												
2033	5.0												
2034	4.3												
2035	3.7												
2036													
2037													
2038													

**Table 4.2.11
Arctic Spill Occurrence Beaufort Sea Sale 2 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
2004	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2005	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2006	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2007	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
Total		0.032	0.016	0.095		0.995	0.150		12.900	0.277		13.911		
2008	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
Total		0.032	0.016	0.095		0.995	0.150		12.900	0.277		13.911		
2009	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
Total		0.026	0.013	0.078		0.817	0.156		17.160	0.260		17.990		
2010	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
Total		0.032	0.016	0.095		0.995	0.150		12.900	0.277		13.911		
2011	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2012	Pipeline													
	Platforms		0.260		0.041	0.052		0.320				0.312		0.361
	Production Wells		0.015		0.008	0.045		0.473	0.075		6.900	0.135		7.380
	Exploration Wells		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
	Development Wells													
Total		0.338	0.080	0.287		2.783	0.375		32.700	1.000		35.563		
2013	Pipeline	10.9	0.768	0.071	0.224	0.432	0.040	1.697	0.140	0.013	2.471	1.340	0.123	4.392
	Platforms		1.126	0.103	0.178	0.226	0.021	1.387				1.352	0.124	1.565
	Production Wells		0.065	0.006	0.033	0.195	0.018	2.048	0.325	0.030	29.900	0.585	0.054	31.980
	Exploration Wells		0.032	0.003	0.016	0.095	0.009	0.995	0.150	0.014	12.900	0.277	0.025	13.911
	Development Wells		0.026	0.002	0.013	0.078	0.007	0.817	0.156	0.014	17.160	0.260	0.024	17.990
	Total			2.017	0.185	0.463	1.026	0.094	6.945	0.771	0.071	62.431	3.813	0.350

**Table 4.2.11
Arctic Spill Occurrence Beaufort Sea Sale 2 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
2014	Pipeline	19.9	0.768	0.039	0.224	0.432	0.022	1.697	0.140	0.007	2.471	1.340	0.067	4.392
	Platforms		1.991	0.100	0.315	0.400	0.020	2.455				2.392	0.120	2.769
	Production Wells		0.115	0.006	0.058	0.345	0.017	3.623	0.575	0.029	52.900	1.035	0.052	56.580
	Exploration Wells													
	Development Wells		0.026	0.001	0.013	0.078	0.004	0.817	0.156	0.008	17.160	0.260	0.013	17.990
	Total		2.901	0.146	0.609	1.255	0.063	8.592	0.871	0.044	72.531	5.027	0.253	81.732
2015	Pipeline	19.9	0.768	0.039	0.224	0.432	0.022	1.697	0.140	0.007	2.471	1.340	0.067	4.392
	Platforms		1.991	0.100	0.315	0.400	0.020	2.455				2.392	0.120	2.769
	Production Wells		0.115	0.006	0.058	0.345	0.017	3.623	0.575	0.029	52.900	1.035	0.052	56.580
	Exploration Wells													
	Development Wells		0.026	0.001	0.013	0.078	0.004	0.817	0.156	0.008	17.160	0.260	0.013	17.990
	Total		2.875	0.144	0.596	1.177	0.059	7.775	0.715	0.036	55.371	4.767	0.240	63.742
2016	Pipeline	19.9	0.768	0.039	0.224	0.432	0.022	1.697	0.140	0.007	2.471	1.340	0.067	4.392
	Platforms		2.257	0.113	0.357	0.454	0.023	2.781				2.710	0.136	3.138
	Production Wells		0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
	Exploration Wells													
	Development Wells													
	Total		3.155	0.159	0.645	1.275	0.064	8.573	0.790	0.040	62.271	5.220	0.262	71.490
2017	Pipeline	34.8	2.108	0.061	0.583	1.071	0.031	4.250	0.342	0.010	5.995	3.522	0.101	10.828
	Platforms		3.406	0.098	0.538	0.684	0.020	4.195				4.091	0.118	4.733
	Production Wells		0.195	0.006	0.098	0.585	0.017	6.143	0.975	0.028	89.700	1.755	0.050	95.940
	Exploration Wells													
	Development Wells													
	Total		5.710	0.164	1.219	2.340	0.067	14.587	1.317	0.038	95.695	9.367	0.269	111.501
2018	Pipeline	44.2	2.108	0.048	0.583	1.071	0.024	4.250	0.342	0.008	5.995	3.522	0.080	10.828
	Platforms		5.175	0.117	0.818	1.039	0.024	6.370				6.215	0.141	7.188
	Production Wells		0.295	0.007	0.148	0.885	0.020	9.293	1.475	0.033	135.700	2.655	0.060	145.140
	Exploration Wells													
	Development Wells													
	Total		7.579	0.171	1.548	2.995	0.068	19.912	1.817	0.041	141.695	12.391	0.280	163.156
2019	Pipeline	41.9	2.108	0.050	0.583	1.071	0.026	4.250	0.342	0.008	5.995	3.522	0.084	10.828
	Platforms		6.060	0.145	0.957	1.217	0.029	7.457				7.276	0.174	8.415
	Production Wells		0.345	0.008	0.173	1.035	0.025	10.868	1.725	0.041	158.700	3.105	0.074	169.740
	Exploration Wells													
	Development Wells													
	Total		8.513	0.203	1.713	3.322	0.079	22.575	2.067	0.049	164.695	13.903	0.332	188.983
2020	Pipeline	39.9	2.108	0.053	0.583	1.071	0.027	4.250	0.342	0.009	5.995	3.522	0.088	10.828
	Platforms		6.060	0.152	0.957	1.217	0.030	7.457				7.276	0.182	8.415
	Production Wells		0.345	0.009	0.173	1.035	0.026	10.868	1.725	0.043	158.700	3.105	0.078	169.740
	Exploration Wells													
	Development Wells													
	Total		8.513	0.213	1.713	3.322	0.083	22.575	2.067	0.052	164.695	13.903	0.348	188.983
2021	Pipeline	38.3	2.108	0.055	0.583	1.071	0.028	4.250	0.342	0.009	5.995	3.522	0.092	10.828
	Platforms		6.060	0.158	0.957	1.217	0.032	7.457				7.276	0.190	8.415
	Production Wells		0.345	0.009	0.173	1.035	0.027	10.868	1.725	0.045	158.700	3.105	0.081	169.740
	Exploration Wells													
	Development Wells													
	Total		8.513	0.222	1.713	3.322	0.087	22.575	2.067	0.054	164.695	13.903	0.363	188.983
2022	Pipeline	32.7	2.108	0.064	0.583	1.071	0.033	4.250	0.342	0.010	5.995	3.522	0.108	10.828
	Platforms		6.060	0.185	0.957	1.217	0.037	7.457				7.276	0.223	8.415
	Production Wells		0.345	0.011	0.173	1.035	0.032	10.868	1.725	0.053	158.700	3.105	0.095	169.740
	Exploration Wells													
	Development Wells													
	Total		8.513	0.260	1.713	3.322	0.102	22.575	2.067	0.063	164.695	13.903	0.425	188.983
2023	Pipeline	27.9	2.108	0.076	0.583	1.071	0.038	4.250	0.342	0.012	5.995	3.522	0.126	10.828
	Platforms		6.060	0.217	0.957	1.217	0.044	7.457				7.276	0.261	8.415
	Production Wells		0.345	0.012	0.173	1.035	0.037	10.868	1.725	0.062	158.700	3.105	0.111	169.740
	Exploration Wells													
	Development Wells													
	Total		8.513	0.305	1.713	3.322	0.119	22.575	2.067	0.074	164.695	13.903	0.498	188.983

**Table 4.2.11
Arctic Spill Occurrence Beaufort Sea Sale 2 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2024	Pipeline	23.8	2.108	0.089	0.583	1.071	0.045	4.250	0.342	0.014	5.995	3.522	0.148	10.828
	Platforms		6.060	0.255	0.957	1.217	0.051	7.457				7.276	0.306	8.415
	Production Wells		0.345	0.014	0.173	1.035	0.043	10.868	1.725	0.072	158.700	3.105	0.130	169.740
	Exploration Wells													
	Development Wells													
	Total		8.513	0.358	1.713	3.322	0.140	22.575	2.067	0.087	164.695	13.903	0.584	188.983
2025	Pipeline	20.3	2.108	0.104	0.583	1.071	0.053	4.250	0.342	0.017	5.995	3.522	0.173	10.828
	Platforms		6.060	0.299	0.957	1.217	0.060	7.457				7.276	0.358	8.415
	Production Wells		0.345	0.017	0.173	1.035	0.051	10.868	1.725	0.085	158.700	3.105	0.153	169.740
	Exploration Wells													
	Development Wells													
	Total		8.513	0.419	1.713	3.322	0.164	22.575	2.067	0.102	164.695	13.903	0.685	188.983
2026	Pipeline	17.3	2.108	0.122	0.583	1.071	0.062	4.250	0.342	0.020	5.995	3.522	0.204	10.828
	Platforms		6.060	0.350	0.957	1.217	0.070	7.457				7.276	0.421	8.415
	Production Wells		0.345	0.020	0.173	1.035	0.060	10.868	1.725	0.100	158.700	3.105	0.179	169.740
	Exploration Wells													
	Development Wells													
	Total		8.513	0.492	1.713	3.322	0.192	22.575	2.067	0.119	164.695	13.903	0.804	188.983
2027	Pipeline	14.8	2.108	0.142	0.583	1.071	0.072	4.250	0.342	0.023	5.995	3.522	0.238	10.828
	Platforms		6.060	0.409	0.957	1.217	0.082	7.457				7.276	0.492	8.415
	Production Wells		0.345	0.023	0.173	1.035	0.070	10.868	1.725	0.117	158.700	3.105	0.210	169.740
	Exploration Wells													
	Development Wells													
	Total		8.513	0.575	1.713	3.322	0.224	22.575	2.067	0.140	164.695	13.903	0.939	188.983
2028	Pipeline	10.7	1.340	0.125	0.359	0.639	0.060	2.552	0.203	0.019	3.524	2.182	0.204	6.436
	Platforms		4.069	0.380	0.643	0.816	0.076	5.003				4.885	0.457	5.645
	Production Wells		0.230	0.021	0.115	0.690	0.064	7.245	1.150	0.107	105.800	2.070	0.193	113.160
	Exploration Wells													
	Development Wells													
	Total		5.639	0.527	1.117	2.145	0.200	14.800	1.353	0.126	109.324	9.136	0.854	125.241
2029	Pipeline	9.2	1.340	0.146	0.359	0.639	0.069	2.552	0.203	0.022	3.524	2.182	0.237	6.436
	Platforms		4.069	0.442	0.643	0.816	0.089	5.003				4.885	0.531	5.645
	Production Wells		0.230	0.025	0.115	0.690	0.075	7.245	1.150	0.125	105.800	2.070	0.225	113.160
	Exploration Wells													
	Development Wells													
	Total		5.639	0.613	1.117	2.145	0.233	14.800	1.353	0.147	109.324	9.136	0.993	125.241
2030	Pipeline	7.9	1.340	0.170	0.359	0.639	0.081	2.552	0.203	0.026	3.524	2.182	0.276	6.436
	Platforms		4.069	0.515	0.643	0.816	0.103	5.003				4.885	0.618	5.645
	Production Wells		0.230	0.029	0.115	0.690	0.087	7.245	1.150	0.146	105.800	2.070	0.262	113.160
	Exploration Wells													
	Development Wells													
	Total		5.639	0.714	1.117	2.145	0.272	14.800	1.353	0.171	109.324	9.136	1.157	125.241
2031	Pipeline	5.8	1.340	0.197	0.300	0.639	0.094	2.209	0.203	0.030	3.240	2.182	0.321	5.748
	Platforms		4.069	0.598	0.643	0.816	0.120	5.003				4.885	0.718	5.645
	Production Wells		0.230	0.034	0.115	0.690	0.101	7.245	1.150	0.169	105.800	2.070	0.304	113.160
	Exploration Wells													
	Development Wells													
	Total		5.639	0.829	1.057	2.145	0.315	14.457	1.353	0.199	109.040	9.136	1.344	124.554
2032	Pipeline	5.0	1.340	0.231	0.359	0.639	0.110	2.552	0.203	0.035	3.524	2.182	0.376	6.436
	Platforms		4.069	0.701	0.643	0.816	0.141	5.003				4.885	0.842	5.645
	Production Wells		0.230	0.040	0.115	0.690	0.119	7.245	1.150	0.198	105.800	2.070	0.357	113.160
	Exploration Wells													
	Development Wells													
	Total		5.639	0.972	1.117	2.145	0.370	14.800	1.353	0.233	109.324	9.136	1.575	125.241
2033	Pipeline	3.7	1.340	0.268	0.359	0.639	0.128	2.552	0.203	0.041	3.524	2.182	0.436	6.436
	Platforms		4.069	0.814	0.643	0.816	0.163	5.003				4.885	0.977	5.645
	Production Wells		0.230	0.046	0.115	0.690	0.138	7.245	1.150	0.230	105.800	2.070	0.414	113.160
	Exploration Wells													
	Development Wells													
	Total		5.639	1.128	1.117	2.145	0.429	14.800	1.353	0.271	109.324	9.136	1.827	125.241

**Table 4.2.11
Arctic Spill Occurrence Beaufort Sea Sale 2 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
2034	Pipeline		1.340	0.312	0.359	0.639	0.149	2.552	0.203	0.047	3.524	2.182	0.507	6.436
	Platforms		4.069	0.946	0.643	0.816	0.190	5.003				4.885	1.136	5.645
	Production Wells		0.230	0.053	0.115	0.690	0.160	7.245	1.150	0.267	105.800	2.070	0.481	113.160
	Exploration Wells													
	Development Wells													
	Total			5.639	1.311	1.117	2.145	0.499	14.800	1.353	0.315	109.324	9.136	2.125
2035	Pipeline		1.340	0.362	0.359	0.639	0.173	2.552	0.203	0.055	3.524	2.182	0.590	6.436
	Platforms		4.069	1.100	0.643	0.816	0.221	5.003				4.885	1.320	5.645
	Production Wells		0.230	0.062	0.115	0.690	0.186	7.245	1.150	0.311	105.800	2.070	0.559	113.160
	Exploration Wells													
	Development Wells													
	Total			5.639	1.524	1.117	2.145	0.580	14.800	1.353	0.366	109.324	9.136	2.469
2036	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2037	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2038	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													

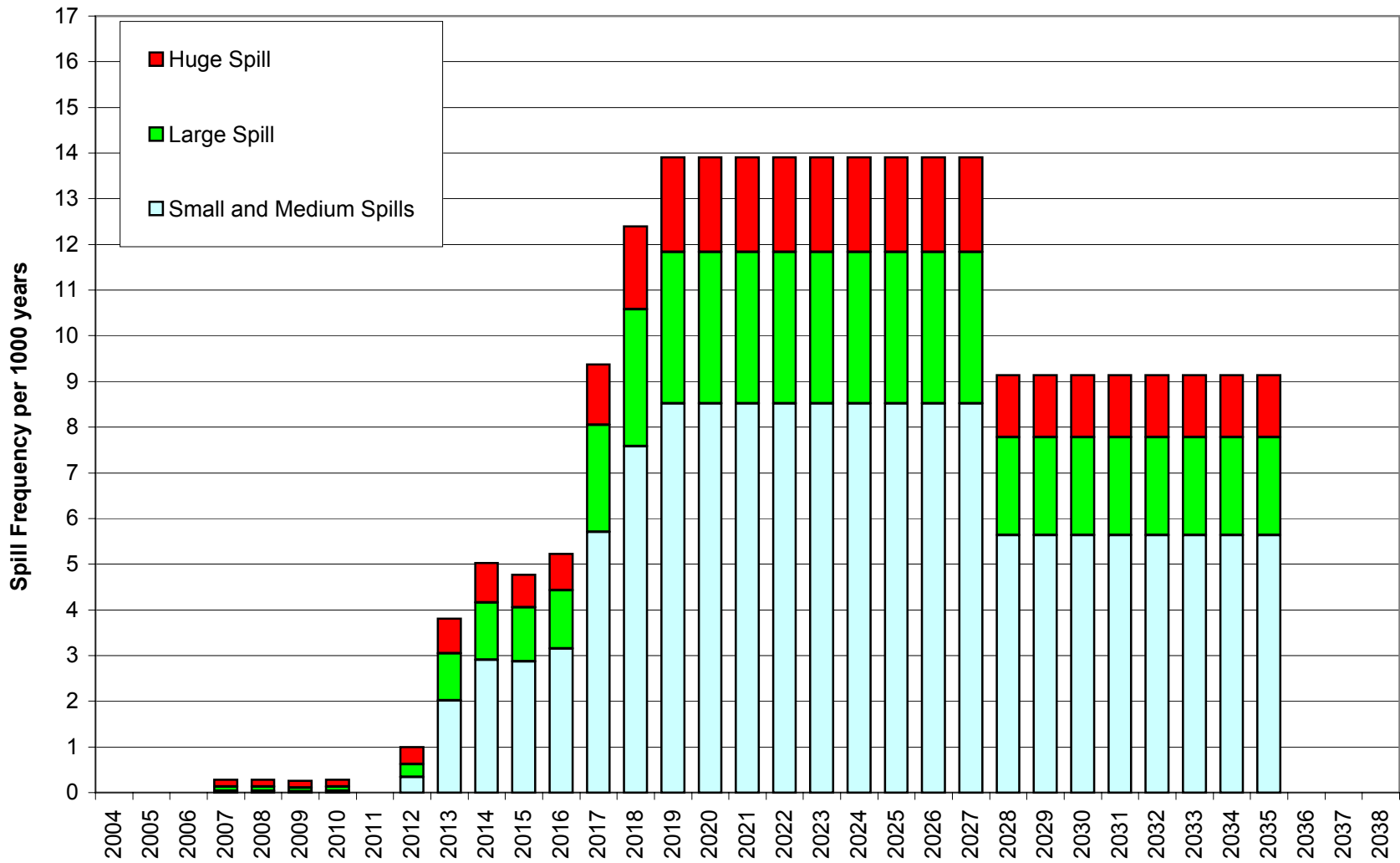
**Table 4.2.12
Arctic Spill Occurrence Beaufort Sea Sale 2 Annual Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2008		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2009		0.03		0.013	0.08		0.817	0.156		17.16	0.260		17.990
2010		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2011													
2012		0.34		0.080	0.29		2.783	0.375		32.70	1.000		35.563
2013	10.9	2.02	0.185	0.463	1.03	0.094	6.945	0.771	0.071	62.43	3.813	0.350	69.839
2014	19.9	2.90	0.146	0.609	1.26	0.063	8.592	0.871	0.044	72.53	5.027	0.253	81.732
2015	19.9	2.87	0.144	0.596	1.18	0.059	7.775	0.715	0.036	55.37	4.767	0.240	63.742
2016	19.9	3.16	0.159	0.645	1.28	0.064	8.573	0.790	0.040	62.27	5.220	0.262	71.490
2017	34.8	5.71	0.164	1.219	2.34	0.067	14.587	1.317	0.038	95.70	9.367	0.269	111.501
2018	44.2	7.58	0.171	1.548	3.00	0.068	19.912	1.817	0.041	141.70	12.391	0.280	163.156
2019	41.9	8.51	0.203	1.713	3.32	0.079	22.575	2.067	0.049	164.70	13.903	0.332	188.983
2020	39.9	8.51	0.213	1.713	3.32	0.083	22.575	2.067	0.052	164.70	13.903	0.348	188.983
2021	38.3	8.51	0.222	1.713	3.32	0.087	22.575	2.067	0.054	164.70	13.903	0.363	188.983
2022	32.7	8.51	0.260	1.713	3.32	0.102	22.575	2.067	0.063	164.70	13.903	0.425	188.983
2023	27.9	8.51	0.305	1.713	3.32	0.119	22.575	2.067	0.074	164.70	13.903	0.498	188.983
2024	23.8	8.51	0.358	1.713	3.32	0.140	22.575	2.067	0.087	164.70	13.903	0.584	188.983
2025	20.3	8.51	0.419	1.713	3.32	0.164	22.575	2.067	0.102	164.70	13.903	0.685	188.983
2026	17.3	8.51	0.492	1.713	3.32	0.192	22.575	2.067	0.119	164.70	13.903	0.804	188.983
2027	14.8	8.51	0.575	1.713	3.32	0.224	22.575	2.067	0.140	164.70	13.903	0.939	188.983
2028	10.7	5.64	0.527	1.117	2.15	0.200	14.800	1.353	0.126	109.32	9.136	0.854	125.241
2029	9.2	5.64	0.613	1.117	2.15	0.233	14.800	1.353	0.147	109.32	9.136	0.993	125.241
2030	7.9	5.64	0.714	1.117	2.15	0.272	14.800	1.353	0.171	109.32	9.136	1.157	125.241
2031	6.8	5.64	0.829	1.057	2.15	0.315	14.457	1.353	0.199	109.04	9.136	1.344	124.554
2032	5.8	5.64	0.972	1.117	2.15	0.370	14.800	1.353	0.233	109.32	9.136	1.575	125.241
2033	5.0	5.64	1.128	1.117	2.15	0.429	14.800	1.353	0.271	109.32	9.136	1.827	125.241
2034	4.3	5.64	1.311	1.117	2.15	0.499	14.800	1.353	0.315	109.32	9.136	2.125	125.241
2035	3.7	5.64	1.524	1.117	2.15	0.580	14.800	1.353	0.366	109.32	9.136	2.469	125.241
2036													
2037													
2038													

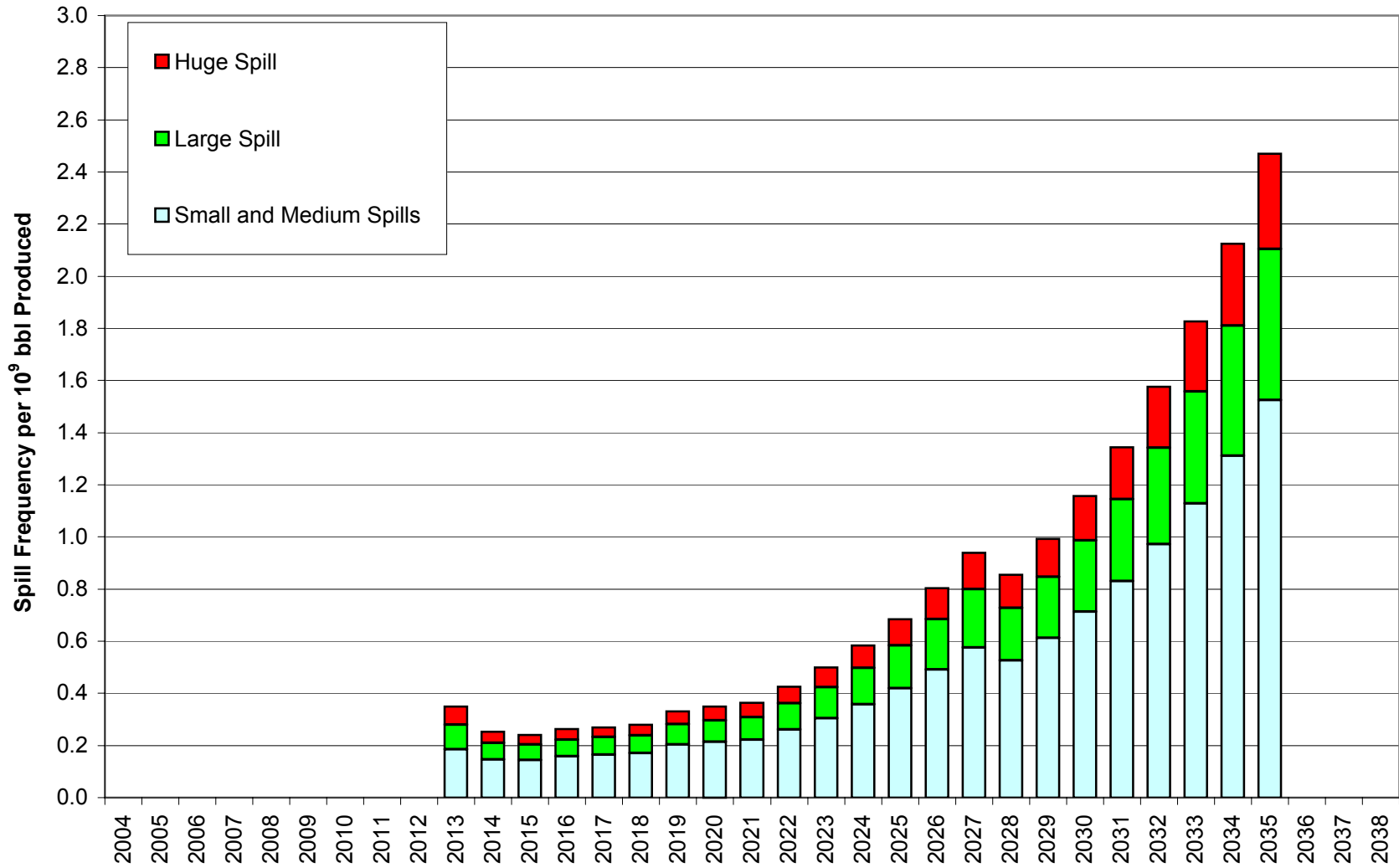
**Table 4.2.13
Arctic Spill Occurrence Beaufort Sea Sale 2 Wells Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2008		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2009		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2010		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2011													
2012		0.078		0.039	0.235		2.462	0.375		32.700	0.688		35.202
2013	10.9	0.123	0.011	0.061	0.368	0.034	3.860	0.631	0.058	59.960	1.122	0.103	63.881
2014	19.9	0.141	0.007	0.071	0.423	0.021	4.440	0.731	0.037	70.060	1.295	0.065	74.570
2015	19.9	0.115	0.006	0.058	0.345	0.017	3.623	0.575	0.029	52.900	1.035	0.052	56.580
2016	19.9	0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
2017	34.8	0.195	0.006	0.098	0.585	0.017	6.143	0.975	0.028	89.700	1.755	0.050	95.940
2018	44.2	0.295	0.007	0.148	0.885	0.020	9.293	1.475	0.033	135.700	2.655	0.060	145.140
2019	41.9	0.345	0.008	0.173	1.035	0.025	10.868	1.725	0.041	158.700	3.105	0.074	169.740
2020	39.9	0.345	0.009	0.173	1.035	0.026	10.868	1.725	0.043	158.700	3.105	0.078	169.740
2021	38.3	0.345	0.009	0.173	1.035	0.027	10.868	1.725	0.045	158.700	3.105	0.081	169.740
2022	32.7	0.345	0.011	0.173	1.035	0.032	10.868	1.725	0.053	158.700	3.105	0.095	169.740
2023	27.9	0.345	0.012	0.173	1.035	0.037	10.868	1.725	0.062	158.700	3.105	0.111	169.740
2024	23.8	0.345	0.014	0.173	1.035	0.043	10.868	1.725	0.072	158.700	3.105	0.130	169.740
2025	20.3	0.345	0.017	0.173	1.035	0.051	10.868	1.725	0.085	158.700	3.105	0.153	169.740
2026	17.3	0.345	0.020	0.173	1.035	0.060	10.868	1.725	0.100	158.700	3.105	0.179	169.740
2027	14.8	0.345	0.023	0.173	1.035	0.070	10.868	1.725	0.117	158.700	3.105	0.210	169.740
2028	10.7	0.230	0.021	0.115	0.690	0.064	7.245	1.150	0.107	105.800	2.070	0.193	113.160
2029	9.2	0.230	0.025	0.115	0.690	0.075	7.245	1.150	0.125	105.800	2.070	0.225	113.160
2030	7.9	0.230	0.029	0.115	0.690	0.087	7.245	1.150	0.146	105.800	2.070	0.262	113.160
2031	6.8	0.230	0.034	0.115	0.690	0.101	7.245	1.150	0.169	105.800	2.070	0.304	113.160
2032	5.8	0.230	0.040	0.115	0.690	0.119	7.245	1.150	0.198	105.800	2.070	0.357	113.160
2033	5.0	0.230	0.046	0.115	0.690	0.138	7.245	1.150	0.230	105.800	2.070	0.414	113.160
2034	4.3	0.230	0.053	0.115	0.690	0.160	7.245	1.150	0.267	105.800	2.070	0.481	113.160
2035	3.7	0.230	0.062	0.115	0.690	0.186	7.245	1.150	0.311	105.800	2.070	0.559	113.160
2036													
2037													
2038													

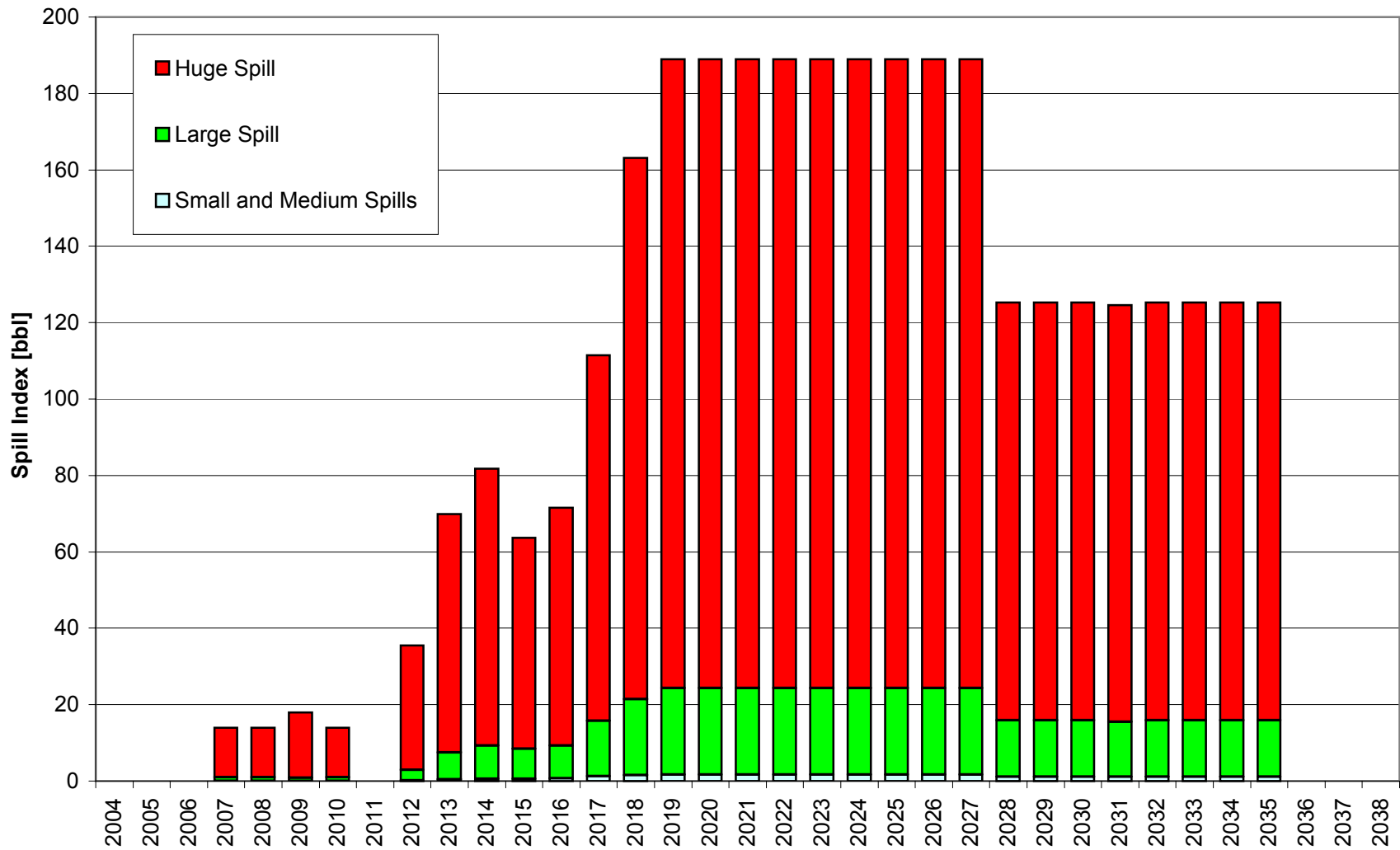
Beaufort Sea Sale 2 Spill Frequency



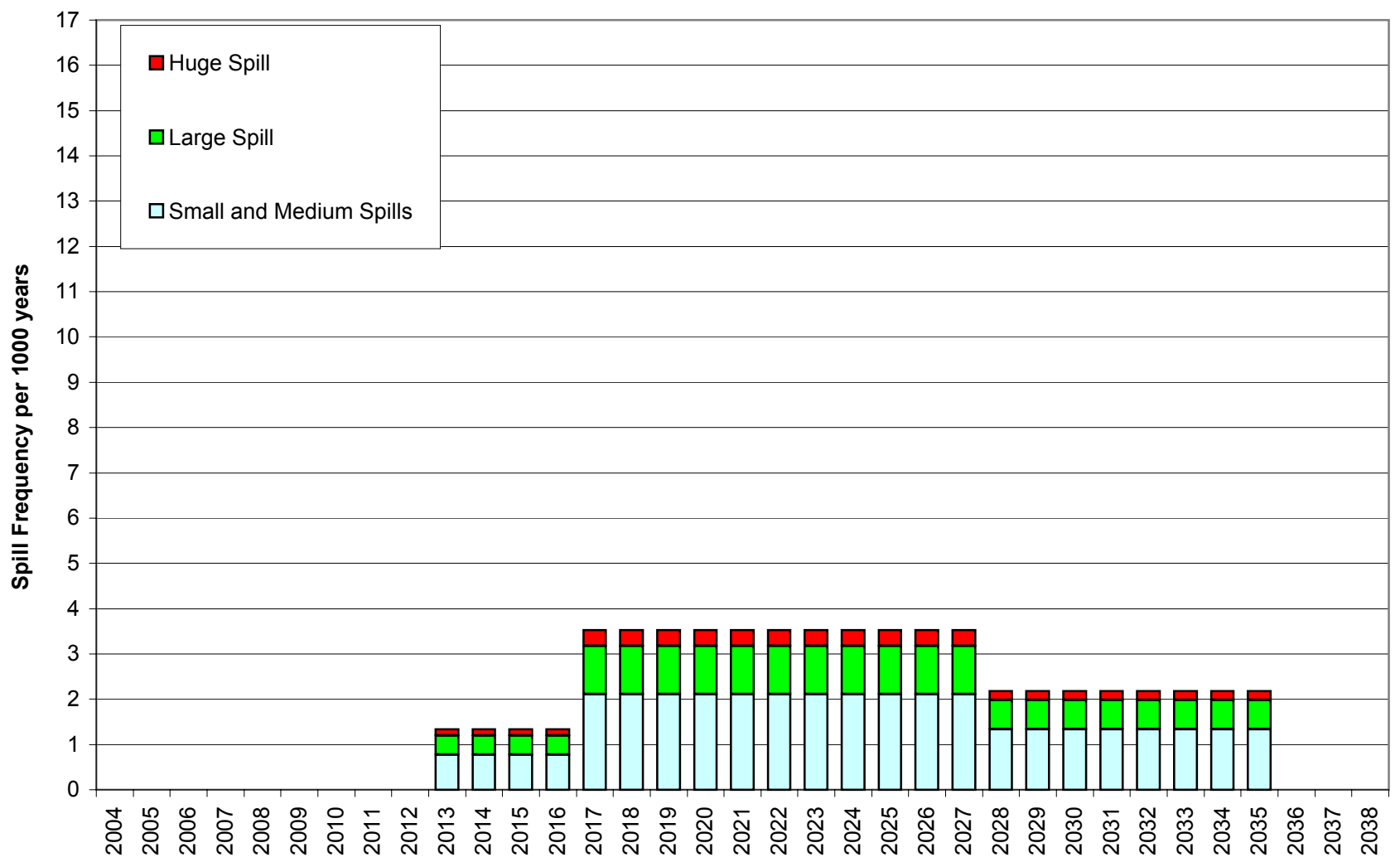
Beaufort Sea Sale 2 Spill Frequency per 10⁹ bbl Produced



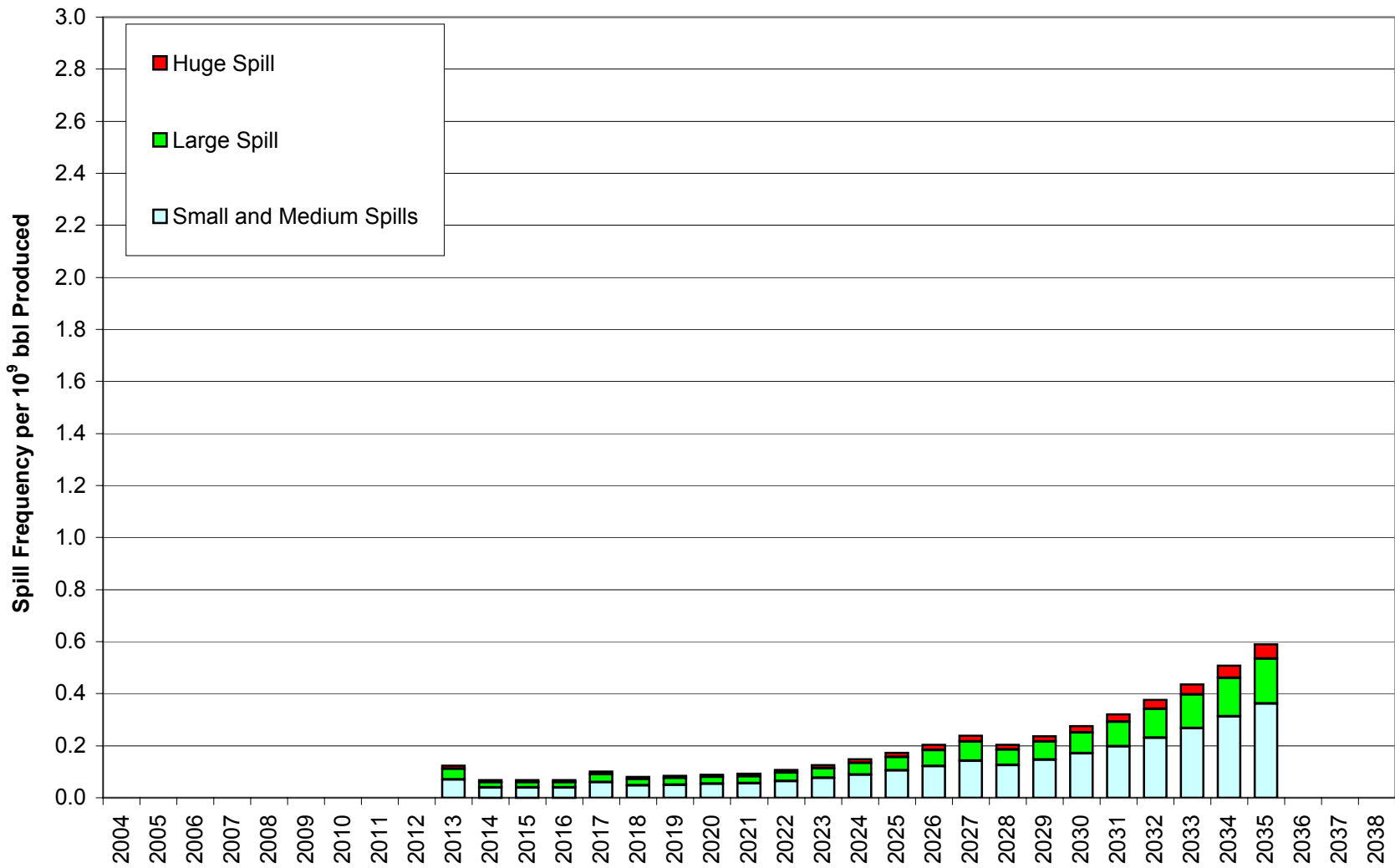
Beaufort Sea Sale 2 Spill Index



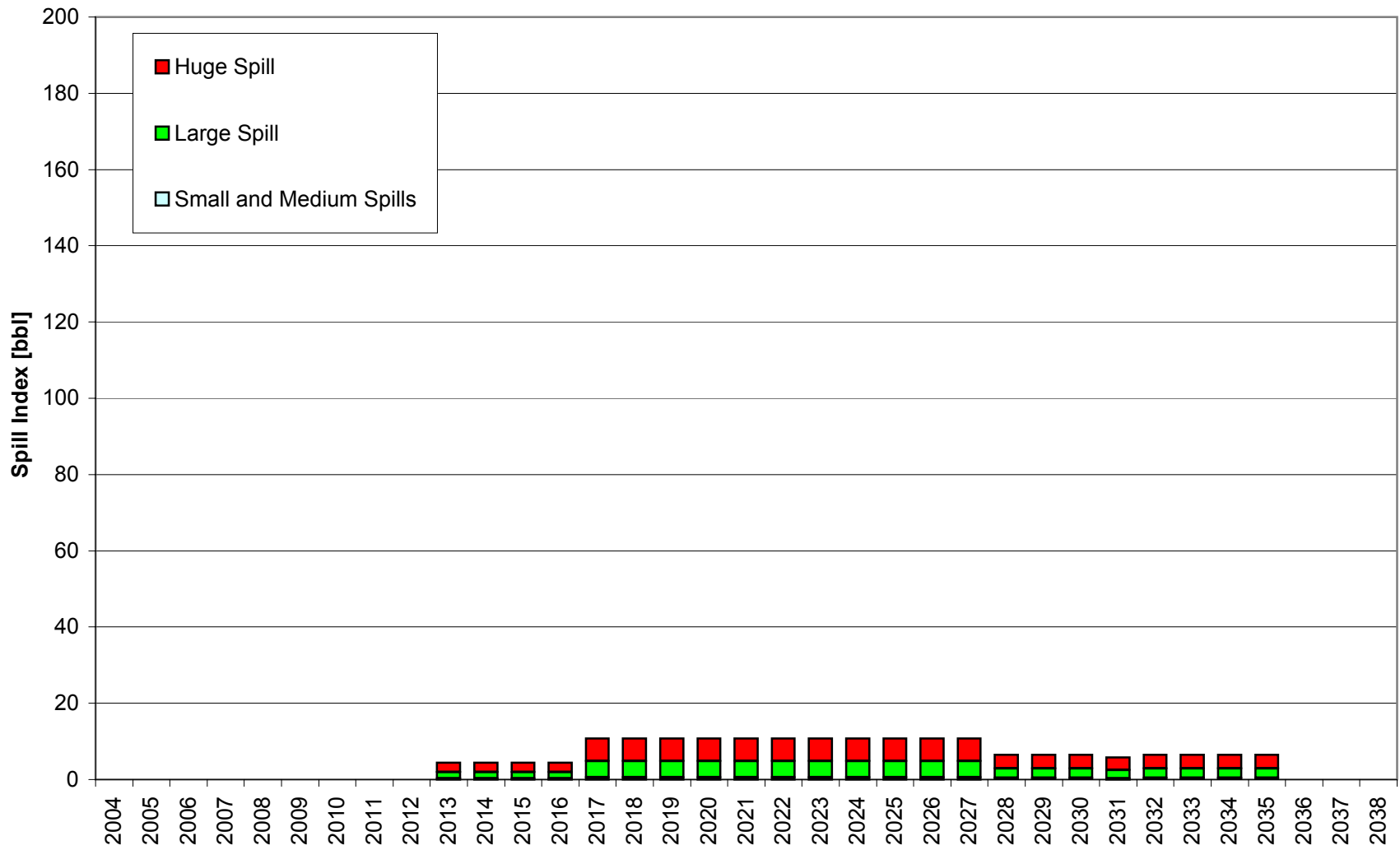
Beaufort Sea Sale 2 Spill Frequency - P/L



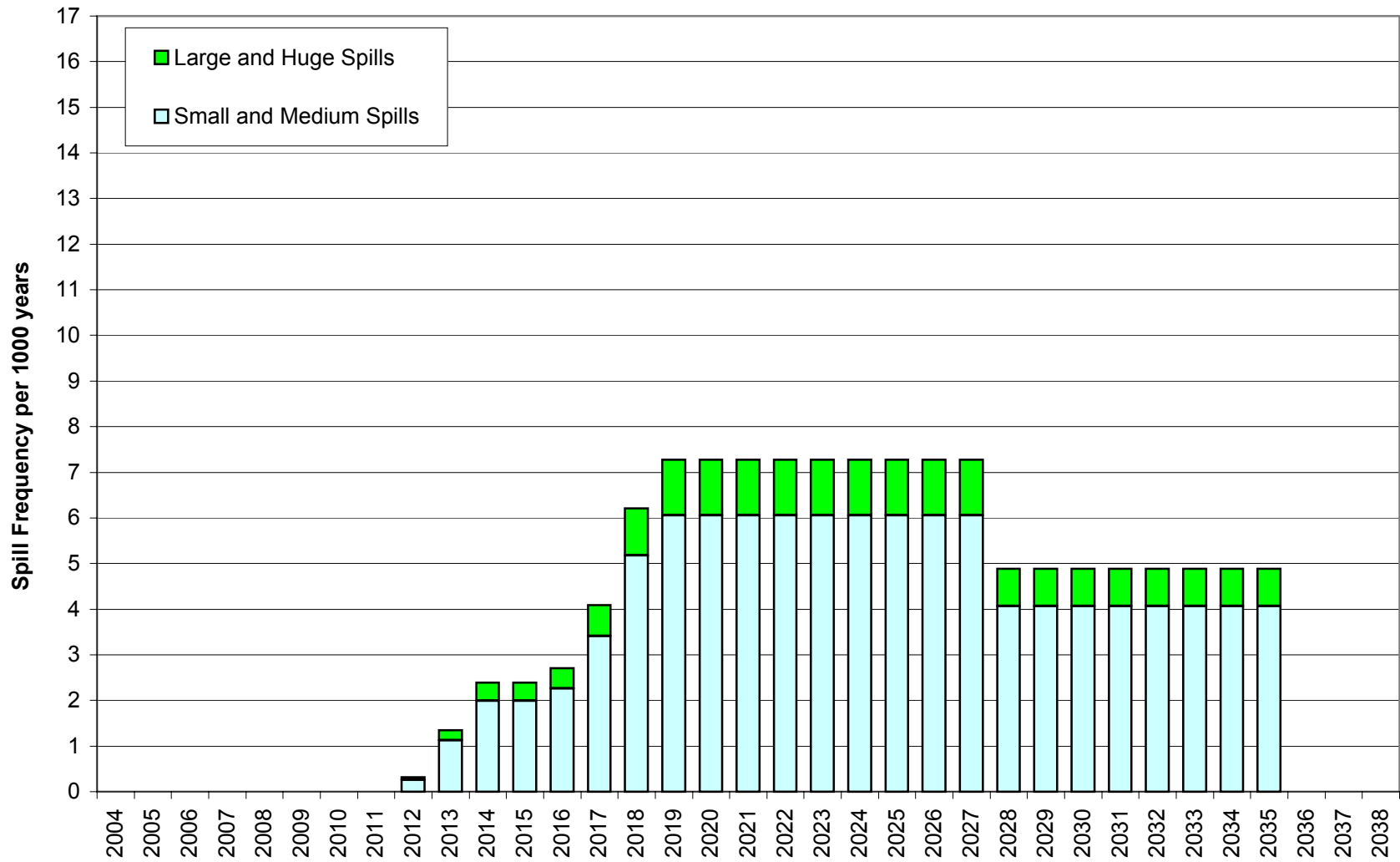
Beaufort Sea Sale 2 Spill Frequency per 10⁹ bbl Produced - P/L



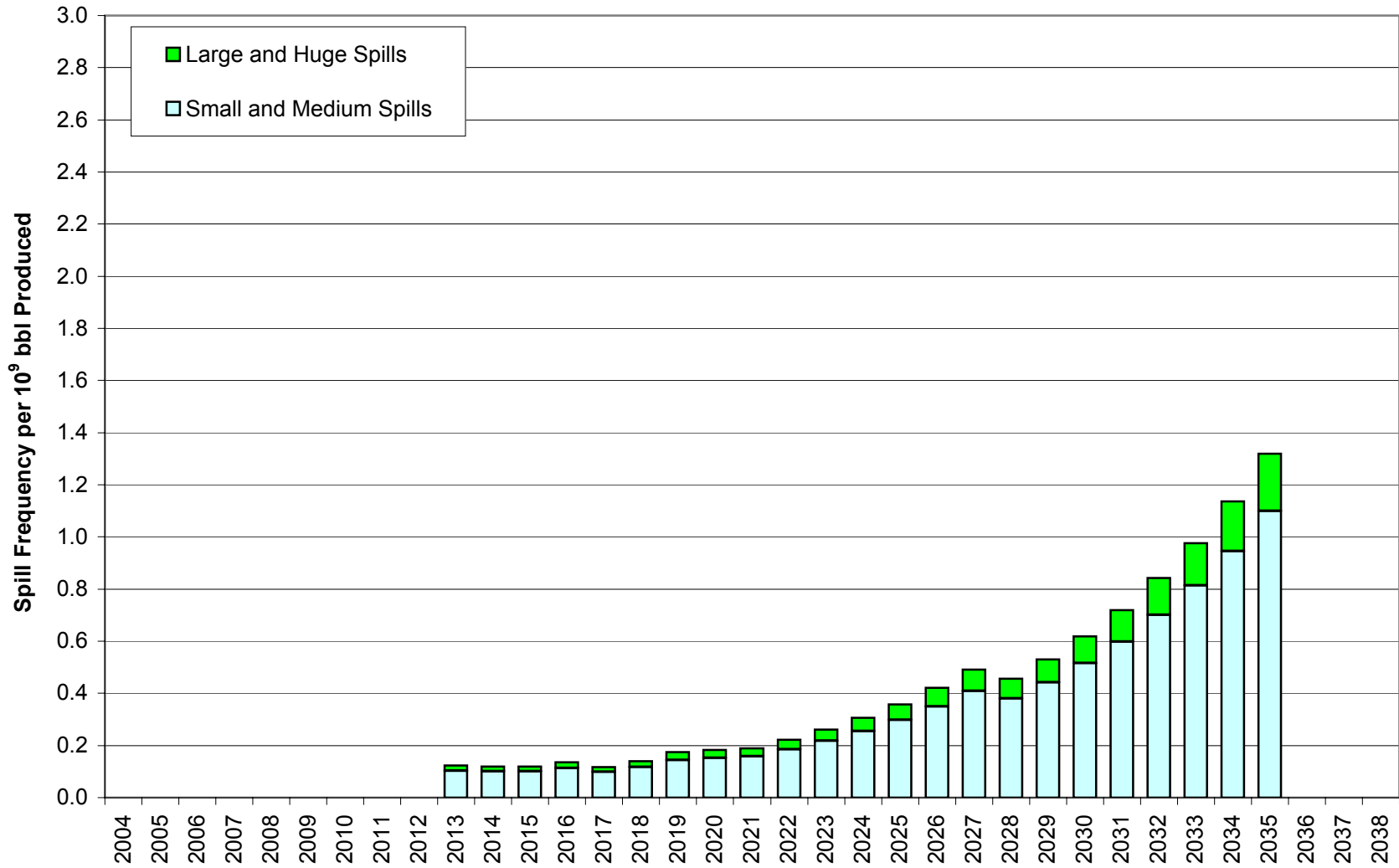
Beaufort Sea Sale 2 Spill Index - P/L



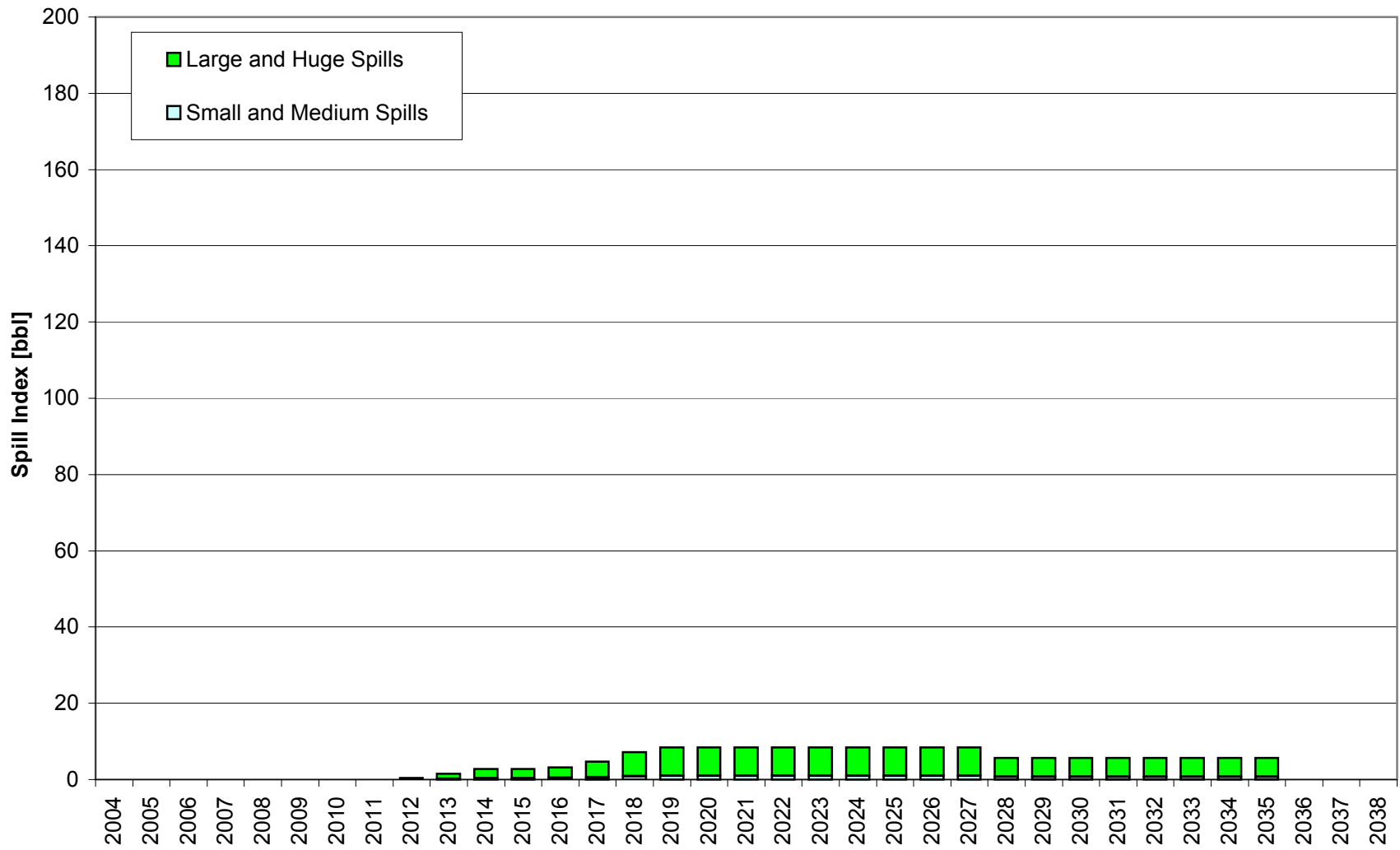
Beaufort Sea Sale 2 Spill Frequency - Platforms



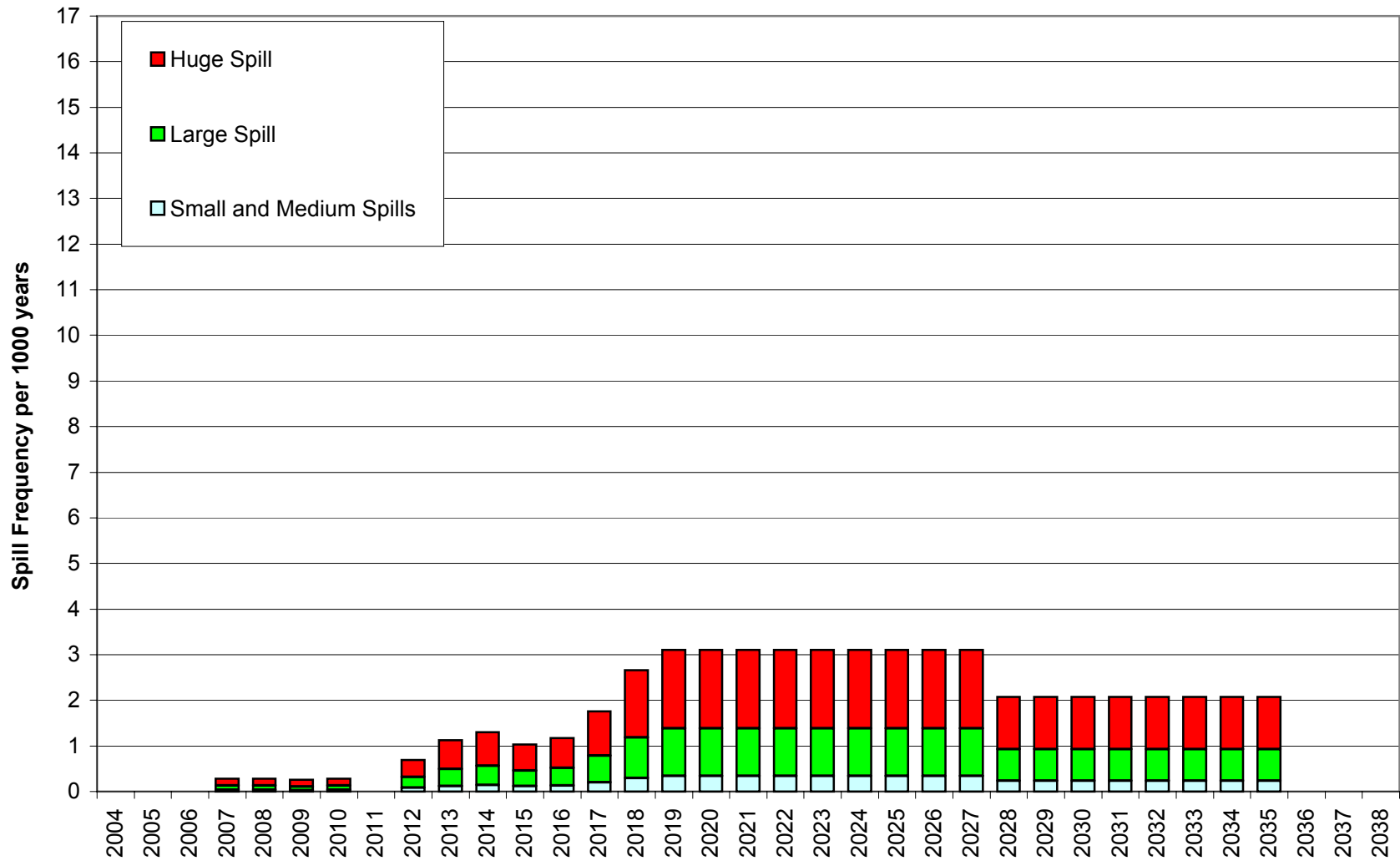
Beaufort Sea Sale 2 Spill Frequency per 10⁹ bbl Produced - Platforms



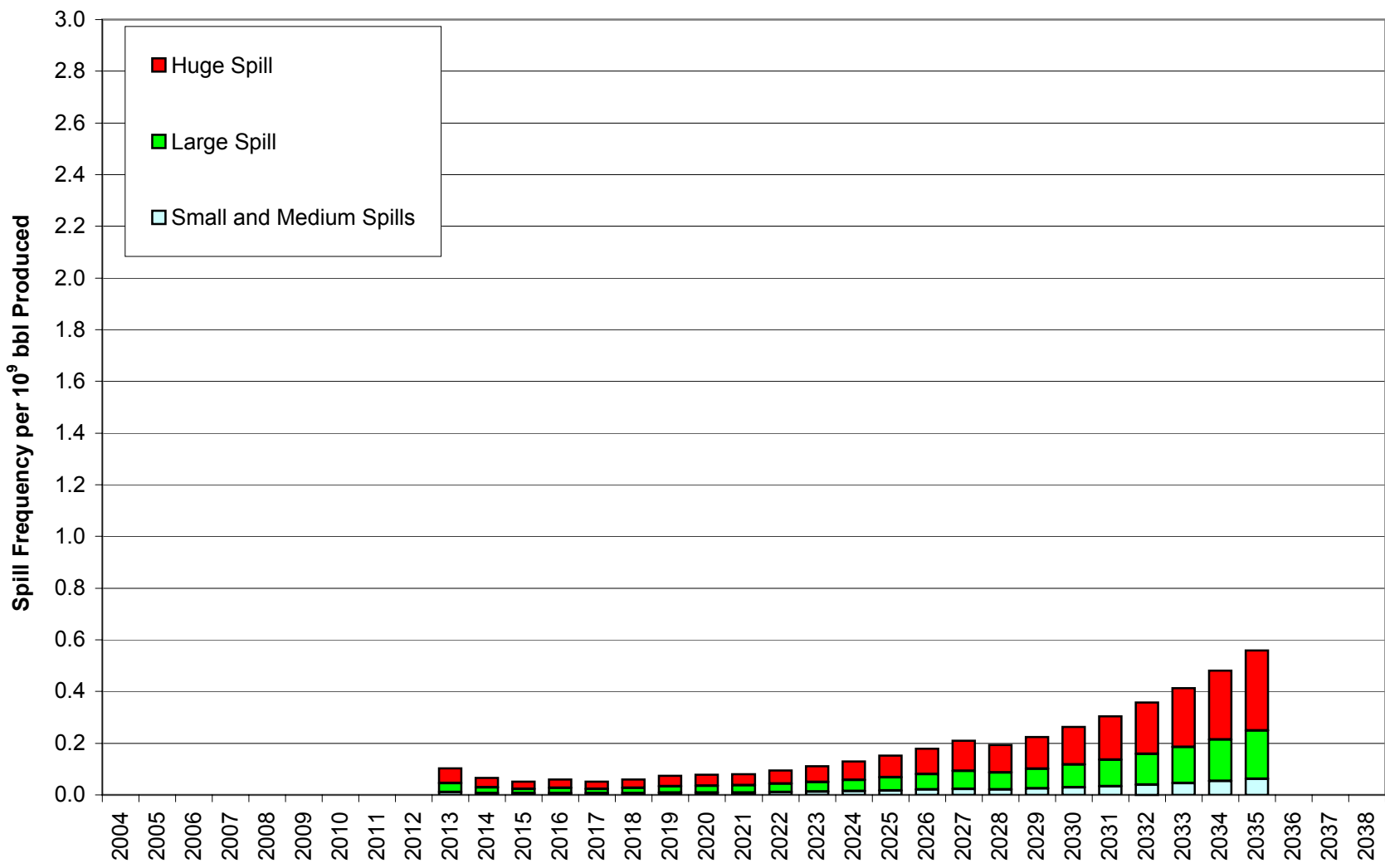
Beaufort Sea Sale 2 Spill Index - Platforms



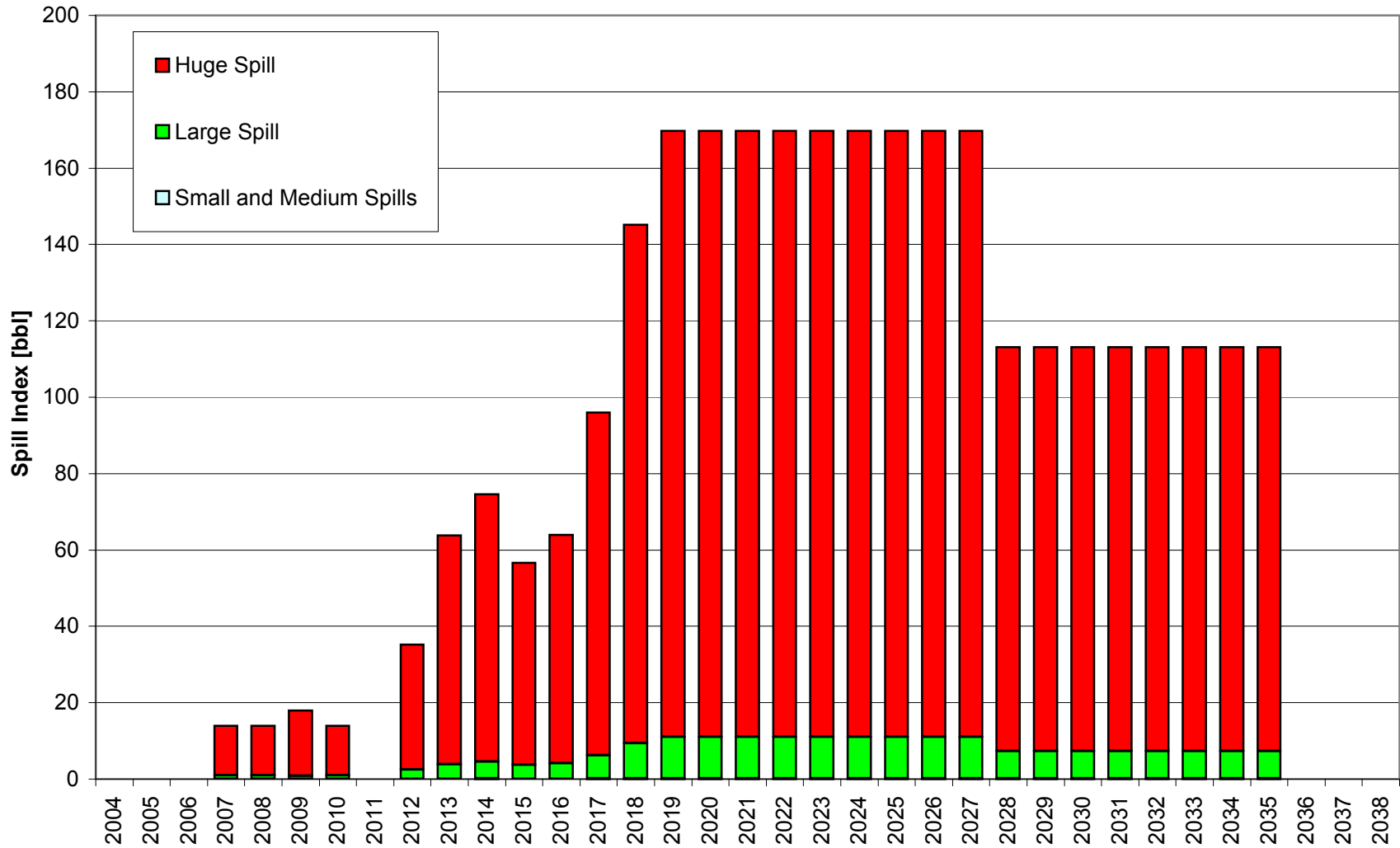
Beaufort Sea Sale 2 Spill Frequency - Wells



Beaufort Sea Sale 2 Spill Frequency per 10⁹ bbl Produced - Wells



Beaufort Sea Sale 2 Spill Index - Wells



**Table 4.3.2
Arctic Spill Occurrence Beaufort Sea Sale 3 P/L Summary**

Year	Production [MMbbl]	Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004																			
2005																			
2006																			
2007																			
2008																			
2009																			
2010																			
2011																			
2012																			
2013																			
2014																			
2015																			
2016																			
2017																			
2018																			
2019	30.8	0.560	0.018	0.033	1.293	0.042	0.476	1.854	0.060	0.509	0.920	0.030	3.657	0.294	0.010	5.144	3.068	0.100	9.310
2020	38.6	0.560	0.015	0.033	1.293	0.034	0.476	1.854	0.048	0.509	0.920	0.024	3.657	0.294	0.008	5.144	3.068	0.079	9.310
2021	38.6	0.560	0.015	0.033	1.293	0.034	0.476	1.854	0.048	0.509	0.920	0.024	3.657	0.294	0.008	5.144	3.068	0.079	9.310
2022	38.6	0.560	0.015	0.033	1.293	0.034	0.476	1.854	0.048	0.509	0.920	0.024	3.657	0.294	0.008	5.144	3.068	0.079	9.310
2023	38.6	0.560	0.015	0.033	1.293	0.034	0.476	1.854	0.048	0.509	0.920	0.024	3.657	0.294	0.008	5.144	3.068	0.079	9.310
2024	38.6	0.560	0.015	0.033	1.293	0.034	0.476	1.854	0.048	0.509	0.920	0.024	3.657	0.294	0.008	5.144	3.068	0.079	9.310
2025	34.0	0.560	0.016	0.033	1.293	0.038	0.476	1.854	0.055	0.509	0.920	0.027	3.657	0.294	0.009	5.144	3.068	0.090	9.310
2026	29.9	0.560	0.019	0.033	1.293	0.043	0.476	1.854	0.062	0.509	0.920	0.031	3.657	0.294	0.010	5.144	3.068	0.103	9.310
2027	26.3	0.560	0.021	0.033	1.293	0.049	0.476	1.854	0.070	0.509	0.920	0.035	3.657	0.294	0.011	5.144	3.068	0.117	9.310
2028	23.2	0.560	0.024	0.033	1.293	0.056	0.476	1.854	0.080	0.509	0.920	0.040	3.657	0.294	0.013	5.144	3.068	0.132	9.310
2029	20.4	0.560	0.027	0.033	1.293	0.063	0.476	1.854	0.091	0.509	0.920	0.045	3.657	0.294	0.014	5.144	3.068	0.150	9.310
2030	17.9	0.560	0.031	0.033	1.293	0.072	0.476	1.854	0.104	0.509	0.920	0.051	3.657	0.294	0.016	5.144	3.068	0.171	9.310
2031	15.8	0.560	0.035	0.026	1.293	0.082	0.424	1.854	0.117	0.449	0.920	0.058	3.314	0.294	0.019	4.859	3.068	0.194	8.622
2032	13.9	0.560	0.040	0.033	1.293	0.093	0.476	1.854	0.133	0.509	0.920	0.066	3.657	0.294	0.021	5.144	3.068	0.221	9.310
2033	12.2	0.560	0.046	0.033	1.293	0.106	0.476	1.854	0.152	0.509	0.920	0.075	3.657	0.294	0.024	5.144	3.068	0.251	9.310
2034	10.8	0.560	0.052	0.033	1.293	0.120	0.476	1.854	0.172	0.509	0.920	0.085	3.657	0.294	0.027	5.144	3.068	0.284	9.310
2035	9.5	0.560	0.059	0.033	1.293	0.136	0.476	1.854	0.195	0.509	0.920	0.097	3.657	0.294	0.031	5.144	3.068	0.323	9.310
2036	8.3	0.560	0.068	0.033	1.293	0.156	0.476	1.854	0.223	0.509	0.920	0.111	3.657	0.294	0.035	5.144	3.068	0.370	9.310
2037	7.3	0.560	0.077	0.033	1.293	0.177	0.476	1.854	0.254	0.509	0.920	0.126	3.657	0.294	0.040	5.144	3.068	0.420	9.310
2038	6.5	0.560	0.086	0.033	1.293	0.199	0.476	1.854	0.285	0.509	0.920	0.142	3.657	0.294	0.045	5.144	3.068	0.472	9.310

**Table 4.3.3
Arctic Spill Occurrence Beaufort Sea Sale 3 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2005	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2006	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2007	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2008	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2009	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2010	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2011	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2012	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2013	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2014	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2015	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2016	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2017	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								

**Table 4.3.3
Arctic Spill Occurrence Beaufort Sea Sale 3 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow			0.866			0.174		
	Medium	1	4	0.884	0.354	0.06	0.177	0.071	0.44
	Deep			0.913			0.182		
	Total	1	4		0.354	0.06		0.071	0.44
2019	Shallow			0.866			0.174		
	Medium	2	18	0.884	1.592	0.25	0.177	0.319	1.96
	Deep			0.913			0.182		
	Total	2	18		1.592	0.25		0.319	1.96
2020	Shallow			0.866			0.174		
	Medium	2	38	0.884	3.361	0.53	0.177	0.674	4.13
	Deep			0.913			0.182		
	Total	2	38		3.361	0.53		0.674	4.13
2021	Shallow			0.866			0.174		
	Medium	2	58	0.884	5.130	0.81	0.177	1.029	6.31
	Deep			0.913			0.182		
	Total	2	58		5.130	0.81		1.029	6.31
2022	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2023	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2024	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2025	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2026	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2027	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2028	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2029	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2030	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2031	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40

**Table 4.3.3
Arctic Spill Occurrence Beaufort Sea Sale 3 Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2033	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2034	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2035	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2036	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2037	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2038	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40

**Table 4.3.4
Arctic Spill Occurrence Beaufort Sea Sale 3 Platforms Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004										
2005										
2006										
2007										
2008										
2009										
2010										
2011										
2012										
2013										
2014										
2015										
2016										
2017										
2018		0.354		0.056	0.071		0.435	0.425		0.491
2019	30.8	1.592	0.052	0.252	0.319	0.010	1.958	1.911	0.062	2.209
2020	38.6	3.361	0.087	0.531	0.674	0.017	4.133	4.035	0.105	4.664
2021	38.6	5.130	0.133	0.811	1.029	0.027	6.308	6.159	0.160	7.118
2022	38.6	6.014	0.156	0.950	1.206	0.031	7.395	7.221	0.187	8.346
2023	38.6	6.014	0.156	0.950	1.206	0.031	7.395	7.221	0.187	8.346
2024	38.6	6.014	0.156	0.950	1.206	0.031	7.395	7.221	0.187	8.346
2025	34.0	6.014	0.177	0.950	1.206	0.035	7.395	7.221	0.212	8.346
2026	29.9	6.014	0.201	0.950	1.206	0.040	7.395	7.221	0.242	8.346
2027	26.3	6.014	0.229	0.950	1.206	0.046	7.395	7.221	0.275	8.346
2028	23.2	6.014	0.259	0.950	1.206	0.052	7.395	7.221	0.311	8.346
2029	20.4	6.014	0.295	0.950	1.206	0.059	7.395	7.221	0.354	8.346
2030	17.9	6.014	0.336	0.950	1.206	0.067	7.395	7.221	0.403	8.346
2031	15.8	6.014	0.381	0.950	1.206	0.076	7.395	7.221	0.457	8.346
2032	13.9	6.014	0.433	0.950	1.206	0.087	7.395	7.221	0.519	8.346
2033	12.2	6.014	0.493	0.950	1.206	0.099	7.395	7.221	0.592	8.346
2034	10.8	6.014	0.557	0.950	1.206	0.112	7.395	7.221	0.669	8.346
2035	9.5	6.014	0.633	0.950	1.206	0.127	7.395	7.221	0.760	8.346
2036	8.3	6.014	0.725	0.950	1.206	0.145	7.395	7.221	0.870	8.346
2037	7.3	6.014	0.824	0.950	1.206	0.165	7.395	7.221	0.989	8.346
2038	6.5	6.014	0.925	0.950	1.206	0.186	7.395	7.221	1.111	8.346

**Table 4.3.5
Arctic Spill Occurrence Beaufort Sea Sale 3 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2009	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2010	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2011	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2012	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2013	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2014	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2015	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2016	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2017	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													

**Table 4.3.5
Arctic Spill Occurrence Beaufort Sea Sale 3 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		0.500			3.500			1.500			1.000		
	Medium	4	0.500	0.020	0.01	3.500	0.140	0.63	1.500	0.060	1.20	1.000	0.040	8.00
	Deep		0.500			3.500			1.500			1.000		
	Total	4		0.020	0.01		0.140	0.63		0.060	1.20		0.040	8.00
2019	Shallow		0.500			3.500			1.500			1.000		
	Medium	18	0.500	0.090	0.05	3.500	0.630	2.84	1.500	0.270	5.40	1.000	0.180	36.00
	Deep		0.500			3.500			1.500			1.000		
	Total	18		0.090	0.05		0.630	2.84		0.270	5.40		0.180	36.00
2020	Shallow		0.500			3.500			1.500			1.000		
	Medium	38	0.500	0.190	0.10	3.500	1.330	5.99	1.500	0.570	11.40	1.000	0.380	76.00
	Deep		0.500			3.500			1.500			1.000		
	Total	38		0.190	0.10		1.330	5.99		0.570	11.40		0.380	76.00
2021	Shallow		0.500			3.500			1.500			1.000		
	Medium	58	0.500	0.290	0.15	3.500	2.030	9.14	1.500	0.870	17.40	1.000	0.580	116.00
	Deep		0.500			3.500			1.500			1.000		
	Total	58		0.290	0.15		2.030	9.14		0.870	17.40		0.580	116.00
2022	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2023	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2024	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2025	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2026	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2027	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2028	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2029	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2030	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2031	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00

**Table 4.3.5
Arctic Spill Occurrence Beaufort Sea Sale 3 Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2033	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2034	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2035	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2036	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2037	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2038	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00

Table 4.3.6

Arctic Spill Occurrence Beaufort Sea Sale 3 Production Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009													
2010													
2011													
2012													
2013													
2014													
2015													
2016													
2017													
2018		0.020		0.010	0.060		0.630	0.100		9.200	0.180		9.840
2019	30.8	0.090	0.003	0.045	0.270	0.009	2.835	0.450	0.015	41.400	0.810	0.026	44.280
2020	38.6	0.190	0.005	0.095	0.570	0.015	5.985	0.950	0.025	87.400	1.710	0.044	93.480
2021	38.6	0.290	0.008	0.145	0.870	0.023	9.135	1.450	0.038	133.400	2.610	0.068	142.680
2022	38.6	0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
2023	38.6	0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
2024	38.6	0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
2025	34.0	0.340	0.010	0.170	1.020	0.030	10.710	1.700	0.050	156.400	3.060	0.090	167.280
2026	29.9	0.340	0.011	0.170	1.020	0.034	10.710	1.700	0.057	156.400	3.060	0.102	167.280
2027	26.3	0.340	0.013	0.170	1.020	0.039	10.710	1.700	0.065	156.400	3.060	0.116	167.280
2028	23.2	0.340	0.015	0.170	1.020	0.044	10.710	1.700	0.073	156.400	3.060	0.132	167.280
2029	20.4	0.340	0.017	0.170	1.020	0.050	10.710	1.700	0.083	156.400	3.060	0.150	167.280
2030	17.9	0.340	0.019	0.170	1.020	0.057	10.710	1.700	0.095	156.400	3.060	0.171	167.280
2031	15.8	0.340	0.022	0.170	1.020	0.065	10.710	1.700	0.108	156.400	3.060	0.194	167.280
2032	13.9	0.340	0.024	0.170	1.020	0.073	10.710	1.700	0.122	156.400	3.060	0.220	167.280
2033	12.2	0.340	0.028	0.170	1.020	0.084	10.710	1.700	0.139	156.400	3.060	0.251	167.280
2034	10.8	0.340	0.031	0.170	1.020	0.094	10.710	1.700	0.157	156.400	3.060	0.283	167.280
2035	9.5	0.340	0.036	0.170	1.020	0.107	10.710	1.700	0.179	156.400	3.060	0.322	167.280
2036	8.3	0.340	0.041	0.170	1.020	0.123	10.710	1.700	0.205	156.400	3.060	0.369	167.280
2037	7.3	0.340	0.047	0.170	1.020	0.140	10.710	1.700	0.233	156.400	3.060	0.419	167.280
2038	6.5	0.340	0.052	0.170	1.020	0.157	10.710	1.700	0.262	156.400	3.060	0.471	167.280

**Table 4.3.7
Arctic Spill Occurrence Beaufort Sea Sale 3 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2005	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2006	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2007	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2008	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2010	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2011	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2012	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2013	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2014	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2015	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2016	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2017	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00

**Table 4.3.7
Arctic Spill Occurrence Beaufort Sea Sale 3 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2019	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2020	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2021	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2022	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2023	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2024	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2025	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2026	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2027	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2028	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2029	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2030	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2031	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

**Table 4.3.7
Arctic Spill Occurrence Beaufort Sea Sale 3 Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2033	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2034	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2035	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2036	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2037	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2038	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.3.8

Arctic Spill Occurrence Beaufort Sea Sale 3 Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009													
2010		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2011													
2012		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2013		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2014													
2015		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2016													
2017		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2018		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2019	30.8												
2020	38.6												
2021	38.6												
2022	38.6												
2023	38.6												
2024	38.6												
2025	34.0												
2026	29.9												
2027	26.3												
2028	23.2												
2029	20.4												
2030	17.9												
2031	15.8												
2032	13.9												
2033	12.2												
2034	10.8												
2035	9.5												
2036	8.3												
2037	7.3												
2038	6.5												

**Table 4.3.9
Arctic Spill Occurrence Beaufort Sea Sale 3 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2009	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2011	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2012	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2013	Shallow		1.300			9.080			3.900			3.900		
	Medium	1	1.300	0.013	0.01	9.080	0.091	0.41	3.900	0.039	0.78	3.900	0.039	7.80
	Deep		1.300			9.080			3.900			3.900		
	Total	1		0.013	0.01		0.091	0.41		0.039	0.78		0.039	7.80
2014	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2015	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2016	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2017	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.3.9
Arctic Spill Occurrence Beaufort Sea Sale 3 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] = 500		Spill Index bbl	Average Spill [bbl] = 4500		Spill Index bbl	Average Spill [bbl] = 20000		Spill Index bbl	Average Spill [bbl] = 200000		Spill Index bbl
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2019	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2020	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2021	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2022	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2023	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2024	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2025	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2026	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2027	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2028	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2029	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2030	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2031	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.3.9
Arctic Spill Occurrence Beaufort Sea Sale 3 Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2033	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2034	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2035	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2036	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2037	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2038	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.3.10

Arctic Spill Occurrence Beaufort Sea Sale 3 Development Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009													
2010													
2011													
2012													
2013		0.013	0.007	0.039	0.409	0.078	8.580	0.130	8.995				
2014		0.026	0.013	0.078	0.817	0.156	17.160	0.260	17.990				
2015		0.026	0.013	0.078	0.817	0.156	17.160	0.260	17.990				
2016													
2017													
2018													
2019	30.8												
2020	38.6												
2021	38.6												
2022	38.6												
2023	38.6												
2024	38.6												
2025	34.0												
2026	29.9												
2027	26.3												
2028	23.2												
2029	20.4												
2030	17.9												
2031	15.8												
2032	13.9												
2033	12.2												
2034	10.8												
2035	9.5												
2036	8.3												
2037	7.3												
2038	6.5												

**Table 4.3.11
Arctic Spill Occurrence Beaufort Sea Sale 3 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2005	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2006	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2007	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2008	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2009	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2010	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032	0.016	0.095	0.995	0.150	12.900	0.277	13.911				
	Total		0.032	0.016	0.095	0.995	0.150	12.900	0.277	13.911				
2011	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total														
2012	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032	0.016	0.095	0.995	0.150	12.900	0.277	13.911				
	Total		0.032	0.016	0.095	0.995	0.150	12.900	0.277	13.911				
2013	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032	0.016	0.095	0.995	0.150	12.900	0.277	13.911				
	Development Wells		0.013	0.007	0.039	0.409	0.078	8.580	0.130	8.995				
Total		0.045	0.022	0.134	1.404	0.228	21.480	0.407	22.906					

**Table 4.3.11
Arctic Spill Occurrence Beaufort Sea Sale 3 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2014	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
	Total		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2015	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
	Total		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901
2016	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
	Total													
2017	Pipeline													
	Platforms													
	Production Wells													
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
	Development Wells													
	Total		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2018	Pipeline													
	Platforms		0.354		0.056	0.071		0.435			0.425		0.491	
	Production Wells		0.020		0.010	0.060		0.630	0.100		9.200	0.180	9.840	
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277	13.911	
	Development Wells													
	Total		0.405		0.082	0.226		2.060	0.250		22.100	0.881		24.242
2019	Pipeline	30.8	1.854	0.060	0.509	0.920	0.030	3.657	0.294	0.010	5.144	3.068	0.100	9.310
	Platforms		1.592	0.052	0.252	0.319	0.010	1.958				1.911	0.062	2.209
	Production Wells		0.090	0.003	0.045	0.270	0.009	2.835	0.450	0.015	41.400	0.810	0.026	44.280
	Exploration Wells													
	Development Wells													
	Total		3.536	0.115	0.806	1.509	0.049	8.449	0.744	0.024	46.544	5.789	0.188	55.799
2020	Pipeline	38.6	1.854	0.048	0.509	0.920	0.024	3.657	0.294	0.008	5.144	3.068	0.079	9.310
	Platforms		3.361	0.087	0.531	0.674	0.017	4.133				4.035	0.105	4.664
	Production Wells		0.190	0.005	0.095	0.570	0.015	5.985	0.950	0.025	87.400	1.710	0.044	93.480
	Exploration Wells													
	Development Wells													
	Total		5.405	0.140	1.135	2.164	0.056	13.774	1.244	0.032	92.544	8.813	0.228	107.453
2021	Pipeline	38.6	1.854	0.048	0.509	0.920	0.024	3.657	0.294	0.008	5.144	3.068	0.079	9.310
	Platforms		5.130	0.133	0.811	1.029	0.027	6.308				6.159	0.160	7.118
	Production Wells		0.290	0.008	0.145	0.870	0.023	9.135	1.450	0.038	133.400	2.610	0.068	142.680
	Exploration Wells													
	Development Wells													
	Total		7.274	0.188	1.464	2.819	0.073	19.099	1.744	0.045	138.544	11.837	0.307	159.108
2022	Pipeline	38.6	1.854	0.048	0.509	0.920	0.024	3.657	0.294	0.008	5.144	3.068	0.079	9.310
	Platforms		6.014	0.156	0.950	1.206	0.031	7.395				7.221	0.187	8.346
	Production Wells		0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.213	1.629	3.146	0.082	21.762	1.994	0.052	161.544	13.349	0.346	184.935
2023	Pipeline	38.6	1.854	0.048	0.509	0.920	0.024	3.657	0.294	0.008	5.144	3.068	0.079	9.310
	Platforms		6.014	0.156	0.950	1.206	0.031	7.395				7.221	0.187	8.346
	Production Wells		0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.213	1.629	3.146	0.082	21.762	1.994	0.052	161.544	13.349	0.346	184.935

**Table 4.3.11
Arctic Spill Occurrence Beaufort Sea Sale 3 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2024	Pipeline	38.6	1.854	0.048	0.509	0.920	0.024	3.657	0.294	0.008	5.144	3.068	0.079	9.310
	Platforms		6.014	0.156	0.950	1.206	0.031	7.395				7.221	0.187	8.346
	Production Wells		0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.213	1.629	3.146	0.082	21.762	1.994	0.052	161.544	13.349	0.346	184.935
2025	Pipeline	34.0	1.854	0.055	0.509	0.920	0.027	3.657	0.294	0.009	5.144	3.068	0.090	9.310
	Platforms		6.014	0.177	0.950	1.206	0.035	7.395				7.221	0.212	8.346
	Production Wells		0.340	0.010	0.170	1.020	0.030	10.710	1.700	0.050	156.400	3.060	0.090	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.241	1.629	3.146	0.093	21.762	1.994	0.059	161.544	13.349	0.393	184.935
2026	Pipeline	29.9	1.854	0.062	0.509	0.920	0.031	3.657	0.294	0.010	5.144	3.068	0.103	9.310
	Platforms		6.014	0.201	0.950	1.206	0.040	7.395				7.221	0.242	8.346
	Production Wells		0.340	0.011	0.170	1.020	0.034	10.710	1.700	0.057	156.400	3.060	0.102	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.275	1.629	3.146	0.105	21.762	1.994	0.067	161.544	13.349	0.446	184.935
2027	Pipeline	26.3	1.854	0.070	0.509	0.920	0.035	3.657	0.294	0.011	5.144	3.068	0.117	9.310
	Platforms		6.014	0.229	0.950	1.206	0.046	7.395				7.221	0.275	8.346
	Production Wells		0.340	0.013	0.170	1.020	0.039	10.710	1.700	0.065	156.400	3.060	0.116	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.312	1.629	3.146	0.120	21.762	1.994	0.076	161.544	13.349	0.508	184.935
2028	Pipeline	23.2	1.854	0.080	0.509	0.920	0.040	3.657	0.294	0.013	5.144	3.068	0.132	9.310
	Platforms		6.014	0.259	0.950	1.206	0.052	7.395				7.221	0.311	8.346
	Production Wells		0.340	0.015	0.170	1.020	0.044	10.710	1.700	0.073	156.400	3.060	0.132	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.354	1.629	3.146	0.136	21.762	1.994	0.086	161.544	13.349	0.575	184.935
2029	Pipeline	20.4	1.854	0.091	0.509	0.920	0.045	3.657	0.294	0.014	5.144	3.068	0.150	9.310
	Platforms		6.014	0.295	0.950	1.206	0.059	7.395				7.221	0.354	8.346
	Production Wells		0.340	0.017	0.170	1.020	0.050	10.710	1.700	0.083	156.400	3.060	0.150	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.402	1.629	3.146	0.154	21.762	1.994	0.098	161.544	13.349	0.654	184.935
2030	Pipeline	17.9	1.854	0.104	0.509	0.920	0.051	3.657	0.294	0.016	5.144	3.068	0.171	9.310
	Platforms		6.014	0.336	0.950	1.206	0.067	7.395				7.221	0.403	8.346
	Production Wells		0.340	0.019	0.170	1.020	0.057	10.710	1.700	0.095	156.400	3.060	0.171	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.459	1.629	3.146	0.176	21.762	1.994	0.111	161.544	13.349	0.746	184.935
2031	Pipeline	15.8	1.854	0.117	0.449	0.920	0.058	3.314	0.294	0.019	4.859	3.068	0.194	8.622
	Platforms		6.014	0.381	0.950	1.206	0.076	7.395				7.221	0.457	8.346
	Production Wells		0.340	0.022	0.170	1.020	0.065	10.710	1.700	0.108	156.400	3.060	0.194	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.520	1.570	3.146	0.199	21.419	1.994	0.126	161.259	13.349	0.845	184.248
2032	Pipeline	13.9	1.854	0.133	0.509	0.920	0.066	3.657	0.294	0.021	5.144	3.068	0.221	9.310
	Platforms		6.014	0.433	0.950	1.206	0.087	7.395				7.221	0.519	8.346
	Production Wells		0.340	0.024	0.170	1.020	0.073	10.710	1.700	0.122	156.400	3.060	0.220	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.591	1.629	3.146	0.226	21.762	1.994	0.143	161.544	13.349	0.960	184.935
2033	Pipeline	12.2	1.854	0.152	0.509	0.920	0.075	3.657	0.294	0.024	5.144	3.068	0.251	9.310
	Platforms		6.014	0.493	0.950	1.206	0.099	7.395				7.221	0.592	8.346
	Production Wells		0.340	0.028	0.170	1.020	0.084	10.710	1.700	0.139	156.400	3.060	0.251	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.673	1.629	3.146	0.258	21.762	1.994	0.163	161.544	13.349	1.094	184.935

**Table 4.3.11
Arctic Spill Occurrence Beaufort Sea Sale 3 Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
2034	Pipeline	10.8	1.854	0.172	0.509	0.920	0.085	3.657	0.294	0.027	5.144	3.068	0.284	9.310
	Platforms		6.014	0.557	0.950	1.206	0.112	7.395				7.221	0.669	8.346
	Production Wells		0.340	0.031	0.170	1.020	0.094	10.710	1.700	0.157	156.400	3.060	0.283	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.760	1.629	3.146	0.291	21.762	1.994	0.185	161.544	13.349	1.236	184.935
2035	Pipeline	9.5	1.854	0.195	0.509	0.920	0.097	3.657	0.294	0.031	5.144	3.068	0.323	9.310
	Platforms		6.014	0.633	0.950	1.206	0.127	7.395				7.221	0.760	8.346
	Production Wells		0.340	0.036	0.170	1.020	0.107	10.710	1.700	0.179	156.400	3.060	0.322	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.864	1.629	3.146	0.331	21.762	1.994	0.210	161.544	13.349	1.405	184.935
2036	Pipeline	8.3	1.854	0.223	0.509	0.920	0.111	3.657	0.294	0.035	5.144	3.068	0.370	9.310
	Platforms		6.014	0.725	0.950	1.206	0.145	7.395				7.221	0.870	8.346
	Production Wells		0.340	0.041	0.170	1.020	0.123	10.710	1.700	0.205	156.400	3.060	0.369	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.989	1.629	3.146	0.379	21.762	1.994	0.240	161.544	13.349	1.608	184.935
2037	Pipeline	7.3	1.854	0.254	0.509	0.920	0.126	3.657	0.294	0.040	5.144	3.068	0.420	9.310
	Platforms		6.014	0.824	0.950	1.206	0.165	7.395				7.221	0.989	8.346
	Production Wells		0.340	0.047	0.170	1.020	0.140	10.710	1.700	0.233	156.400	3.060	0.419	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	1.124	1.629	3.146	0.431	21.762	1.994	0.273	161.544	13.349	1.829	184.935
2038	Pipeline	6.5	1.854	0.285	0.509	0.920	0.142	3.657	0.294	0.045	5.144	3.068	0.472	9.310
	Platforms		6.014	0.925	0.950	1.206	0.186	7.395				7.221	1.111	8.346
	Production Wells		0.340	0.052	0.170	1.020	0.157	10.710	1.700	0.262	156.400	3.060	0.471	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	1.263	1.629	3.146	0.484	21.762	1.994	0.307	161.544	13.349	2.054	184.935

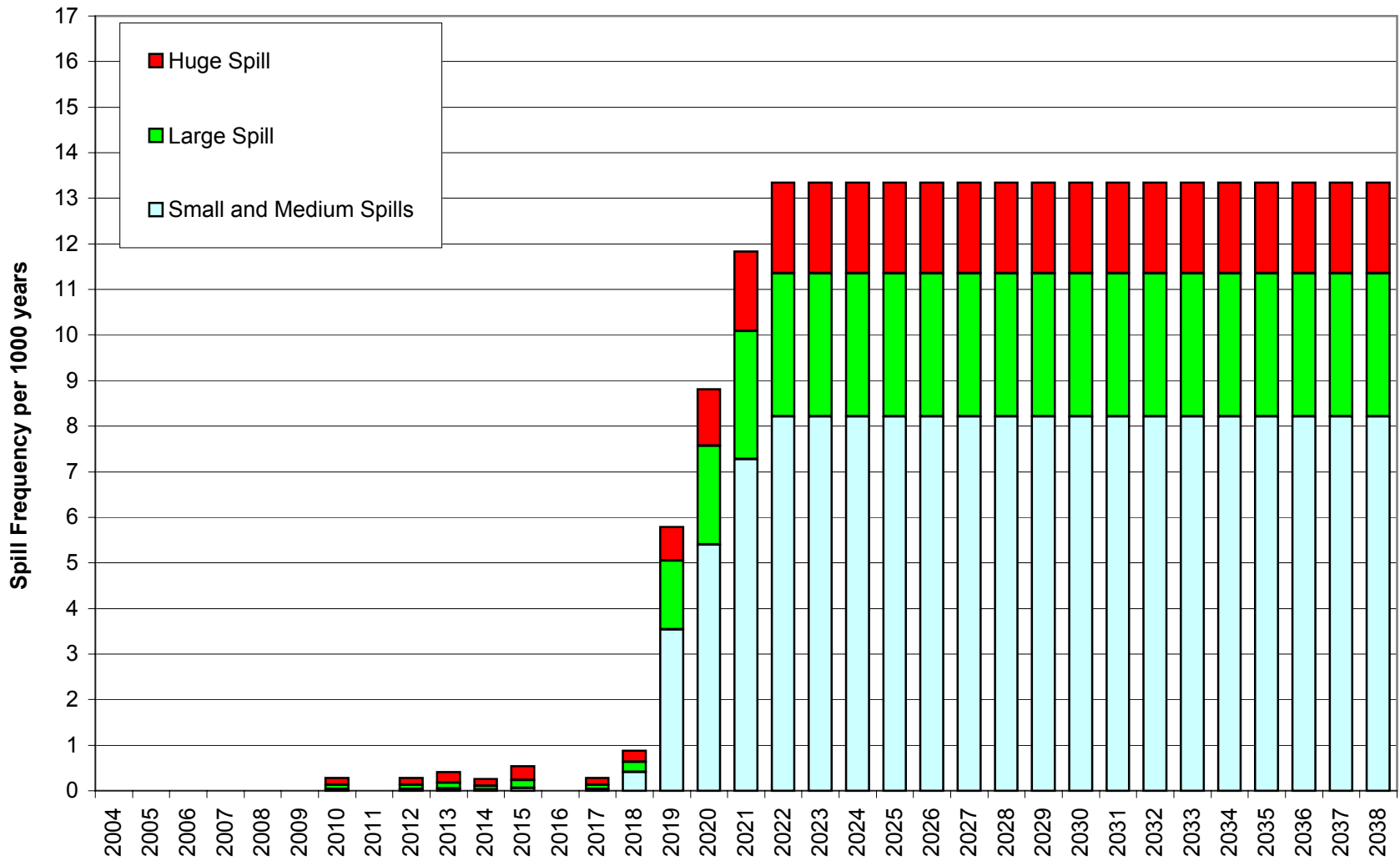
**Table 4.3.12
Arctic Spill Occurrence Beaufort Sea Sale 3 Annual Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009													
2010		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2011													
2012		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2013		0.04		0.022	0.13		1.404	0.228		21.48	0.407		22.906
2014		0.03		0.013	0.08		0.817	0.156		17.16	0.260		17.990
2015		0.06		0.029	0.17		1.812	0.306		30.06	0.537		31.901
2016													
2017		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2018		0.41		0.082	0.23		2.060	0.250		22.10	0.881		24.242
2019	30.8	3.54	0.115	0.806	1.51	0.049	8.449	0.744	0.024	46.54	5.789	0.188	55.799
2020	38.6	5.40	0.140	1.135	2.16	0.056	13.774	1.244	0.032	92.54	8.813	0.228	107.453
2021	38.6	7.27	0.188	1.464	2.82	0.073	19.099	1.744	0.045	138.54	11.837	0.307	159.108
2022	38.6	8.21	0.213	1.629	3.15	0.082	21.762	1.994	0.052	161.54	13.349	0.346	184.935
2023	38.6	8.21	0.213	1.629	3.15	0.082	21.762	1.994	0.052	161.54	13.349	0.346	184.935
2024	38.6	8.21	0.213	1.629	3.15	0.082	21.762	1.994	0.052	161.54	13.349	0.346	184.935
2025	34.0	8.21	0.241	1.629	3.15	0.093	21.762	1.994	0.059	161.54	13.349	0.393	184.935
2026	29.9	8.21	0.275	1.629	3.15	0.105	21.762	1.994	0.067	161.54	13.349	0.446	184.935
2027	26.3	8.21	0.312	1.629	3.15	0.120	21.762	1.994	0.076	161.54	13.349	0.508	184.935
2028	23.2	8.21	0.354	1.629	3.15	0.136	21.762	1.994	0.086	161.54	13.349	0.575	184.935
2029	20.4	8.21	0.402	1.629	3.15	0.154	21.762	1.994	0.098	161.54	13.349	0.654	184.935
2030	17.9	8.21	0.459	1.629	3.15	0.176	21.762	1.994	0.111	161.54	13.349	0.746	184.935
2031	15.8	8.21	0.520	1.570	3.15	0.199	21.419	1.994	0.126	161.26	13.349	0.845	184.248
2032	13.9	8.21	0.591	1.629	3.15	0.226	21.762	1.994	0.143	161.54	13.349	0.960	184.935
2033	12.2	8.21	0.673	1.629	3.15	0.258	21.762	1.994	0.163	161.54	13.349	1.094	184.935
2034	10.8	8.21	0.760	1.629	3.15	0.291	21.762	1.994	0.185	161.54	13.349	1.236	184.935
2035	9.5	8.21	0.864	1.629	3.15	0.331	21.762	1.994	0.210	161.54	13.349	1.405	184.935
2036	8.3	8.21	0.989	1.629	3.15	0.379	21.762	1.994	0.240	161.54	13.349	1.608	184.935
2037	7.3	8.21	1.124	1.629	3.15	0.431	21.762	1.994	0.273	161.54	13.349	1.829	184.935
2038	6.5	8.21	1.263	1.629	3.15	0.484	21.762	1.994	0.307	161.54	13.349	2.054	184.935

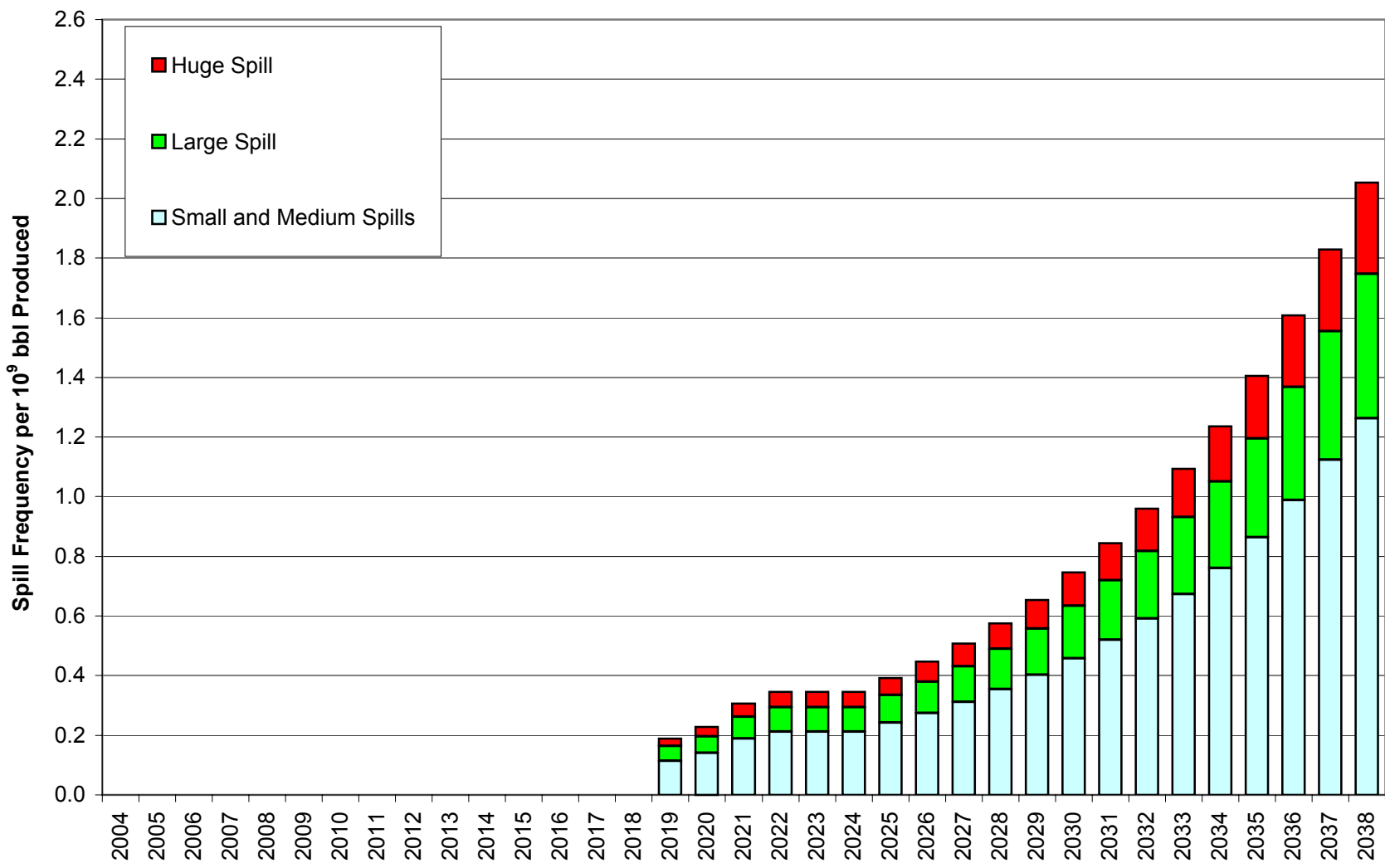
**Table 4.3.13
Arctic Spill Occurrence Beaufort Sea Sale 3 Wells Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009													
2010		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2011													
2012		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2013		0.045		0.022	0.134		1.404	0.228		21.480	0.407		22.906
2014		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2015		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901
2016													
2017		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2018		0.052		0.026	0.155		1.625	0.250		22.100	0.457		23.751
2019	30.8	0.090	0.003	0.045	0.270	0.009	2.835	0.450	0.015	41.400	0.810	0.026	44.280
2020	38.6	0.190	0.005	0.095	0.570	0.015	5.985	0.950	0.025	87.400	1.710	0.044	93.480
2021	38.6	0.290	0.008	0.145	0.870	0.023	9.135	1.450	0.038	133.400	2.610	0.068	142.680
2022	38.6	0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
2023	38.6	0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
2024	38.6	0.340	0.009	0.170	1.020	0.026	10.710	1.700	0.044	156.400	3.060	0.079	167.280
2025	34.0	0.340	0.010	0.170	1.020	0.030	10.710	1.700	0.050	156.400	3.060	0.090	167.280
2026	29.9	0.340	0.011	0.170	1.020	0.034	10.710	1.700	0.057	156.400	3.060	0.102	167.280
2027	26.3	0.340	0.013	0.170	1.020	0.039	10.710	1.700	0.065	156.400	3.060	0.116	167.280
2028	23.2	0.340	0.015	0.170	1.020	0.044	10.710	1.700	0.073	156.400	3.060	0.132	167.280
2029	20.4	0.340	0.017	0.170	1.020	0.050	10.710	1.700	0.083	156.400	3.060	0.150	167.280
2030	17.9	0.340	0.019	0.170	1.020	0.057	10.710	1.700	0.095	156.400	3.060	0.171	167.280
2031	15.8	0.340	0.022	0.170	1.020	0.065	10.710	1.700	0.108	156.400	3.060	0.194	167.280
2032	13.9	0.340	0.024	0.170	1.020	0.073	10.710	1.700	0.122	156.400	3.060	0.220	167.280
2033	12.2	0.340	0.028	0.170	1.020	0.084	10.710	1.700	0.139	156.400	3.060	0.251	167.280
2034	10.8	0.340	0.031	0.170	1.020	0.094	10.710	1.700	0.157	156.400	3.060	0.283	167.280
2035	9.5	0.340	0.036	0.170	1.020	0.107	10.710	1.700	0.179	156.400	3.060	0.322	167.280
2036	8.3	0.340	0.041	0.170	1.020	0.123	10.710	1.700	0.205	156.400	3.060	0.369	167.280
2037	7.3	0.340	0.047	0.170	1.020	0.140	10.710	1.700	0.233	156.400	3.060	0.419	167.280
2038	6.5	0.340	0.052	0.170	1.020	0.157	10.710	1.700	0.262	156.400	3.060	0.471	167.280

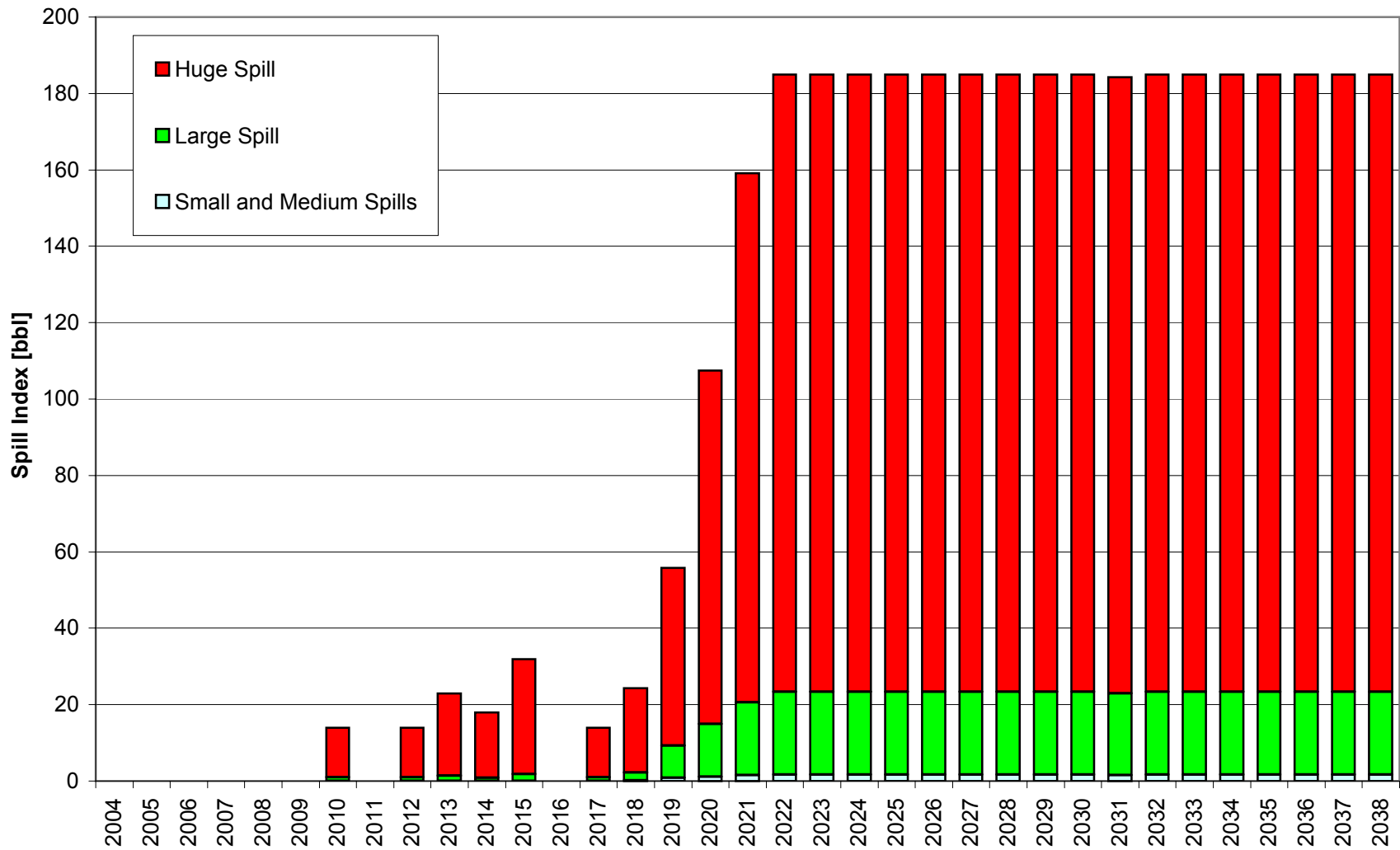
Beaufort Sea Sale 3 Spill Frequency



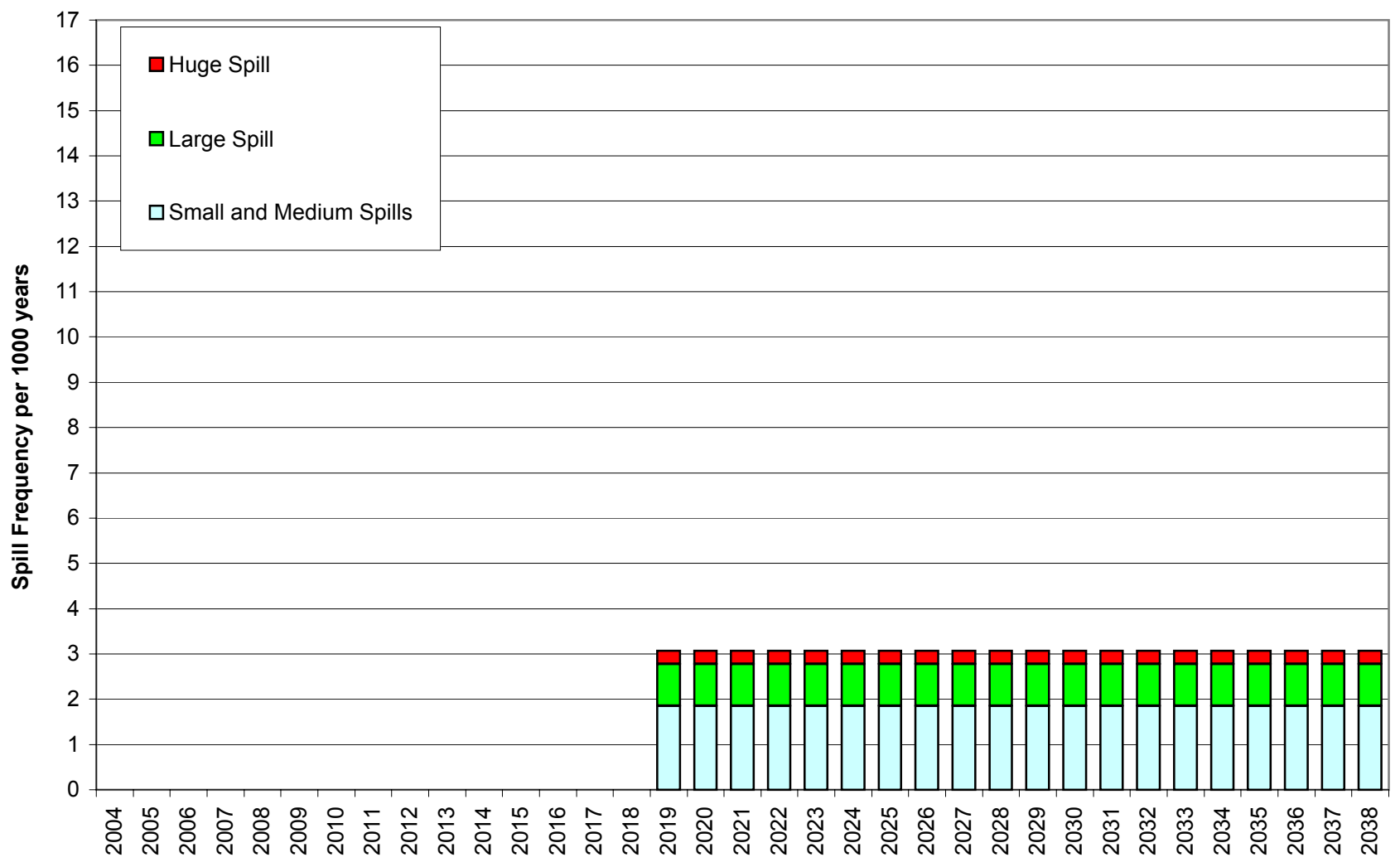
Beaufort Sea Sale 3 Spill Frequency per 10⁹ bbl Produced



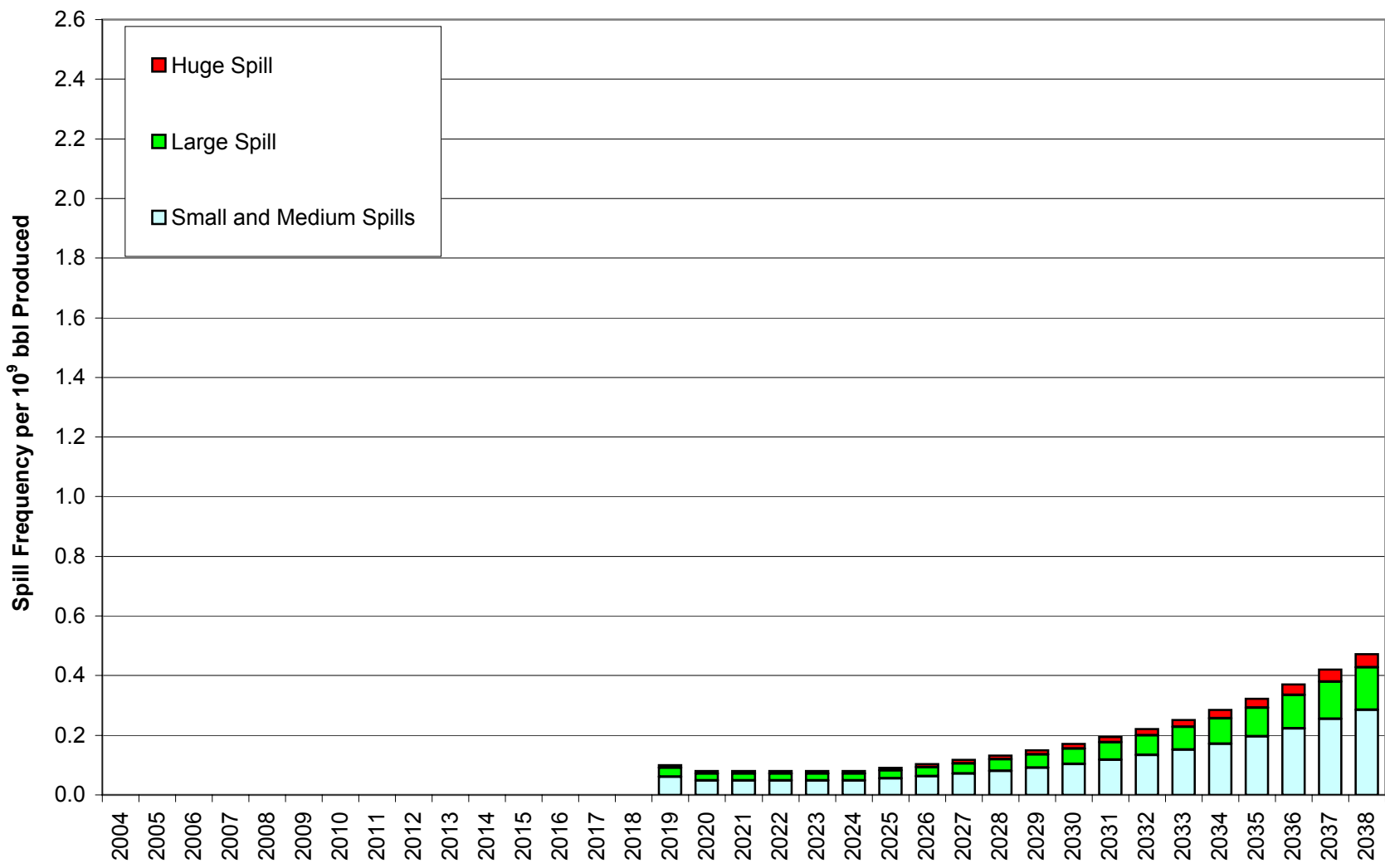
Beaufort Sea Sale 3 Spill Index



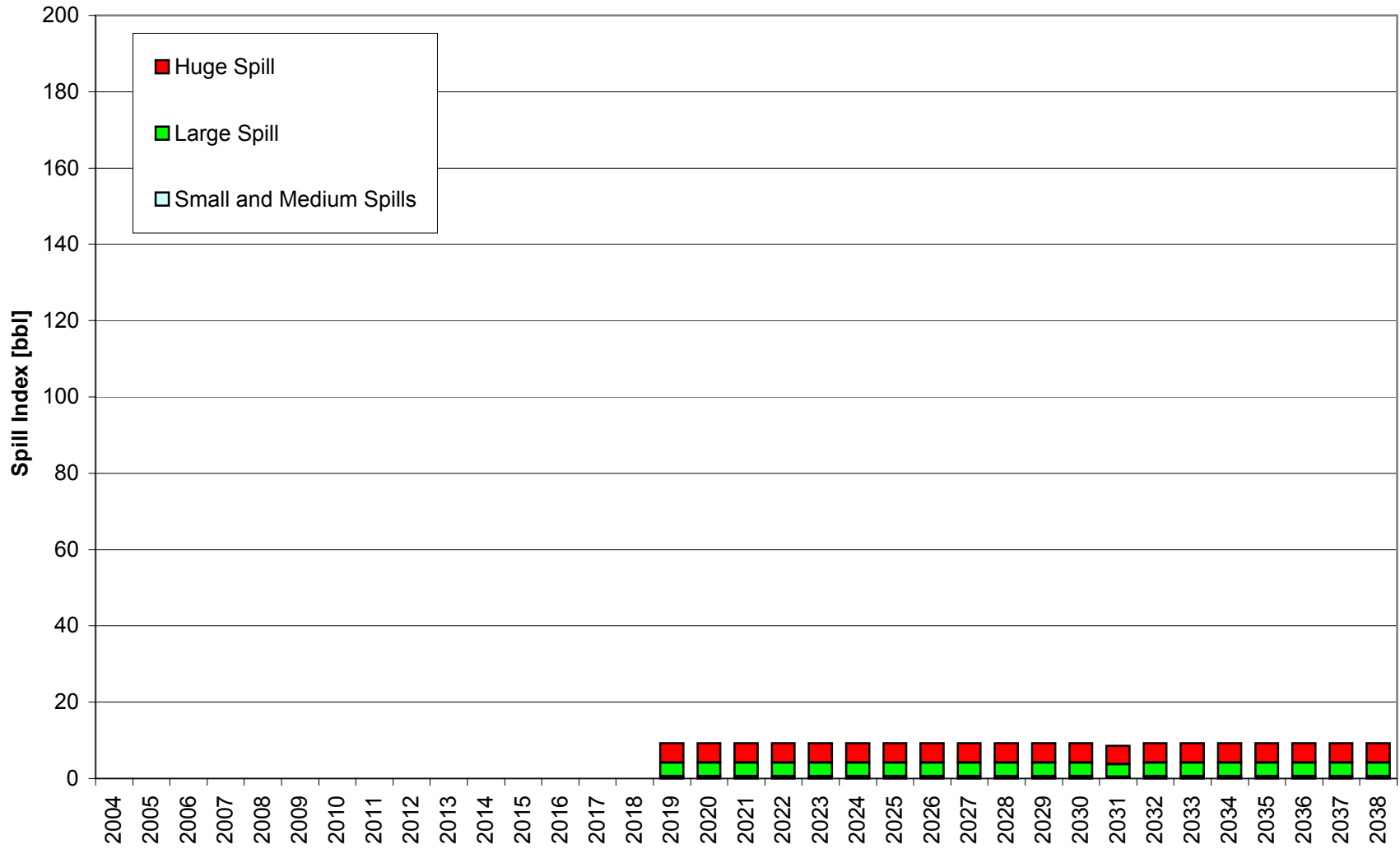
Beaufort Sea Sale 3 Spill Frequency - P/L



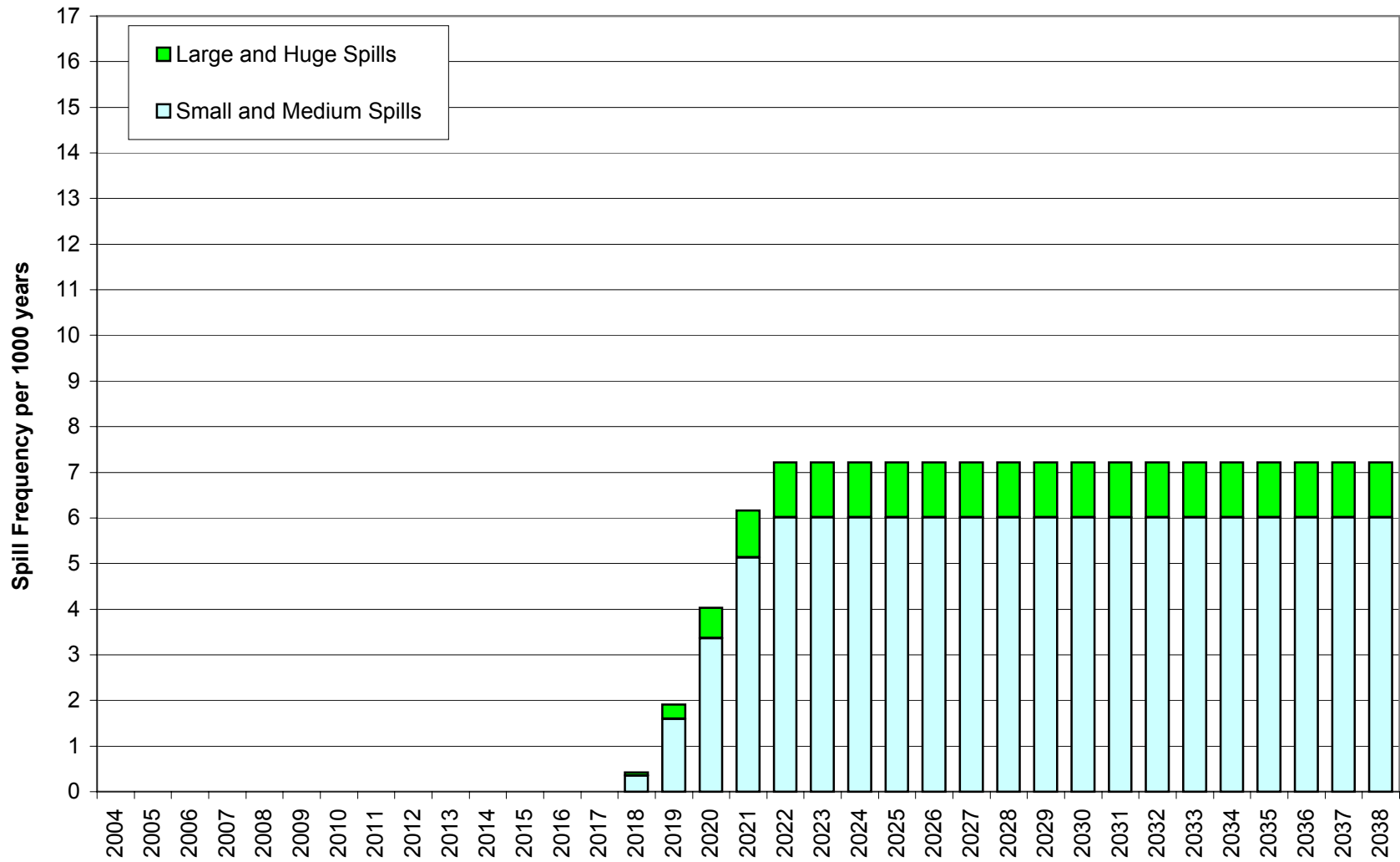
Beaufort Sea Sale 3 Spill Frequency per 10⁹ bbl Produced - P/L



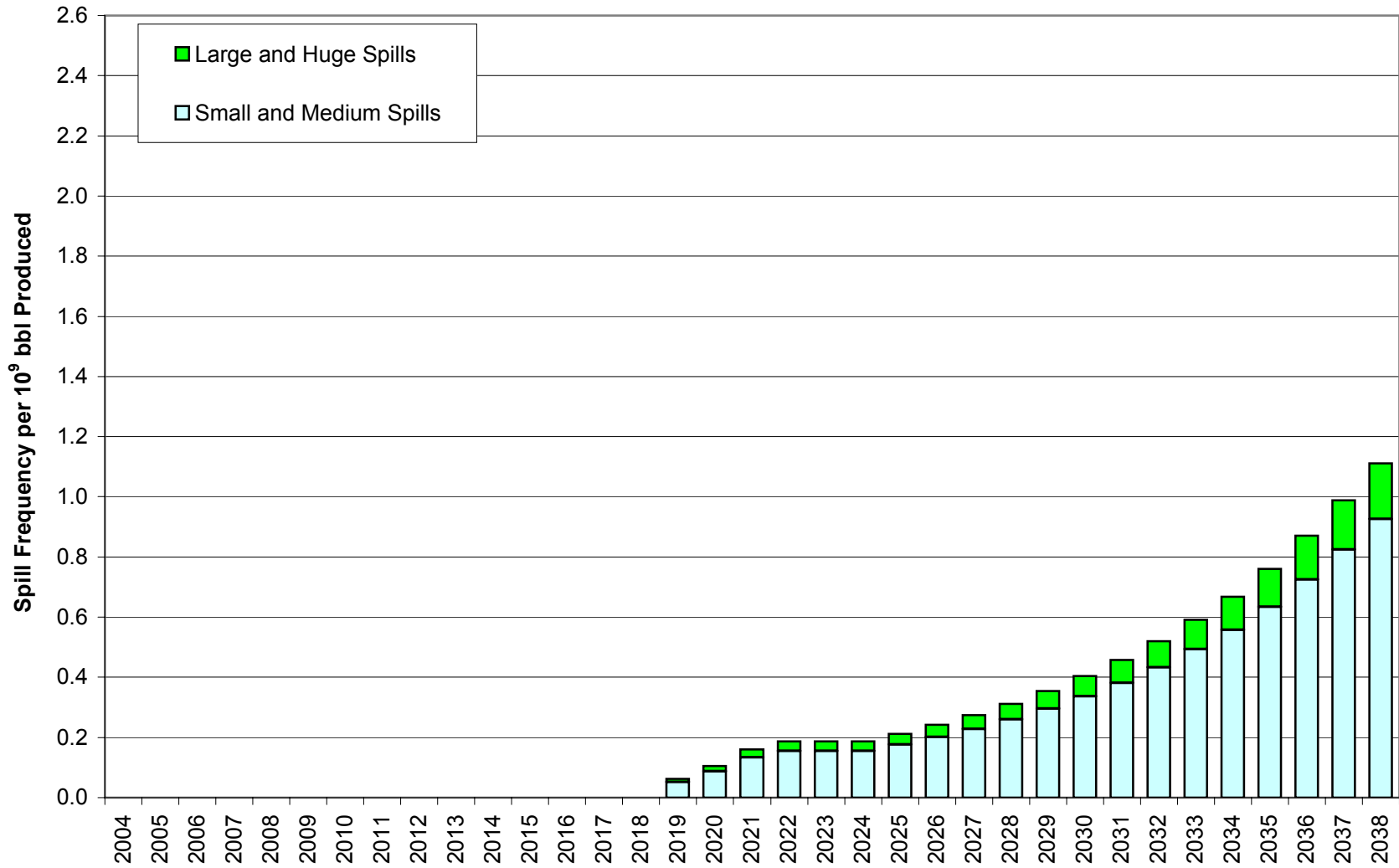
Beaufort Sea Sale 3 Spill Index - P/L



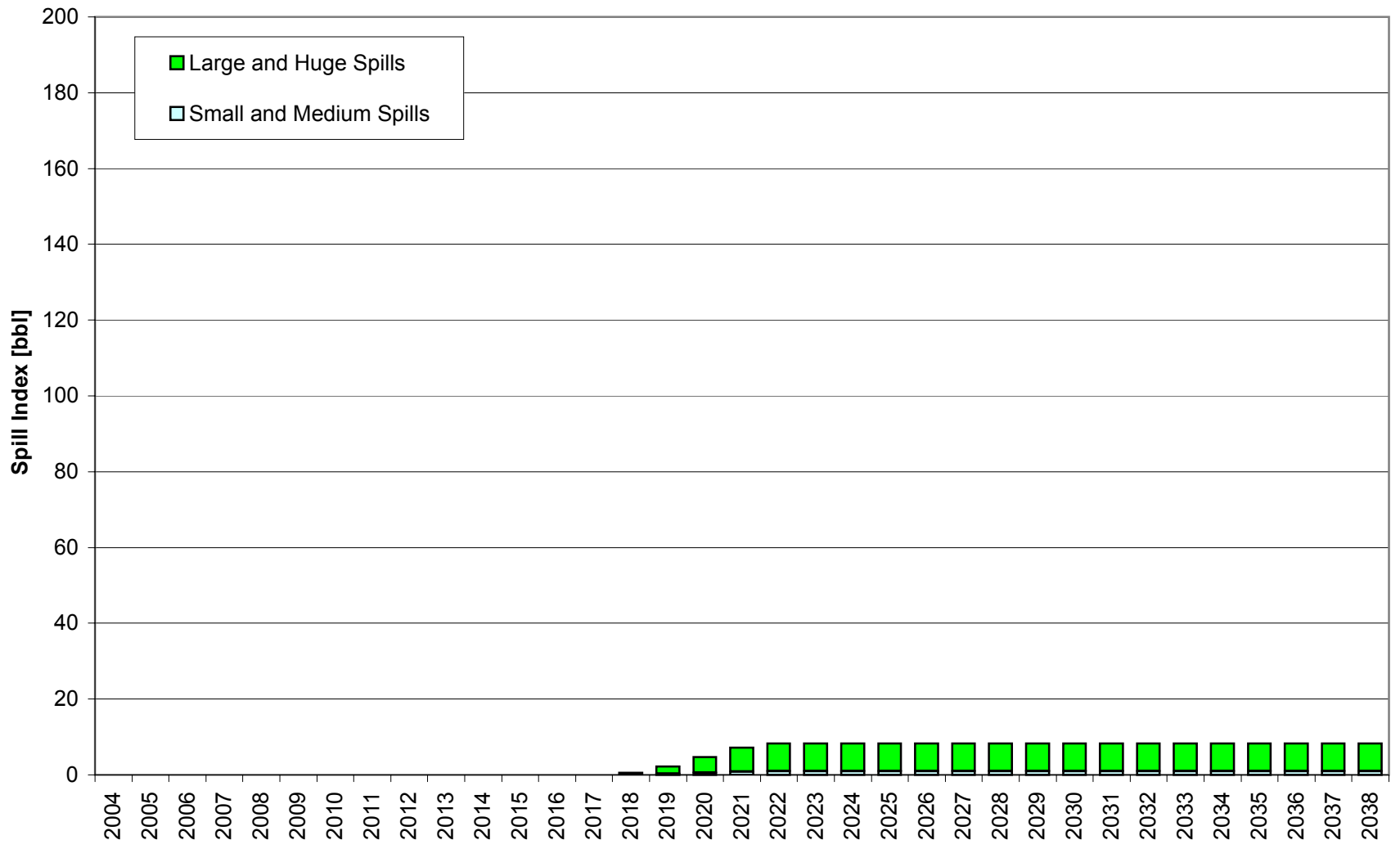
Beaufort Sea Sale 3 Spill Frequency - Platforms



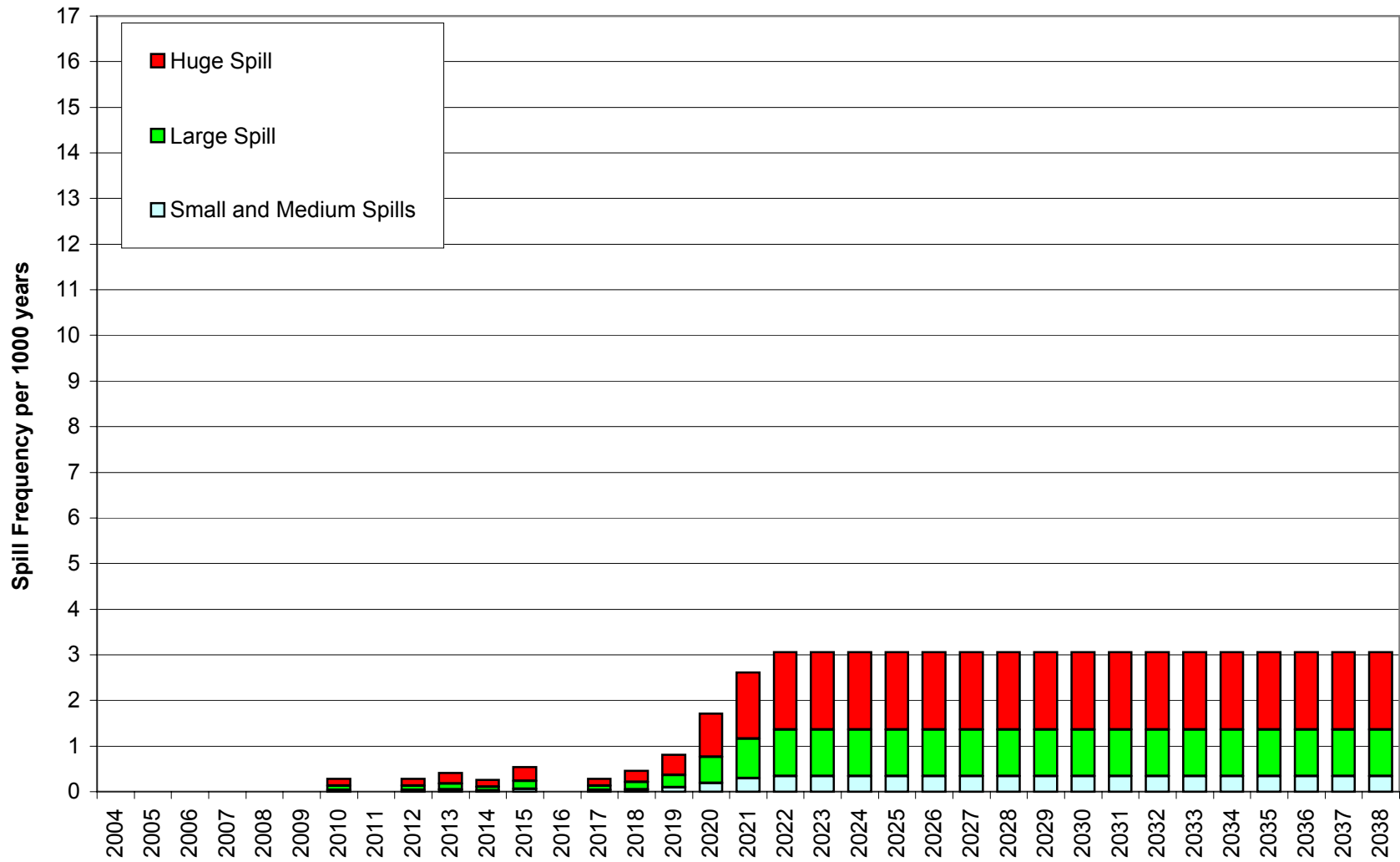
Beaufort Sea Sale 3 Spill Frequency per 10⁹ bbl Produced - Platforms



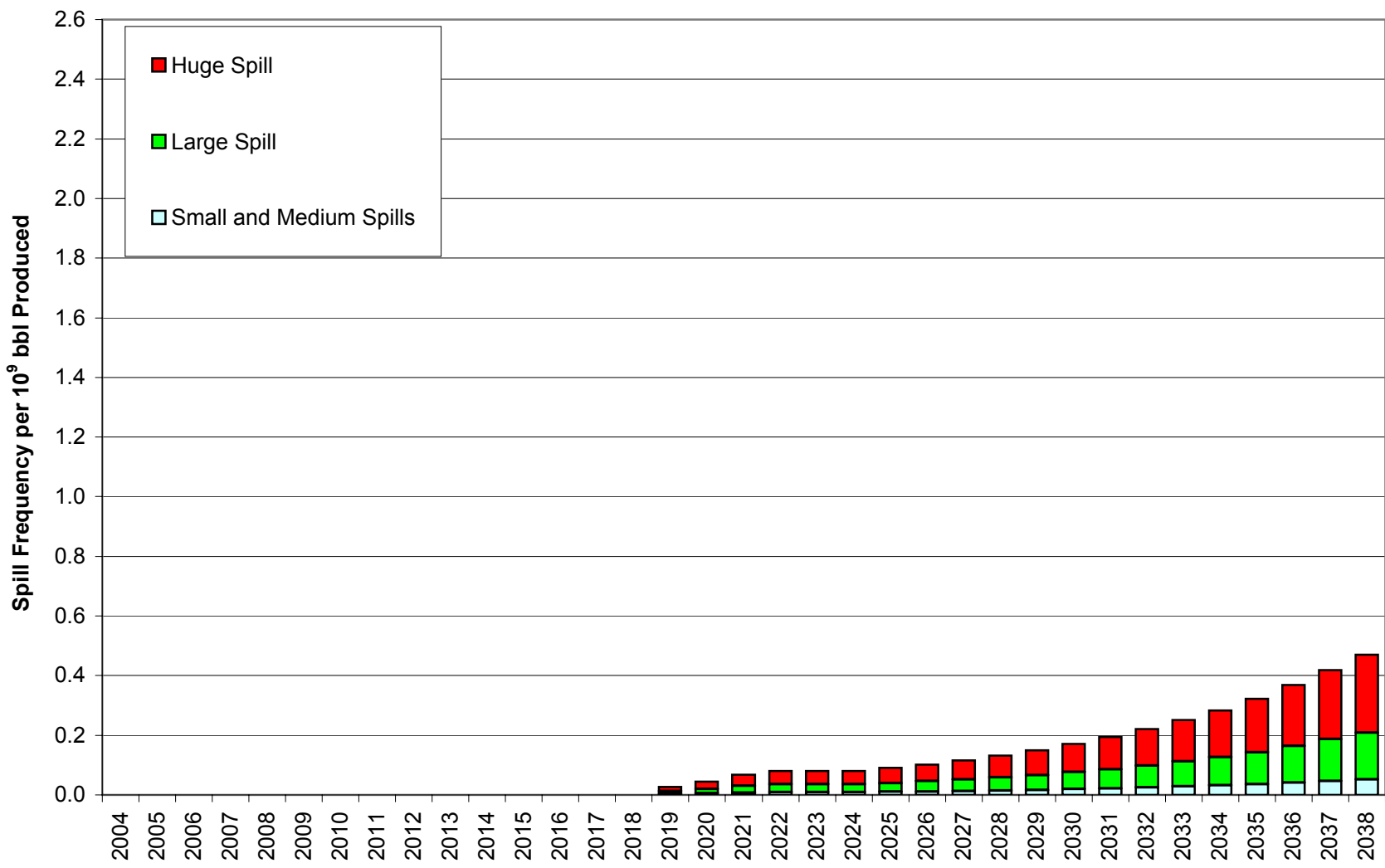
Beaufort Sea Sale 3 Spill Index - Platforms



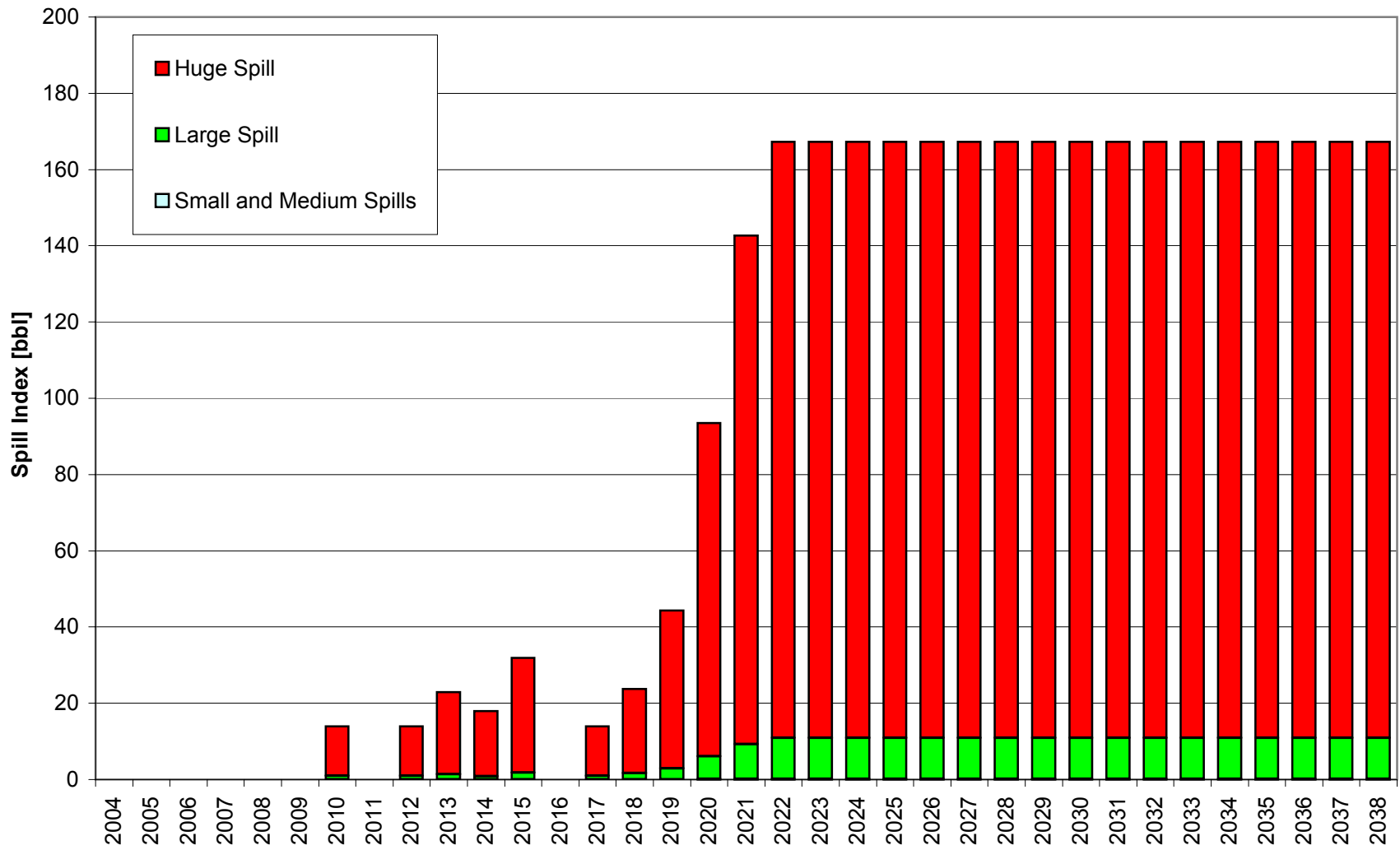
Beaufort Sea Sale 3 Spill Frequency - Wells



Beaufort Sea Sale 3 Spill Frequency per 10⁹ bbl Produced - Wells



Beaufort Sea Sale 3 Spill Index - Wells



**Table 4.4.1
Arctic Spill Occurrence Beaufort Sea Sale All P/L**

17705
Spill Index bbl
1.65
1.65
1.65
1.65
3.30
3.30
5.77
5.77
5.77
5.77
7.41
1.59
9.01
7.41
1.59
9.01
9.06
3.18
12.25
9.06
3.18
12.25
11.53
5.57
17.10
11.53
5.57
17.10
11.53
5.57
17.10

**Table 4.4.1
 Artic Spill Occurrence Beaufort Sea Sale All P/L**

17705
Spill Index bbl
11.53
5.57
17.10
11.53
5.57
17.10
11.53
5.57
17.10
9.89
5.57
15.46
9.89
5.57
15.46
8.24
5.57
13.81
5.77
5.57
11.34
5.77
5.57
11.34
4.12
3.98
8.10
4.12
3.98
8.10
4.12
3.98
8.10
4.12
3.98
8.10
4.12
3.98
8.10
2.47
2.39
4.86
2.47
2.39
4.86
2.47
2.39
4.86

**Table 4.4.2
Arctic Spill Occurrence Beaufort Sea Sale All P/L Summary**

Year	Production [MMbbbl]	Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]
2004																			
2005																			
2006																			
2007																			
2008																			
2009																			
2010	10.9	0.149	0.014	0.009	0.363	0.033	0.141	0.512	0.047	0.149	0.288	0.026	1.132	0.093	0.009	1.648	0.893	0.082	2.928
2011	19.9	0.149	0.008	0.009	0.363	0.018	0.141	0.512	0.026	0.149	0.288	0.014	1.132	0.093	0.005	1.648	0.893	0.045	2.928
2012	30.8	0.299	0.010	0.017	0.726	0.024	0.281	1.025	0.033	0.298	0.576	0.019	2.263	0.186	0.006	3.295	1.786	0.058	5.857
2013	50.7	0.522	0.010	0.030	1.271	0.025	0.492	1.793	0.035	0.522	1.007	0.020	3.961	0.326	0.006	5.766	3.126	0.062	10.249
2014	56.2	0.522	0.009	0.030	1.271	0.023	0.492	1.793	0.032	0.522	1.007	0.018	3.961	0.326	0.006	5.766	3.126	0.056	10.249
2015	64.2	0.820	0.013	0.048	2.000	0.031	0.774	2.821	0.044	0.822	1.569	0.024	6.170	0.509	0.008	9.006	4.898	0.076	15.997
2016	67.4	0.820	0.012	0.048	2.000	0.030	0.774	2.821	0.042	0.822	1.569	0.023	6.170	0.509	0.008	9.006	4.898	0.073	15.997
2017	77.4	1.232	0.016	0.071	2.929	0.038	1.109	4.161	0.054	1.181	2.208	0.029	8.722	0.711	0.009	12.530	7.080	0.091	22.433
2018	82.9	1.232	0.015	0.071	2.929	0.035	1.109	4.161	0.050	1.181	2.208	0.027	8.722	0.711	0.009	12.530	7.080	0.085	22.433
2019	104.6	1.792	0.017	0.104	4.222	0.040	1.586	6.014	0.057	1.690	3.128	0.030	12.379	1.006	0.010	17.674	10.148	0.097	31.742
2020	104.8	1.792	0.017	0.104	4.222	0.040	1.586	6.014	0.057	1.690	3.128	0.030	12.379	1.006	0.010	17.674	10.148	0.097	31.742
2021	98.6	1.792	0.018	0.104	4.222	0.043	1.586	6.014	0.061	1.690	3.128	0.032	12.379	1.006	0.010	17.674	10.148	0.103	31.742
2022	89.2	1.792	0.020	0.104	4.222	0.047	1.586	6.014	0.067	1.690	3.128	0.035	12.379	1.006	0.011	17.674	10.148	0.114	31.742
2023	81.4	1.792	0.022	0.104	4.222	0.052	1.586	6.014	0.074	1.690	3.128	0.038	12.379	1.006	0.012	17.674	10.148	0.125	31.742
2024	74.8	1.792	0.024	0.104	4.222	0.056	1.586	6.014	0.080	1.690	3.128	0.042	12.379	1.006	0.013	17.674	10.148	0.136	31.742
2025	62.5	1.643	0.026	0.095	3.859	0.062	1.445	5.502	0.088	1.541	2.841	0.045	11.247	0.913	0.015	16.026	9.255	0.148	28.814
2026	54.1	1.643	0.030	0.095	3.859	0.071	1.445	5.502	0.102	1.541	2.841	0.053	11.247	0.913	0.017	16.026	9.255	0.171	28.814
2027	44.6	1.494	0.033	0.087	3.496	0.078	1.305	4.990	0.112	1.391	2.553	0.057	10.115	0.819	0.018	14.379	8.362	0.187	25.886
2028	36.9	1.270	0.034	0.074	2.951	0.080	1.094	4.221	0.114	1.168	2.121	0.057	8.418	0.680	0.018	11.908	7.022	0.190	21.493
2029	32.2	1.270	0.039	0.074	2.951	0.092	1.094	4.221	0.131	1.168	2.121	0.066	8.418	0.680	0.021	11.908	7.022	0.218	21.493
2030	25.8	0.972	0.038	0.056	2.222	0.086	0.812	3.194	0.124	0.868	1.559	0.060	6.209	0.497	0.019	8.668	5.250	0.203	15.745
2031	22.6	0.972	0.043	0.043	2.222	0.098	0.706	3.194	0.141	0.749	1.559	0.069	5.523	0.497	0.022	8.099	5.250	0.232	14.371
2032	19.7	0.972	0.049	0.056	2.222	0.113	0.812	3.194	0.162	0.868	1.559	0.079	6.209	0.497	0.025	8.668	5.250	0.266	15.745
2033	17.2	0.972	0.057	0.056	2.222	0.129	0.812	3.194	0.186	0.868	1.559	0.091	6.209	0.497	0.029	8.668	5.250	0.305	15.745
2034	15.1	0.972	0.064	0.056	2.222	0.147	0.812	3.194	0.211	0.868	1.559	0.103	6.209	0.497	0.033	8.668	5.250	0.348	15.745
2035	13.2	0.972	0.074	0.056	2.222	0.168	0.812	3.194	0.242	0.868	1.559	0.118	6.209	0.497	0.038	8.668	5.250	0.398	15.745
2036	8.3	0.560	0.068	0.033	1.293	0.156	0.476	1.854	0.223	0.509	0.920	0.111	3.657	0.294	0.035	5.144	3.068	0.370	9.310
2037	7.3	0.560	0.077	0.033	1.293	0.177	0.476	1.854	0.254	0.509	0.920	0.126	3.657	0.294	0.040	5.144	3.068	0.420	9.310
2038	6.5	0.560	0.086	0.033	1.293	0.199	0.476	1.854	0.285	0.509	0.920	0.142	3.657	0.294	0.045	5.144	3.068	0.472	9.310

**Table 4.4.3
Arctic Spill Occurrence Beaufort Sea Sale All Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2005	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2006	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2007	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2008	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2009	Shallow	1	3	0.866	0.260	0.04	0.174	0.052	0.32
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	1	3		0.260	0.04		0.052	0.32
2010	Shallow	1	13	0.866	1.126	0.18	0.174	0.226	1.39
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	1	13		1.126	0.18		0.226	1.39
2011	Shallow	2	26	0.866	2.251	0.36	0.174	0.453	2.77
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	2	26		2.251	0.36		0.453	2.77
2012	Shallow	3	39	0.866	3.377	0.53	0.174	0.679	4.16
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	3	39		3.377	0.53		0.679	4.16
2013	Shallow	3	59	0.866	5.108	0.81	0.174	1.027	6.30
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total	3	59		5.108	0.81		1.027	6.30
2014	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	1	3	0.884	0.265	0.04	0.177	0.053	0.33
	Deep			0.913			0.182		
	Total	4	72		6.239	0.99		1.255	7.69
2015	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	1	13	0.884	1.150	0.18	0.177	0.231	1.41
	Deep			0.913			0.182		
	Total	4	82		7.124	1.13		1.432	8.78
2016	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	2	26	0.884	2.300	0.36	0.177	0.461	2.83
	Deep			0.913			0.182		
	Total	5	95		8.274	1.31		1.663	10.19
2017	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	3	39	0.884	3.449	0.55	0.177	0.692	4.24
	Deep			0.913			0.182		
	Total	6	108		9.423	1.49		1.893	11.61

**Table 4.4.3
Arctic Spill Occurrence Beaufort Sea Sale All Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	4	63	0.884	5.572	0.88	0.177	1.118	6.85
	Deep			0.913			0.182		
	Total	7	132		11.546	1.82		2.319	14.22
2019	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	5	87	0.884	7.695	1.22	0.177	1.543	9.46
	Deep			0.913			0.182		
	Total	8	156		13.669	2.16		2.745	16.83
2020	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	5	107	0.884	9.464	1.50	0.177	1.898	11.64
	Deep			0.913			0.182		
	Total	8	176		15.438	2.44		3.100	19.00
2021	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	5	127	0.884	11.233	1.77	0.177	2.253	13.81
	Deep			0.913			0.182		
	Total	8	196		17.207	2.72		3.454	21.18
2022	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	5	137	0.884	12.117	1.91	0.177	2.431	14.90
	Deep			0.913			0.182		
	Total	8	206		18.091	2.86		3.632	22.26
2023	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	5	137	0.884	12.117	1.91	0.177	2.431	14.90
	Deep			0.913			0.182		
	Total	8	206		18.091	2.86		3.632	22.26
2024	Shallow	3	69	0.866	5.974	0.94	0.174	1.201	7.36
	Medium	5	137	0.884	12.117	1.91	0.177	2.431	14.90
	Deep			0.913			0.182		
	Total	8	206		18.091	2.86		3.632	22.26
2025	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	5	137	0.884	12.117	1.91	0.177	2.431	14.90
	Deep			0.913			0.182		
	Total	7	183		16.100	2.54		3.231	19.81
2026	Shallow	2	46	0.866	3.983	0.63	0.174	0.801	4.91
	Medium	5	137	0.884	12.117	1.91	0.177	2.431	14.90
	Deep			0.913			0.182		
	Total	7	183		16.100	2.54		3.231	19.81
2027	Shallow	1	23	0.866	1.991	0.31	0.174	0.400	2.45
	Medium	5	137	0.884	12.117	1.91	0.177	2.431	14.90
	Deep			0.913			0.182		
	Total	6	160		14.109	2.23		2.831	17.35
2028	Shallow			0.866			0.174		
	Medium	5	137	0.884	12.117	1.91	0.177	2.431	14.90
	Deep			0.913			0.182		
	Total	5	137		12.117	1.91		2.431	14.90
2029	Shallow			0.866			0.174		
	Medium	5	137	0.884	12.117	1.91	0.177	2.431	14.90
	Deep			0.913			0.182		
	Total	5	137		12.117	1.91		2.431	14.90
2030	Shallow			0.866			0.174		
	Medium	4	114	0.884	10.083	1.59	0.177	2.022	12.40
	Deep			0.913			0.182		
	Total	4	114		10.083	1.59		2.022	12.40
2031	Shallow			0.866			0.174		
	Medium	4	114	0.884	10.083	1.59	0.177	2.022	12.40
	Deep			0.913			0.182		
	Total	4	114		10.083	1.59		2.022	12.40

**Table 4.4.3
Arctic Spill Occurrence Beaufort Sea Sale All Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow			0.866			0.174		
	Medium	4	114	0.884	10.083	1.59	0.177	2.022	12.40
	Deep			0.913			0.182		
	Total	4	114		10.083	1.59		2.022	12.40
2033	Shallow			0.866			0.174		
	Medium	4	114	0.884	10.083	1.59	0.177	2.022	12.40
	Deep			0.913			0.182		
	Total	4	114		10.083	1.59		2.022	12.40
2034	Shallow			0.866			0.174		
	Medium	4	114	0.884	10.083	1.59	0.177	2.022	12.40
	Deep			0.913			0.182		
	Total	4	114		10.083	1.59		2.022	12.40
2035	Shallow			0.866			0.174		
	Medium	4	114	0.884	10.083	1.59	0.177	2.022	12.40
	Deep			0.913			0.182		
	Total	4	114		10.083	1.59		2.022	12.40
2036	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2037	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40
2038	Shallow			0.866			0.174		
	Medium	2	68	0.884	6.014	0.95	0.177	1.206	7.40
	Deep			0.913			0.182		
	Total	2	68		6.014	0.95		1.206	7.40

**Table 4.4.4
Arctic Spill Occurrence Beaufort Sea Sale All Platforms Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]
2004										
2005										
2006										
2007										
2008										
2009		0.260		0.041	0.052		0.320	0.312		0.361
2010	10.9	1.126	0.103	0.178	0.226	0.021	1.387	1.352	0.124	1.565
2011	19.9	2.251	0.113	0.356	0.453	0.023	2.775	2.704	0.136	3.131
2012	30.8	3.377	0.110	0.533	0.679	0.022	4.162	4.056	0.132	4.696
2013	50.7	5.108	0.101	0.807	1.027	0.020	6.297	6.135	0.121	7.104
2014	56.2	6.239	0.111	0.986	1.255	0.022	7.691	7.494	0.133	8.676
2015	64.2	7.124	0.111	1.126	1.432	0.022	8.778	8.556	0.133	9.904
2016	67.4	8.274	0.123	1.307	1.663	0.025	10.192	9.936	0.147	11.499
2017	77.4	9.423	0.122	1.489	1.893	0.024	11.606	11.317	0.146	13.095
2018	82.9	11.546	0.139	1.824	2.319	0.028	14.216	13.865	0.167	16.040
2019	104.6	13.669	0.131	2.160	2.745	0.026	16.826	16.414	0.157	18.986
2020	104.8	15.438	0.147	2.439	3.100	0.030	19.001	18.537	0.177	21.440
2021	98.6	17.207	0.175	2.719	3.454	0.035	21.176	20.661	0.210	23.895
2022	89.2	18.091	0.203	2.858	3.632	0.041	22.264	21.723	0.244	25.122
2023	81.4	18.091	0.222	2.858	3.632	0.045	22.264	21.723	0.267	25.122
2024	74.8	18.091	0.242	2.858	3.632	0.049	22.264	21.723	0.290	25.122
2025	62.5	16.100	0.258	2.544	3.231	0.052	19.809	19.331	0.309	22.353
2026	54.1	16.100	0.298	2.544	3.231	0.060	19.809	19.331	0.357	22.353
2027	44.6	14.109	0.316	2.229	2.831	0.063	17.354	16.940	0.380	19.583
2028	36.9	12.117	0.328	1.915	2.431	0.066	14.899	14.548	0.394	16.814
2029	32.2	12.117	0.376	1.915	2.431	0.075	14.899	14.548	0.452	16.814
2030	25.8	10.083	0.391	1.593	2.022	0.078	12.398	12.106	0.469	13.991
2031	22.6	10.083	0.446	1.593	2.022	0.089	12.398	12.106	0.536	13.991
2032	19.7	10.083	0.512	1.593	2.022	0.103	12.398	12.106	0.614	13.991
2033	17.2	10.083	0.586	1.593	2.022	0.118	12.398	12.106	0.704	13.991
2034	15.1	10.083	0.668	1.593	2.022	0.134	12.398	12.106	0.802	13.991
2035	13.2	10.083	0.764	1.593	2.022	0.153	12.398	12.106	0.917	13.991
2036	8.3	6.014	0.725	0.950	1.206	0.145	7.395	7.221	0.870	8.346
2037	7.3	6.014	0.824	0.950	1.206	0.165	7.395	7.221	0.989	8.346
2038	6.5	6.014	0.925	0.950	1.206	0.186	7.395	7.221	1.111	8.346

**Table 4.4.5
Arctic Spill Occurrence Beaufort Sea Sale All Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2009	Shallow	3	0.500	0.015	0.01	3.500	0.105	0.47	1.500	0.045	0.90	1.000	0.030	6.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	3		0.015	0.01		0.105	0.47		0.045	0.90		0.030	6.00
2010	Shallow	13	0.500	0.065	0.03	3.500	0.455	2.05	1.500	0.195	3.90	1.000	0.130	26.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	13		0.065	0.03		0.455	2.05		0.195	3.90		0.130	26.00
2011	Shallow	26	0.500	0.130	0.07	3.500	0.910	4.10	1.500	0.390	7.80	1.000	0.260	52.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	26		0.130	0.07		0.910	4.10		0.390	7.80		0.260	52.00
2012	Shallow	39	0.500	0.195	0.10	3.500	1.365	6.14	1.500	0.585	11.70	1.000	0.390	78.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	39		0.195	0.10		1.365	6.14		0.585	11.70		0.390	78.00
2013	Shallow	59	0.500	0.295	0.15	3.500	2.065	9.29	1.500	0.885	17.70	1.000	0.590	118.00
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total	59		0.295	0.15		2.065	9.29		0.885	17.70		0.590	118.00
2014	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	3	0.500	0.015	0.01	3.500	0.105	0.47	1.500	0.045	0.90	1.000	0.030	6.00
	Deep		0.500			3.500			1.500			1.000		
	Total	72		0.360	0.18		2.520	11.34		1.080	21.60		0.720	144.00
2015	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	13	0.500	0.065	0.03	3.500	0.455	2.05	1.500	0.195	3.90	1.000	0.130	26.00
	Deep		0.500			3.500			1.500			1.000		
	Total	82		0.410	0.21		2.870	12.92		1.230	24.60		0.820	164.00
2016	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	26	0.500	0.130	0.07	3.500	0.910	4.10	1.500	0.390	7.80	1.000	0.260	52.00
	Deep		0.500			3.500			1.500			1.000		
	Total	95		0.475	0.24		3.325	14.96		1.425	28.50		0.950	190.00
2017	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	39	0.500	0.195	0.10	3.500	1.365	6.14	1.500	0.585	11.70	1.000	0.390	78.00
	Deep		0.500			3.500			1.500			1.000		
	Total	108		0.540	0.27		3.780	17.01		1.620	32.40		1.080	216.00

**Table 4.4.5
Arctic Spill Occurrence Beaufort Sea Sale All Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	63	0.500	0.315	0.16	3.500	2.205	9.92	1.500	0.945	18.90	1.000	0.630	126.00
	Deep		0.500			3.500			1.500			1.000		
	Total	132		0.660	0.33		4.620	20.79		1.980	39.60		1.320	264.00
2019	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	87	0.500	0.435	0.22	3.500	3.045	13.70	1.500	1.305	26.10	1.000	0.870	174.00
	Deep		0.500			3.500			1.500			1.000		
	Total	156		0.780	0.39		5.460	24.57		2.340	46.80		1.560	312.00
2020	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	107	0.500	0.535	0.27	3.500	3.745	16.85	1.500	1.605	32.10	1.000	1.070	214.00
	Deep		0.500			3.500			1.500			1.000		
	Total	176		0.880	0.44		6.160	27.72		2.640	52.80		1.760	352.00
2021	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	127	0.500	0.635	0.32	3.500	4.445	20.00	1.500	1.905	38.10	1.000	1.270	254.00
	Deep		0.500			3.500			1.500			1.000		
	Total	196		0.980	0.49		6.860	30.87		2.940	58.80		1.960	392.00
2022	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	206		1.030	0.52		7.210	32.45		3.090	61.80		2.060	412.00
2023	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	206		1.030	0.52		7.210	32.45		3.090	61.80		2.060	412.00
2024	Shallow	69	0.500	0.345	0.17	3.500	2.415	10.87	1.500	1.035	20.70	1.000	0.690	138.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	206		1.030	0.52		7.210	32.45		3.090	61.80		2.060	412.00
2025	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	183		0.915	0.46		6.405	28.82		2.745	54.90		1.830	366.00
2026	Shallow	46	0.500	0.230	0.12	3.500	1.610	7.25	1.500	0.690	13.80	1.000	0.460	92.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	183		0.915	0.46		6.405	28.82		2.745	54.90		1.830	366.00
2027	Shallow	23	0.500	0.115	0.06	3.500	0.805	3.62	1.500	0.345	6.90	1.000	0.230	46.00
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	160		0.800	0.40		5.600	25.20		2.400	48.00		1.600	320.00
2028	Shallow		0.500			3.500			1.500			1.000		
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	137		0.685	0.34		4.795	21.58		2.055	41.10		1.370	274.00
2029	Shallow		0.500			3.500			1.500			1.000		
	Medium	137	0.500	0.685	0.34	3.500	4.795	21.58	1.500	2.055	41.10	1.000	1.370	274.00
	Deep		0.500			3.500			1.500			1.000		
	Total	137		0.685	0.34		4.795	21.58		2.055	41.10		1.370	274.00
2030	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00
2031	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00

**Table 4.4.5
Arctic Spill Occurrence Beaufort Sea Sale All Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00
2033	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00
2034	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00
2035	Shallow		0.500			3.500			1.500			1.000		
	Medium	114	0.500	0.570	0.29	3.500	3.990	17.96	1.500	1.710	34.20	1.000	1.140	228.00
	Deep		0.500			3.500			1.500			1.000		
	Total	114		0.570	0.29		3.990	17.96		1.710	34.20		1.140	228.00
2036	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2037	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00
2038	Shallow		0.500			3.500			1.500			1.000		
	Medium	68	0.500	0.340	0.17	3.500	2.380	10.71	1.500	1.020	20.40	1.000	0.680	136.00
	Deep		0.500			3.500			1.500			1.000		
	Total	68		0.340	0.17		2.380	10.71		1.020	20.40		0.680	136.00

Table 4.4.6

Arctic Spill Occurrence Beaufort Sea Sale All Production Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]
2004													
2005													
2006													
2007													
2008													
2009		0.015		0.008	0.045		0.473	0.075		6.900	0.135		7.380
2010	10.9	0.065	0.006	0.033	0.195	0.018	2.048	0.325	0.030	29.900	0.585	0.054	31.980
2011	19.9	0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
2012	30.8	0.195	0.006	0.098	0.585	0.019	6.143	0.975	0.032	89.700	1.755	0.057	95.940
2013	50.7	0.295	0.006	0.148	0.885	0.017	9.293	1.475	0.029	135.700	2.655	0.052	145.140
2014	56.2	0.360	0.006	0.180	1.080	0.019	11.340	1.800	0.032	165.600	3.240	0.058	177.120
2015	64.2	0.410	0.006	0.205	1.230	0.019	12.915	2.050	0.032	188.600	3.690	0.057	201.720
2016	67.4	0.475	0.007	0.238	1.425	0.021	14.963	2.375	0.035	218.500	4.275	0.063	233.700
2017	77.4	0.540	0.007	0.270	1.620	0.021	17.010	2.700	0.035	248.400	4.860	0.063	265.680
2018	82.9	0.660	0.008	0.330	1.980	0.024	20.790	3.300	0.040	303.600	5.940	0.072	324.720
2019	104.6	0.780	0.007	0.390	2.340	0.022	24.570	3.900	0.037	358.800	7.020	0.067	383.760
2020	104.8	0.880	0.008	0.440	2.640	0.025	27.720	4.400	0.042	404.800	7.920	0.076	432.960
2021	98.6	0.980	0.010	0.490	2.940	0.030	30.870	4.900	0.050	450.800	8.820	0.089	482.160
2022	89.2	1.030	0.012	0.515	3.090	0.035	32.445	5.150	0.058	473.800	9.270	0.104	506.760
2023	81.4	1.030	0.013	0.515	3.090	0.038	32.445	5.150	0.063	473.800	9.270	0.114	506.760
2024	74.8	1.030	0.014	0.515	3.090	0.041	32.445	5.150	0.069	473.800	9.270	0.124	506.760
2025	62.5	0.915	0.015	0.458	2.745	0.044	28.823	4.575	0.073	420.900	8.235	0.132	450.180
2026	54.1	0.915	0.017	0.458	2.745	0.051	28.823	4.575	0.085	420.900	8.235	0.152	450.180
2027	44.6	0.800	0.018	0.400	2.400	0.054	25.200	4.000	0.090	368.000	7.200	0.161	393.600
2028	36.9	0.685	0.019	0.343	2.055	0.056	21.578	3.425	0.093	315.100	6.165	0.167	337.020
2029	32.2	0.685	0.021	0.343	2.055	0.064	21.578	3.425	0.106	315.100	6.165	0.191	337.020
2030	25.8	0.570	0.022	0.285	1.710	0.066	17.955	2.850	0.110	262.200	5.130	0.199	280.440
2031	22.6	0.570	0.025	0.285	1.710	0.076	17.955	2.850	0.126	262.200	5.130	0.227	280.440
2032	19.7	0.570	0.029	0.285	1.710	0.087	17.955	2.850	0.145	262.200	5.130	0.260	280.440
2033	17.2	0.570	0.033	0.285	1.710	0.099	17.955	2.850	0.166	262.200	5.130	0.298	280.440
2034	15.1	0.570	0.038	0.285	1.710	0.113	17.955	2.850	0.189	262.200	5.130	0.340	280.440
2035	13.2	0.570	0.043	0.285	1.710	0.130	17.955	2.850	0.216	262.200	5.130	0.389	280.440
2036	8.3	0.340	0.041	0.170	1.020	0.123	10.710	1.700	0.205	156.400	3.060	0.369	167.280
2037	7.3	0.340	0.047	0.170	1.020	0.140	10.710	1.700	0.233	156.400	3.060	0.419	167.280
2038	6.5	0.340	0.052	0.170	1.020	0.157	10.710	1.700	0.262	156.400	3.060	0.471	167.280

**Table 4.4.7
Arctic Spill Occurrence Beaufort Sea Sale All Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2005	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2006	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2007	Shallow	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2008	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2010	Shallow	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep		3.160			22.110			9.500			5.500		
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2011	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2012	Shallow		3.160			22.110			9.500			5.500		
	Medium	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	3		0.095	0.05		0.663	2.98		0.285	5.70		0.165	33.00
2013	Shallow		3.160			22.110			9.500			5.500		
	Medium	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2014	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2015	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2016	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2017	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00

**Table 4.4.7
Arctic Spill Occurrence Beaufort Sea Sale All Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	1	3.160	0.032	0.02	22.110	0.221	0.99	9.500	0.095	1.90	5.500	0.055	11.00
	Total	1		0.032	0.02		0.221	0.99		0.095	1.90		0.055	11.00
2019	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2020	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2021	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2022	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2023	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2024	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2025	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2026	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2027	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2028	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2029	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2030	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2031	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

**Table 4.4.7
Arctic Spill Occurrence Beaufort Sea Sale All Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2033	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2034	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2035	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2036	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2037	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2038	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.4.8

Arctic Spill Occurrence Beaufort Sea Sale All Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]
2004		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2005		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2006		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2007		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2008		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2009		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2010	10.9	0.063	0.006	0.032	0.190	0.017	1.990	0.300	0.028	25.800	0.553	0.051	27.822
2011	19.9												
2012	30.8	0.095	0.003	0.047	0.285	0.009	2.985	0.450	0.015	38.700	0.830	0.027	41.732
2013	50.7	0.063	0.001	0.032	0.190	0.004	1.990	0.300	0.006	25.800	0.553	0.011	27.822
2014	56.2												
2015	64.2	0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.004	13.911
2016	67.4												
2017	77.4	0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.004	13.911
2018	82.9	0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.003	13.911
2019	104.6												
2020	104.8												
2021	98.6												
2022	89.2												
2023	81.4												
2024	74.8												
2025	62.5												
2026	54.1												
2027	44.6												
2028	36.9												
2029	32.2												
2030	25.8												
2031	22.6												
2032	19.7												
2033	17.2												
2034	15.1												
2035	13.2												
2036	8.3												
2037	7.3												
2038	6.5												

**Table 4.4.9
Arctic Spill Occurrence Beaufort Sea Sale All Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2009	Shallow	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2011	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2012	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2013	Shallow		1.300			9.080			3.900			3.900		
	Medium	3	1.300	0.039	0.02	9.080	0.272	1.23	3.900	0.117	2.34	3.900	0.117	23.40
	Deep		1.300			9.080			3.900			3.900		
	Total	3		0.039	0.02		0.272	1.23		0.117	2.34		0.117	23.40
2014	Shallow		1.300			9.080			3.900			3.900		
	Medium	4	1.300	0.052	0.03	9.080	0.363	1.63	3.900	0.156	3.12	3.900	0.156	31.20
	Deep		1.300			9.080			3.900			3.900		
	Total	4		0.052	0.03		0.363	1.63		0.156	3.12		0.156	31.20
2015	Shallow		1.300			9.080			3.900			3.900		
	Medium	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Deep		1.300			9.080			3.900			3.900		
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
2016	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2017	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.4.9
Arctic Spill Occurrence Beaufort Sea Sale All Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] = 500		Spill Index bbl	Average Spill [bbl] = 4500		Spill Index bbl	Average Spill [bbl] = 20000		Spill Index bbl	Average Spill [bbl] = 200000		Spill Index bbl
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2018	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2019	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2020	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2021	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2022	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2023	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2024	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2025	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2026	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2027	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2028	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2029	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2030	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2031	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

**Table 4.4.9
Arctic Spill Occurrence Beaufort Sea Sale All Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
2032	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2033	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2034	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2035	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2036	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2037	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2038	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.4.10

Arctic Spill Occurrence Beaufort Sea Sale All Development Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004													
2005													
2006		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2007													
2008		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2009		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
2010	10.9	0.026	0.002	0.013	0.078	0.007	0.817	0.156	0.014	17.160	0.260	0.024	17.990
2011	19.9												
2012	30.8												
2013	50.7	0.039	0.001	0.020	0.117	0.002	1.226	0.234	0.005	25.740	0.390	0.008	26.985
2014	56.2	0.052	0.001	0.026	0.156	0.003	1.634	0.312	0.006	34.320	0.520	0.009	35.980
2015	64.2	0.026	0.000	0.013	0.078	0.001	0.817	0.156	0.002	17.160	0.260	0.004	17.990
2016	67.4												
2017	77.4												
2018	82.9												
2019	104.6												
2020	104.8												
2021	98.6												
2022	89.2												
2023	81.4												
2024	74.8												
2025	62.5												
2026	54.1												
2027	44.6												
2028	36.9												
2029	32.2												
2030	25.8												
2031	22.6												
2032	19.7												
2033	17.2												
2034	15.1												
2035	13.2												
2036	8.3												
2037	7.3												
2038	6.5												

**Table 4.4.11
Arctic Spill Occurrence Beaufort Sea Sale All Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills			
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	
2004	Pipeline														
	Platforms														
	Production Wells														
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911	
	Development Wells														
	Total		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911	
2005	Pipeline														
	Platforms														
	Production Wells														
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911	
	Development Wells														
	Total		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911	
2006	Pipeline														
	Platforms														
	Production Wells														
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911	
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990	
	Total		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901	
2007	Pipeline														
	Platforms														
	Production Wells														
	Exploration Wells		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822	
	Development Wells														
	Total		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822	
2008	Pipeline														
	Platforms														
	Production Wells														
	Exploration Wells		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822	
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990	
	Total		0.089		0.045	0.268		2.807	0.456		42.960	0.813		45.812	
2009	Pipeline														
	Platforms		0.260		0.041	0.052		0.320			0.312		0.361		
	Production Wells		0.015		0.008	0.045		0.473	0.075		6.900	0.135		7.380	
	Exploration Wells		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911	
	Development Wells		0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990	
	Total		0.332		0.077	0.270		2.605	0.381		36.960	0.984		39.642	
2010	Pipeline	10.9	0.512	0.047	0.149	0.288	0.026	1.132	0.093	0.009	1.648	0.893	0.082	2.928	
	Platforms		1.126	0.103	0.178	0.226	0.021	1.387				1.352	0.124	1.565	
	Production Wells		0.065	0.006	0.033	0.195	0.018	2.048	0.325	0.030	29.900	0.585	0.054	31.980	
	Exploration Wells		0.063	0.006	0.032	0.190	0.017	1.990	0.300	0.028	25.800	0.553	0.051	27.822	
	Development Wells		0.026	0.002	0.013	0.078	0.007	0.817	0.156	0.014	17.160	0.260	0.024	17.990	
	Total		1.792	0.164	0.404	0.977	0.090	7.374	0.874	0.080	74.508	3.643	0.334	82.285	
2011	Pipeline	19.9	0.512	0.026	0.149	0.288	0.014	1.132	0.093	0.005	1.648	0.893	0.045	2.928	
	Platforms		2.251	0.113	0.356	0.453	0.023	2.775				2.704	0.136	3.131	
	Production Wells		0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960	
	Exploration Wells														
	Development Wells														
	Total		2.893	0.145	0.570	1.130	0.057	8.002	0.743	0.037	61.448	4.767	0.240	70.019	
2012	Pipeline	30.8	1.025	0.033	0.298	0.576	0.019	2.263	0.186	0.006	3.295	1.786	0.058	5.857	
	Platforms		3.377	0.110	0.533	0.679	0.022	4.162				4.056	0.132	4.696	
	Production Wells		0.195	0.006	0.098	0.585	0.019	6.143	0.975	0.032	89.700	1.755	0.057	95.940	
	Exploration Wells		0.095	0.003	0.047	0.285	0.009	2.985	0.450	0.015	38.700	0.830	0.027	41.732	
	Development Wells														
	Total		4.691	0.152	0.977	2.125	0.069	15.553	1.611	0.052	131.695	8.427	0.274	148.225	
2013	Pipeline	50.7	1.793	0.035	0.522	1.007	0.020	3.961	0.326	0.006	5.766	3.126	0.062	10.249	
	Platforms		5.108	0.101	0.807	1.027	0.020	6.297				6.135	0.121	7.104	
	Production Wells		0.295	0.006	0.148	0.885	0.017	9.293	1.475	0.029	135.700	2.655	0.052	145.140	
	Exploration Wells		0.063	0.001	0.032	0.190	0.004	1.990	0.300	0.006	25.800	0.553	0.011	27.822	
	Development Wells		0.039	0.001	0.020	0.117	0.002	1.226	0.234	0.005	25.740	0.390	0.008	26.985	
	Total		7.298	0.144	1.528	3.227	0.064	22.766	2.335	0.046	193.006	12.860	0.254	217.300	

**Table 4.4.11
Arctic Spill Occurrence Beaufort Sea Sale All Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2014	Pipeline	56.2	1.793	0.032	0.522	1.007	0.018	3.961	0.326	0.006	5.766	3.126	0.056	10.249
	Platforms		6.239	0.111	0.986	1.255	0.022	7.691				7.494	0.133	8.676
	Production Wells		0.360	0.006	0.180	1.080	0.019	11.340	1.800	0.032	165.600	3.240	0.058	177.120
	Exploration Wells													
	Development Wells		0.052	0.001	0.026	0.156	0.003	1.634	0.312	0.006	34.320	0.520	0.009	35.980
	Total		8.444	0.150	1.714	3.498	0.062	24.626	2.438	0.043	205.686	14.380	0.256	232.026
2015	Pipeline	64.2	2.821	0.044	0.822	1.569	0.024	6.170	0.509	0.008	9.006	4.898	0.076	15.997
	Platforms		7.124	0.111	1.126	1.432	0.022	8.778				8.556	0.133	9.904
	Production Wells		0.410	0.006	0.205	1.230	0.019	12.915	2.050	0.032	188.600	3.690	0.057	201.720
	Exploration Wells		0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.004	13.911
	Development Wells		0.026	0.000	0.013	0.078	0.001	0.817	0.156	0.002	17.160	0.260	0.004	17.990
	Total		10.412	0.162	2.181	4.404	0.069	29.675	2.865	0.045	227.666	17.681	0.275	259.522
2016	Pipeline	67.4	2.821	0.042	0.822	1.569	0.023	6.170	0.509	0.008	9.006	4.898	0.073	15.997
	Platforms		8.274	0.123	1.307	1.663	0.025	10.192				9.936	0.147	11.499
	Production Wells		0.475	0.007	0.238	1.425	0.021	14.963	2.375	0.035	218.500	4.275	0.063	233.700
	Exploration Wells													
	Development Wells													
	Total		11.569	0.172	2.366	4.657	0.069	31.324	2.884	0.043	227.506	19.110	0.284	261.196
2017	Pipeline	77.4	4.161	0.054	1.181	2.208	0.029	8.722	0.711	0.009	12.530	7.080	0.091	22.433
	Platforms		9.423	0.122	1.489	1.893	0.024	11.606				11.317	0.146	13.095
	Production Wells		0.540	0.007	0.270	1.620	0.021	17.010	2.700	0.035	248.400	4.860	0.063	265.680
	Exploration Wells		0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.004	13.911
	Development Wells													
	Total		14.156	0.183	2.956	5.817	0.075	38.333	3.561	0.046	273.830	23.533	0.304	315.118
2018	Pipeline	82.9	4.161	0.050	1.181	2.208	0.027	8.722	0.711	0.009	12.530	7.080	0.085	22.433
	Platforms		11.546	0.139	1.824	2.319	0.028	14.216				13.865	0.167	16.040
	Production Wells		0.660	0.008	0.330	1.980	0.024	20.790	3.300	0.040	303.600	5.940	0.072	324.720
	Exploration Wells		0.032	0.000	0.016	0.095	0.001	0.995	0.150	0.002	12.900	0.277	0.003	13.911
	Development Wells													
	Total		16.398	0.198	3.351	6.602	0.080	44.723	4.161	0.050	329.030	27.162	0.328	377.104
2019	Pipeline	104.6	6.014	0.057	1.690	3.128	0.030	12.379	1.006	0.010	17.674	10.148	0.097	31.742
	Platforms		13.669	0.131	2.160	2.745	0.026	16.826				16.414	0.157	18.986
	Production Wells		0.780	0.007	0.390	2.340	0.022	24.570	3.900	0.037	358.800	7.020	0.067	383.760
	Exploration Wells													
	Development Wells													
	Total		20.463	0.196	4.239	8.213	0.079	53.775	4.906	0.047	376.474	33.582	0.321	434.488
2020	Pipeline	104.8	6.014	0.057	1.690	3.128	0.030	12.379	1.006	0.010	17.674	10.148	0.097	31.742
	Platforms		15.438	0.147	2.439	3.100	0.030	19.001				18.537	0.177	21.440
	Production Wells		0.880	0.008	0.440	2.640	0.025	27.720	4.400	0.042	404.800	7.920	0.076	432.960
	Exploration Wells													
	Development Wells													
	Total		22.332	0.213	4.569	8.868	0.085	59.100	5.406	0.052	422.474	36.606	0.349	486.143
2021	Pipeline	98.6	6.014	0.061	1.690	3.128	0.032	12.379	1.006	0.010	17.674	10.148	0.103	31.742
	Platforms		17.207	0.175	2.719	3.454	0.035	21.176				20.661	0.210	23.895
	Production Wells		0.980	0.010	0.490	2.940	0.030	30.870	4.900	0.050	450.800	8.820	0.089	482.160
	Exploration Wells													
	Development Wells													
	Total		24.201	0.245	4.898	9.523	0.097	64.425	5.906	0.060	468.474	39.629	0.402	537.797
2022	Pipeline	89.2	6.014	0.067	1.690	3.128	0.035	12.379	1.006	0.011	17.674	10.148	0.114	31.742
	Platforms		18.091	0.203	2.858	3.632	0.041	22.264				21.723	0.244	25.122
	Production Wells		1.030	0.012	0.515	3.090	0.035	32.445	5.150	0.058	473.800	9.270	0.104	506.760
	Exploration Wells													
	Development Wells													
	Total		25.136	0.282	5.063	9.850	0.110	67.087	6.156	0.069	491.474	41.141	0.461	563.624
2023	Pipeline	81.4	6.014	0.074	1.690	3.128	0.038	12.379	1.006	0.012	17.674	10.148	0.125	31.742
	Platforms		18.091	0.222	2.858	3.632	0.045	22.264				21.723	0.267	25.122
	Production Wells		1.030	0.013	0.515	3.090	0.038	32.445	5.150	0.063	473.800	9.270	0.114	506.760
	Exploration Wells													
	Development Wells													
	Total		25.136	0.309	5.063	9.850	0.121	67.087	6.156	0.076	491.474	41.141	0.505	563.624

**Table 4.4.11
Arctic Spill Occurrence Beaufort Sea Sale All Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2024	Pipeline	74.8	6.014	0.080	1.690	3.128	0.042	12.379	1.006	0.013	17.674	10.148	0.136	31.742
	Platforms		18.091	0.242	2.858	3.632	0.049	22.264				21.723	0.290	25.122
	Production Wells		1.030	0.014	0.515	3.090	0.041	32.445	5.150	0.069	473.800	9.270	0.124	506.760
	Exploration Wells													
	Development Wells													
Total			25.136	0.336	5.063	9.850	0.132	67.087	6.156	0.082	491.474	41.141	0.550	563.624
2025	Pipeline	62.5	5.502	0.088	1.541	2.841	0.045	11.247	0.913	0.015	16.026	9.255	0.148	28.814
	Platforms		16.100	0.258	2.544	3.231	0.052	19.809				19.331	0.309	22.353
	Production Wells		0.915	0.015	0.458	2.745	0.044	28.823	4.575	0.073	420.900	8.235	0.132	450.180
	Exploration Wells													
	Development Wells													
Total			22.517	0.360	4.542	8.817	0.141	59.878	5.488	0.088	436.926	36.821	0.589	501.347
2026	Pipeline	54.1	5.502	0.102	1.541	2.841	0.053	11.247	0.913	0.017	16.026	9.255	0.171	28.814
	Platforms		16.100	0.298	2.544	3.231	0.060	19.809				19.331	0.357	22.353
	Production Wells		0.915	0.017	0.458	2.745	0.051	28.823	4.575	0.085	420.900	8.235	0.152	450.180
	Exploration Wells													
	Development Wells													
Total			22.517	0.416	4.542	8.817	0.163	59.878	5.488	0.101	436.926	36.821	0.681	501.347
2027	Pipeline	44.6	4.990	0.112	1.391	2.553	0.057	10.115	0.819	0.018	14.379	8.362	0.187	25.886
	Platforms		14.109	0.316	2.229	2.831	0.063	17.354				16.940	0.380	19.583
	Production Wells		0.800	0.018	0.400	2.400	0.054	25.200	4.000	0.090	368.000	7.200	0.161	393.600
	Exploration Wells													
	Development Wells													
Total			19.898	0.446	4.021	7.784	0.175	52.669	4.819	0.108	382.379	32.502	0.729	439.069
2028	Pipeline	36.9	4.221	0.114	1.168	2.121	0.057	8.418	0.680	0.018	11.908	7.022	0.190	21.493
	Platforms		12.117	0.328	1.915	2.431	0.066	14.899				14.548	0.394	16.814
	Production Wells		0.685	0.019	0.343	2.055	0.056	21.578	3.425	0.093	315.100	6.165	0.167	337.020
	Exploration Wells													
	Development Wells													
Total			17.024	0.461	3.425	6.607	0.179	44.895	4.105	0.111	327.008	27.735	0.752	375.327
2029	Pipeline	32.2	4.221	0.131	1.168	2.121	0.066	8.418	0.680	0.021	11.908	7.022	0.218	21.493
	Platforms		12.117	0.376	1.915	2.431	0.075	14.899				14.548	0.452	16.814
	Production Wells		0.685	0.021	0.343	2.055	0.064	21.578	3.425	0.106	315.100	6.165	0.191	337.020
	Exploration Wells													
	Development Wells													
Total			17.024	0.529	3.425	6.607	0.205	44.895	4.105	0.127	327.008	27.735	0.861	375.327
2030	Pipeline	25.8	3.194	0.124	0.868	1.559	0.060	6.209	0.497	0.019	8.668	5.250	0.203	15.745
	Platforms		10.083	0.391	1.593	2.022	0.078	12.398				12.106	0.469	13.991
	Production Wells		0.570	0.022	0.285	1.710	0.066	17.955	2.850	0.110	262.200	5.130	0.199	280.440
	Exploration Wells													
	Development Wells													
Total			13.847	0.537	2.746	5.292	0.205	36.562	3.347	0.130	270.868	22.485	0.872	310.176
2031	Pipeline	22.6	3.194	0.141	0.749	1.559	0.069	5.523	0.497	0.022	8.099	5.250	0.232	14.371
	Platforms		10.083	0.446	1.593	2.022	0.089	12.398				12.106	0.536	13.991
	Production Wells		0.570	0.025	0.285	1.710	0.076	17.955	2.850	0.126	262.200	5.130	0.227	280.440
	Exploration Wells													
	Development Wells													
Total			13.847	0.613	2.627	5.292	0.234	35.876	3.347	0.148	270.299	22.485	0.995	308.802
2032	Pipeline	19.7	3.194	0.162	0.868	1.559	0.079	6.209	0.497	0.025	8.668	5.250	0.266	15.745
	Platforms		10.083	0.512	1.593	2.022	0.103	12.398				12.106	0.614	13.991
	Production Wells		0.570	0.029	0.285	1.710	0.087	17.955	2.850	0.145	262.200	5.130	0.260	280.440
	Exploration Wells													
	Development Wells													
Total			13.847	0.703	2.746	5.292	0.269	36.562	3.347	0.170	270.868	22.485	1.141	310.176
2033	Pipeline	17.2	3.194	0.186	0.868	1.559	0.091	6.209	0.497	0.029	8.668	5.250	0.305	15.745
	Platforms		10.083	0.586	1.593	2.022	0.118	12.398				12.106	0.704	13.991
	Production Wells		0.570	0.033	0.285	1.710	0.099	17.955	2.850	0.166	262.200	5.130	0.298	280.440
	Exploration Wells													
	Development Wells													
Total			13.847	0.805	2.746	5.292	0.308	36.562	3.347	0.195	270.868	22.485	1.307	310.176

**Table 4.4.11
Arctic Spill Occurrence Beaufort Sea Sale All Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2034	Pipeline	15.1	3.194	0.211	0.868	1.559	0.103	6.209	0.497	0.033	8.668	5.250	0.348	15.745
	Platforms		10.083	0.668	1.593	2.022	0.134	12.398				12.106	0.802	13.991
	Production Wells		0.570	0.038	0.285	1.710	0.113	17.955	2.850	0.189	262.200	5.130	0.340	280.440
	Exploration Wells													
	Development Wells													
	Total		13.847	0.917	2.746	5.292	0.350	36.562	3.347	0.222	270.868	22.485	1.489	310.176
2035	Pipeline	13.2	3.194	0.242	0.868	1.559	0.118	6.209	0.497	0.038	8.668	5.250	0.398	15.745
	Platforms		10.083	0.764	1.593	2.022	0.153	12.398				12.106	0.917	13.991
	Production Wells		0.570	0.043	0.285	1.710	0.130	17.955	2.850	0.216	262.200	5.130	0.389	280.440
	Exploration Wells													
	Development Wells													
	Total		13.847	1.049	2.746	5.292	0.401	36.562	3.347	0.254	270.868	22.485	1.703	310.176
2036	Pipeline	8.3	1.854	0.223	0.509	0.920	0.111	3.657	0.294	0.035	5.144	3.068	0.370	9.310
	Platforms		6.014	0.725	0.950	1.206	0.145	7.395				7.221	0.870	8.346
	Production Wells		0.340	0.041	0.170	1.020	0.123	10.710	1.700	0.205	156.400	3.060	0.369	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	0.989	1.629	3.146	0.379	21.762	1.994	0.240	161.544	13.349	1.608	184.935
2037	Pipeline	7.3	1.854	0.254	0.509	0.920	0.126	3.657	0.294	0.040	5.144	3.068	0.420	9.310
	Platforms		6.014	0.824	0.950	1.206	0.165	7.395				7.221	0.989	8.346
	Production Wells		0.340	0.047	0.170	1.020	0.140	10.710	1.700	0.233	156.400	3.060	0.419	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	1.124	1.629	3.146	0.431	21.762	1.994	0.273	161.544	13.349	1.829	184.935
2038	Pipeline	6.5	1.854	0.285	0.509	0.920	0.142	3.657	0.294	0.045	5.144	3.068	0.472	9.310
	Platforms		6.014	0.925	0.950	1.206	0.186	7.395				7.221	1.111	8.346
	Production Wells		0.340	0.052	0.170	1.020	0.157	10.710	1.700	0.262	156.400	3.060	0.471	167.280
	Exploration Wells													
	Development Wells													
	Total		8.208	1.263	1.629	3.146	0.484	21.762	1.994	0.307	161.544	13.349	2.054	184.935

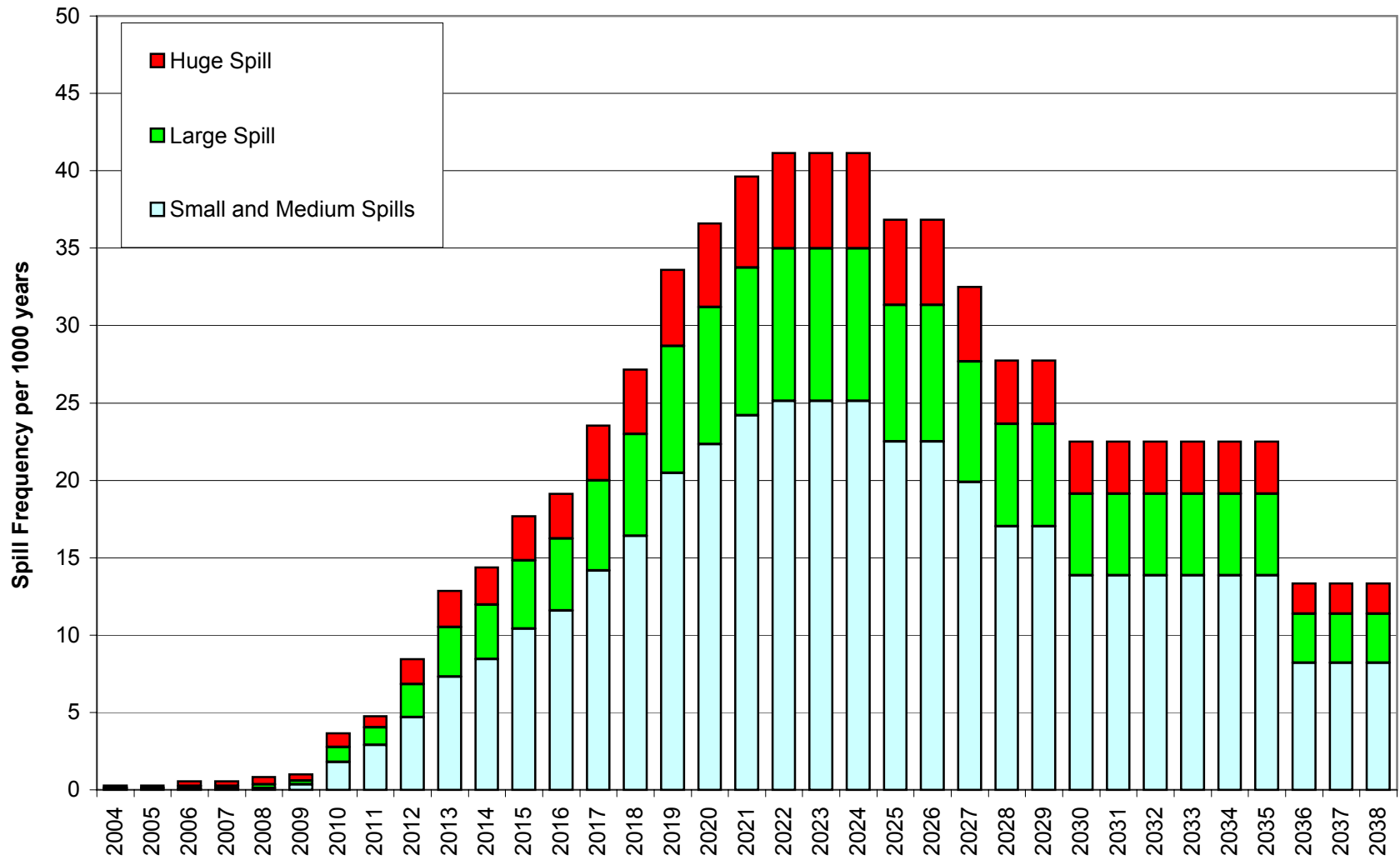
**Table 4.4.12
Arctic Spill Occurrence Beaufort Sea Sale All Annual Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
2004		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2005		0.03		0.016	0.10		0.995	0.150		12.90	0.277		13.911
2006		0.06		0.029	0.17		1.812	0.306		30.06	0.537		31.901
2007		0.06		0.032	0.19		1.990	0.300		25.80	0.553		27.822
2008		0.09		0.045	0.27		2.807	0.456		42.96	0.813		45.812
2009		0.33		0.077	0.27		2.605	0.381		36.96	0.984		39.642
2010	10.9	1.79	0.164	0.404	0.98	0.090	7.374	0.874	0.080	74.51	3.643	0.334	82.285
2011	19.9	2.89	0.145	0.570	1.13	0.057	8.002	0.743	0.037	61.45	4.767	0.240	70.019
2012	30.8	4.69	0.152	0.977	2.12	0.069	15.553	1.611	0.052	131.70	8.427	0.274	148.225
2013	50.7	7.30	0.144	1.528	3.23	0.064	22.766	2.335	0.046	193.01	12.860	0.254	217.300
2014	56.2	8.44	0.150	1.714	3.50	0.062	24.626	2.438	0.043	205.69	14.380	0.256	232.026
2015	64.2	10.41	0.162	2.181	4.40	0.069	29.675	2.865	0.045	227.67	17.681	0.275	259.522
2016	67.4	11.57	0.172	2.366	4.66	0.069	31.324	2.884	0.043	227.51	19.110	0.284	261.196
2017	77.4	14.16	0.183	2.956	5.82	0.075	38.333	3.561	0.046	273.83	23.533	0.304	315.118
2018	82.9	16.40	0.198	3.351	6.60	0.080	44.723	4.161	0.050	329.03	27.162	0.328	377.104
2019	104.6	20.46	0.196	4.239	8.21	0.079	53.775	4.906	0.047	376.47	33.582	0.321	434.488
2020	104.8	22.33	0.213	4.569	8.87	0.085	59.100	5.406	0.052	422.47	36.606	0.349	486.143
2021	98.6	24.20	0.245	4.898	9.52	0.097	64.425	5.906	0.060	468.47	39.629	0.402	537.797
2022	89.2	25.14	0.282	5.063	9.85	0.110	67.087	6.156	0.069	491.47	41.141	0.461	563.624
2023	81.4	25.14	0.309	5.063	9.85	0.121	67.087	6.156	0.076	491.47	41.141	0.505	563.624
2024	74.8	25.14	0.336	5.063	9.85	0.132	67.087	6.156	0.082	491.47	41.141	0.550	563.624
2025	62.5	22.52	0.360	4.542	8.82	0.141	59.878	5.488	0.088	436.93	36.821	0.589	501.347
2026	54.1	22.52	0.416	4.542	8.82	0.163	59.878	5.488	0.101	436.93	36.821	0.681	501.347
2027	44.6	19.90	0.446	4.021	7.78	0.175	52.669	4.819	0.108	382.38	32.502	0.729	439.069
2028	36.9	17.02	0.461	3.425	6.61	0.179	44.895	4.105	0.111	327.01	27.735	0.752	375.327
2029	32.2	17.02	0.529	3.425	6.61	0.205	44.895	4.105	0.127	327.01	27.735	0.861	375.327
2030	25.8	13.85	0.537	2.746	5.29	0.205	36.562	3.347	0.130	270.87	22.485	0.872	310.176
2031	22.6	13.85	0.613	2.627	5.29	0.234	35.876	3.347	0.148	270.30	22.485	0.995	308.802
2032	19.7	13.85	0.703	2.746	5.29	0.269	36.562	3.347	0.170	270.87	22.485	1.141	310.176
2033	17.2	13.85	0.805	2.746	5.29	0.308	36.562	3.347	0.195	270.87	22.485	1.307	310.176
2034	15.1	13.85	0.917	2.746	5.29	0.350	36.562	3.347	0.222	270.87	22.485	1.489	310.176
2035	13.2	13.85	1.049	2.746	5.29	0.401	36.562	3.347	0.254	270.87	22.485	1.703	310.176
2036	8.3	8.21	0.989	1.629	3.15	0.379	21.762	1.994	0.240	161.54	13.349	1.608	184.935
2037	7.3	8.21	1.124	1.629	3.15	0.431	21.762	1.994	0.273	161.54	13.349	1.829	184.935
2038	6.5	8.21	1.263	1.629	3.15	0.484	21.762	1.994	0.307	161.54	13.349	2.054	184.935

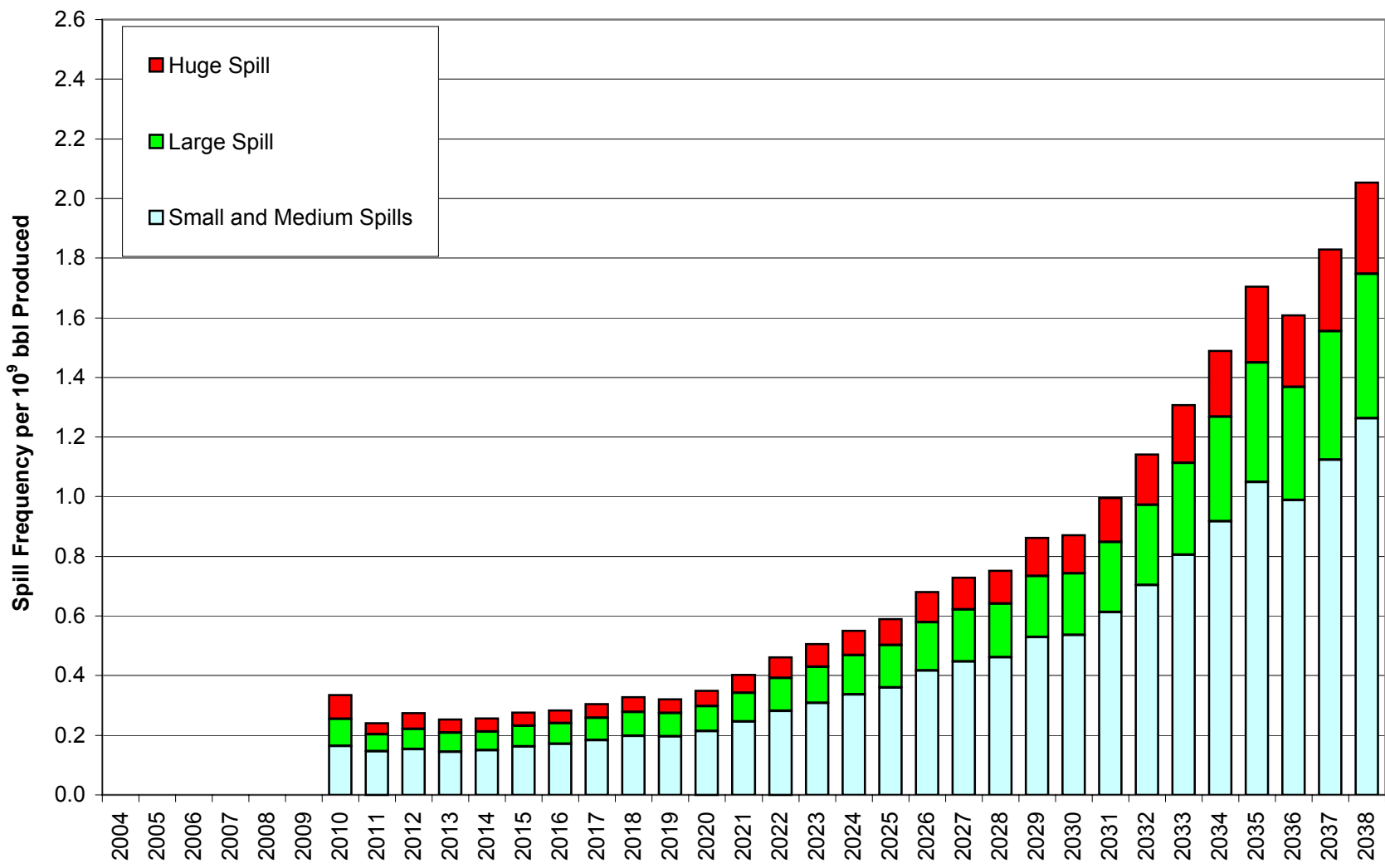
**Table 4.4.13
Arctic Spill Occurrence Beaufort Sea Sale All Wells Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
2004		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2005		0.032		0.016	0.095		0.995	0.150		12.900	0.277		13.911
2006		0.058		0.029	0.173		1.812	0.306		30.060	0.537		31.901
2007		0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2008		0.089		0.045	0.268		2.807	0.456		42.960	0.813		45.812
2009		0.073		0.036	0.218		2.285	0.381		36.960	0.672		39.281
2010	10.9	0.154	0.014	0.077	0.463	0.042	4.855	0.781	0.072	72.860	1.398	0.128	77.792
2011	19.9	0.130	0.007	0.065	0.390	0.020	4.095	0.650	0.033	59.800	1.170	0.059	63.960
2012	30.8	0.290	0.009	0.145	0.870	0.028	9.127	1.425	0.046	128.400	2.585	0.084	137.672
2013	50.7	0.397	0.008	0.199	1.192	0.024	12.508	2.009	0.040	187.240	3.598	0.071	199.947
2014	56.2	0.412	0.007	0.206	1.236	0.022	12.974	2.112	0.038	199.920	3.760	0.067	213.100
2015	64.2	0.468	0.007	0.234	1.403	0.022	14.727	2.356	0.037	218.660	4.227	0.066	233.621
2016	67.4	0.475	0.007	0.238	1.425	0.021	14.963	2.375	0.035	218.500	4.275	0.063	233.700
2017	77.4	0.572	0.007	0.286	1.715	0.022	18.005	2.850	0.037	261.300	5.137	0.066	279.591
2018	82.9	0.692	0.008	0.346	2.075	0.025	21.785	3.450	0.042	316.500	6.217	0.075	338.631
2019	104.6	0.780	0.007	0.390	2.340	0.022	24.570	3.900	0.037	358.800	7.020	0.067	383.760
2020	104.8	0.880	0.008	0.440	2.640	0.025	27.720	4.400	0.042	404.800	7.920	0.076	432.960
2021	98.6	0.980	0.010	0.490	2.940	0.030	30.870	4.900	0.050	450.800	8.820	0.089	482.160
2022	89.2	1.030	0.012	0.515	3.090	0.035	32.445	5.150	0.058	473.800	9.270	0.104	506.760
2023	81.4	1.030	0.013	0.515	3.090	0.038	32.445	5.150	0.063	473.800	9.270	0.114	506.760
2024	74.8	1.030	0.014	0.515	3.090	0.041	32.445	5.150	0.069	473.800	9.270	0.124	506.760
2025	62.5	0.915	0.015	0.458	2.745	0.044	28.823	4.575	0.073	420.900	8.235	0.132	450.180
2026	54.1	0.915	0.017	0.458	2.745	0.051	28.823	4.575	0.085	420.900	8.235	0.152	450.180
2027	44.6	0.800	0.018	0.400	2.400	0.054	25.200	4.000	0.090	368.000	7.200	0.161	393.600
2028	36.9	0.685	0.019	0.343	2.055	0.056	21.578	3.425	0.093	315.100	6.165	0.167	337.020
2029	32.2	0.685	0.021	0.343	2.055	0.064	21.578	3.425	0.106	315.100	6.165	0.191	337.020
2030	25.8	0.570	0.022	0.285	1.710	0.066	17.955	2.850	0.110	262.200	5.130	0.199	280.440
2031	22.6	0.570	0.025	0.285	1.710	0.076	17.955	2.850	0.126	262.200	5.130	0.227	280.440
2032	19.7	0.570	0.029	0.285	1.710	0.087	17.955	2.850	0.145	262.200	5.130	0.260	280.440
2033	17.2	0.570	0.033	0.285	1.710	0.099	17.955	2.850	0.166	262.200	5.130	0.298	280.440
2034	15.1	0.570	0.038	0.285	1.710	0.113	17.955	2.850	0.189	262.200	5.130	0.340	280.440
2035	13.2	0.570	0.043	0.285	1.710	0.130	17.955	2.850	0.216	262.200	5.130	0.389	280.440
2036	8.3	0.340	0.041	0.170	1.020	0.123	10.710	1.700	0.205	156.400	3.060	0.369	167.280
2037	7.3	0.340	0.047	0.170	1.020	0.140	10.710	1.700	0.233	156.400	3.060	0.419	167.280
2038	6.5	0.340	0.052	0.170	1.020	0.157	10.710	1.700	0.262	156.400	3.060	0.471	167.280

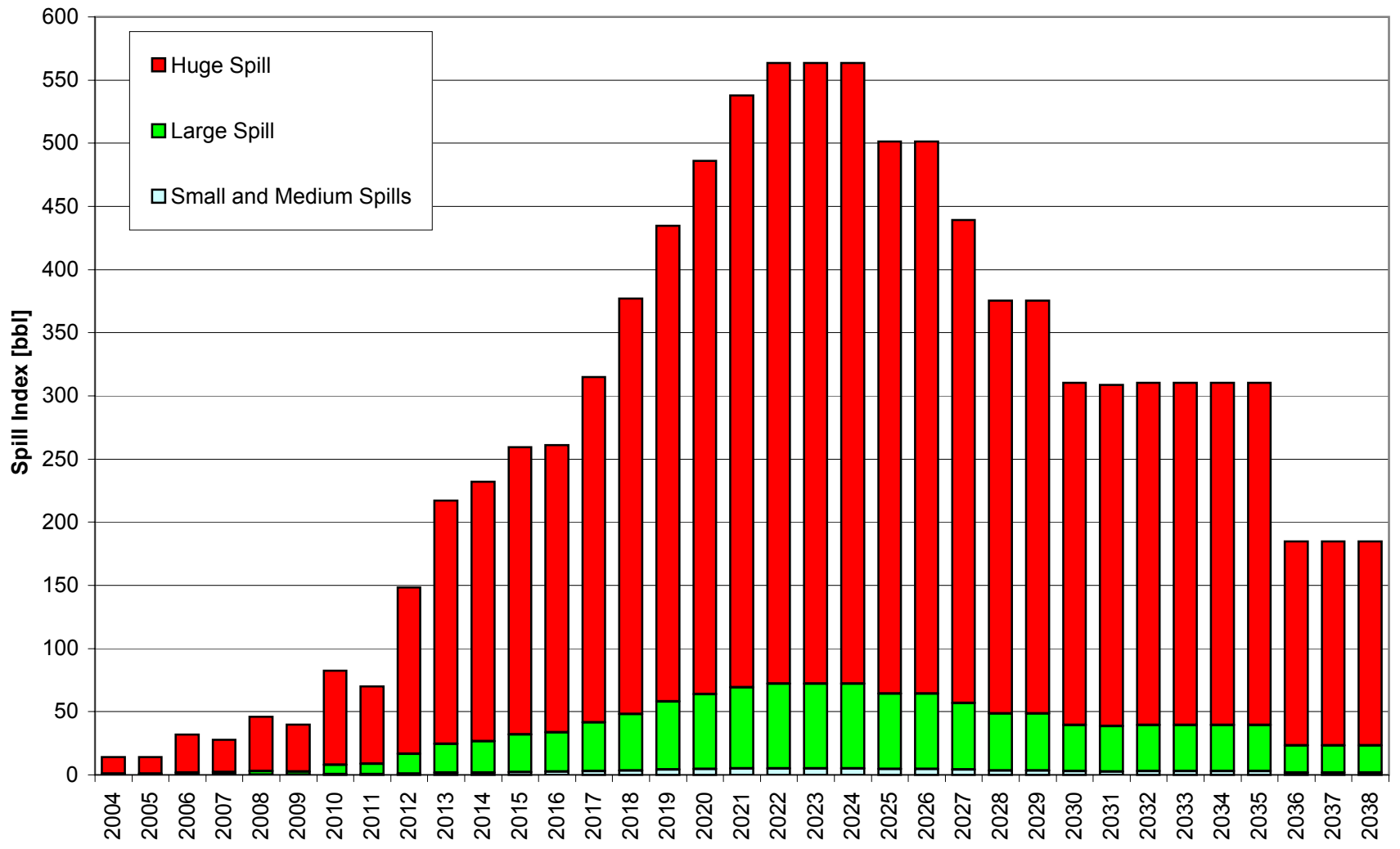
Beaufort Sea Sale All Spill Frequency



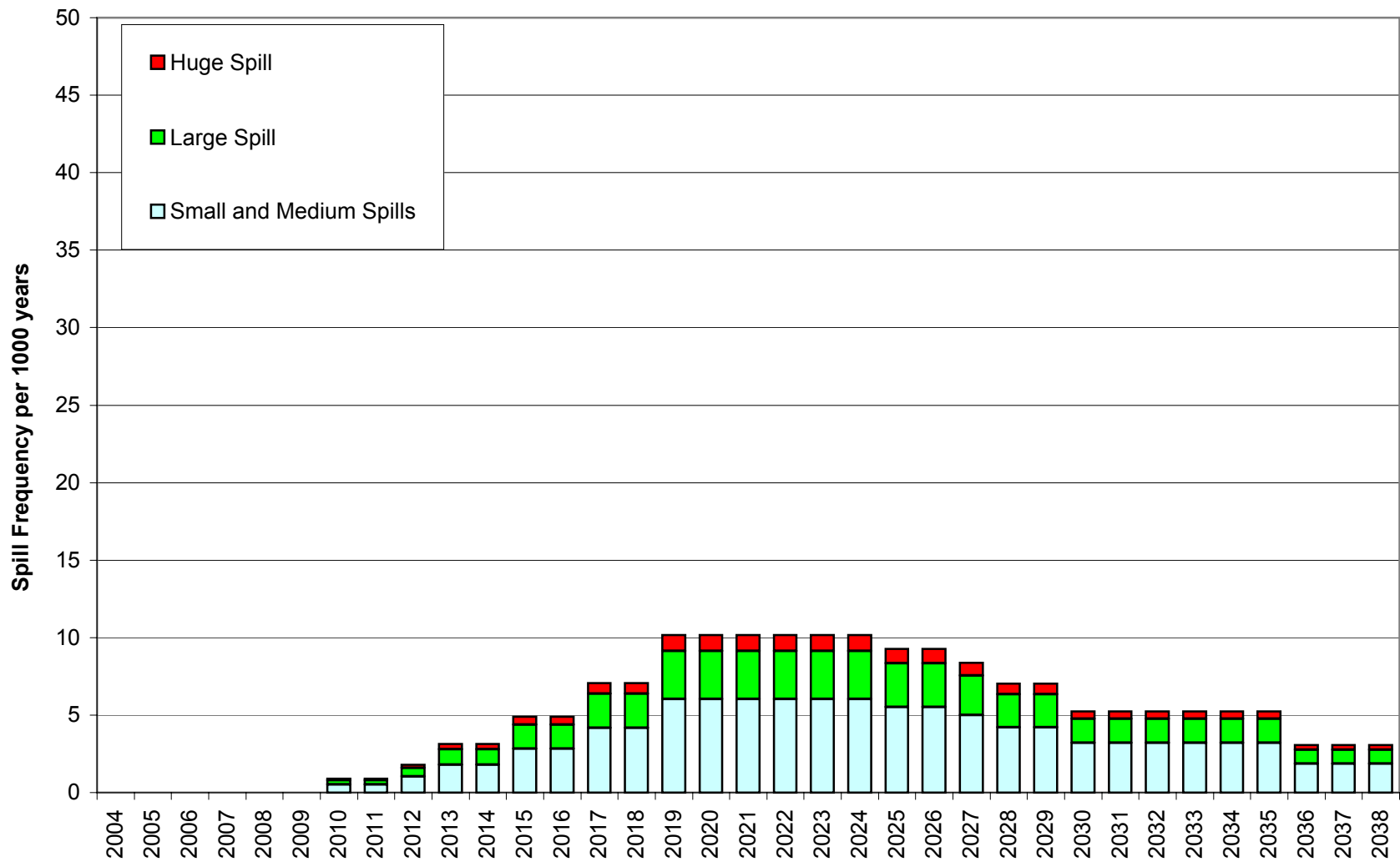
Beaufort Sea Sale All Spill Frequency per 10⁹ bbl Produced



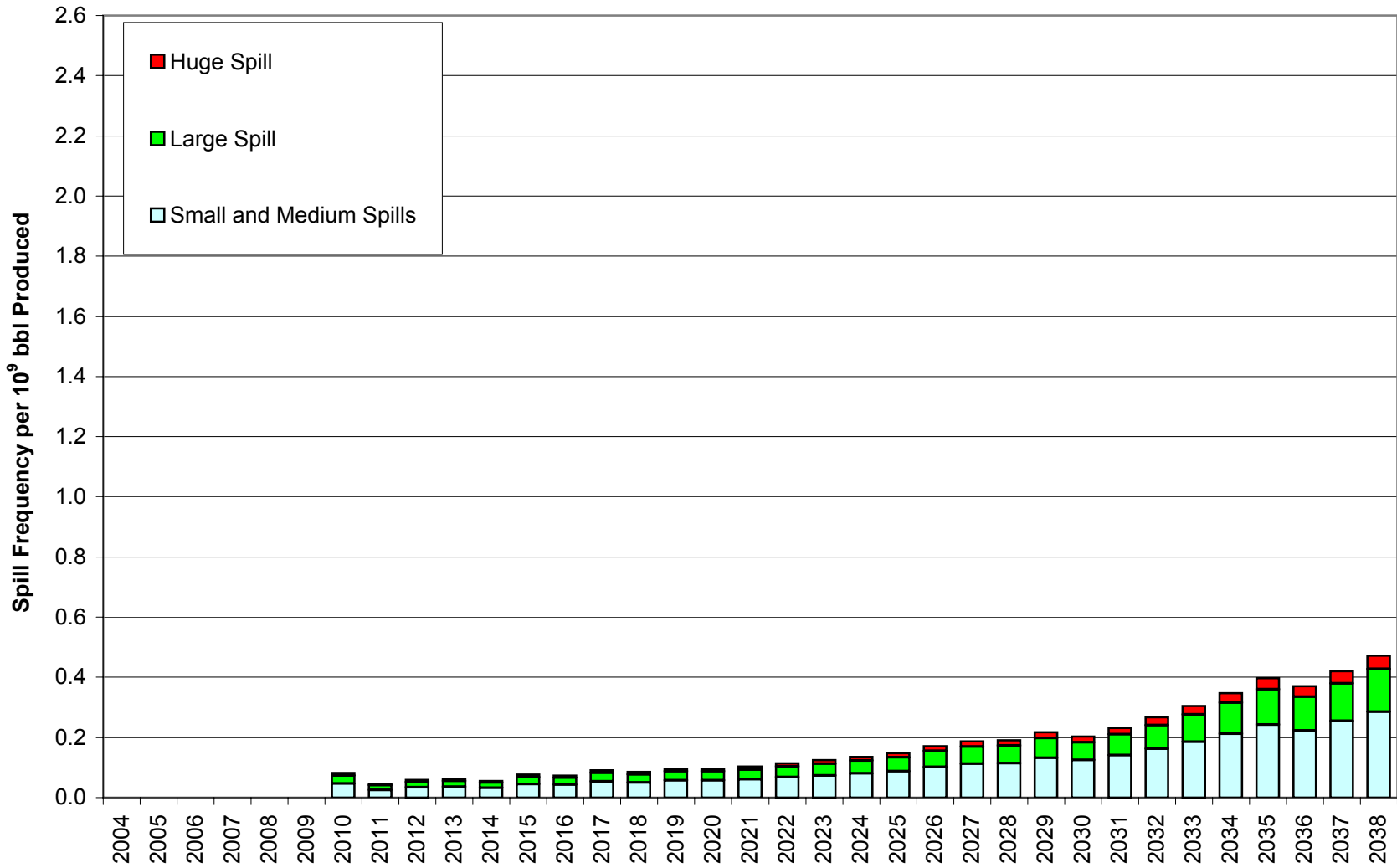
Beaufort Sea Sale All Spill Index



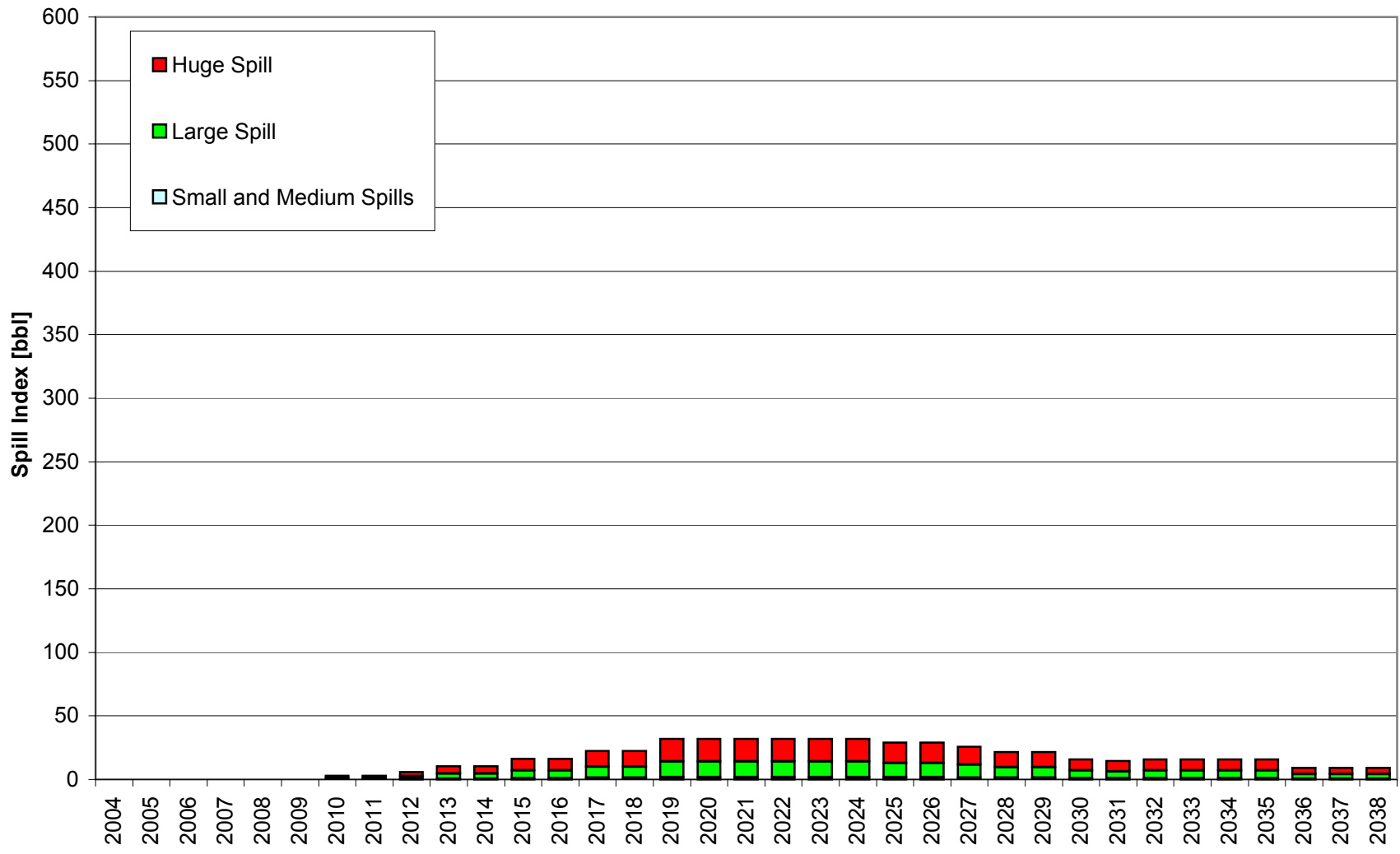
Beaufort Sea Sale All Spill Frequency - P/L



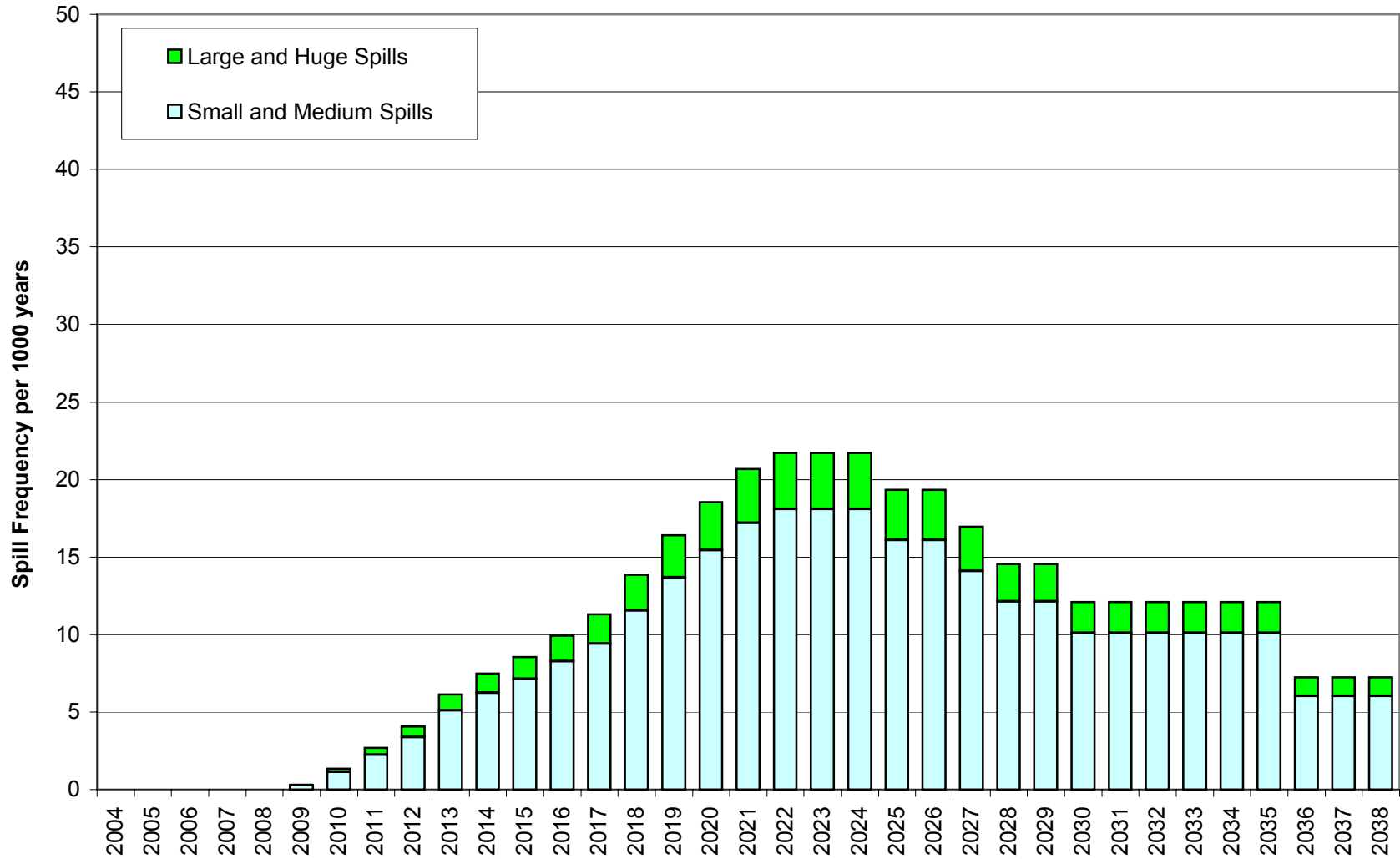
Beaufort Sea Sale All Spill Frequency per 10⁹ bbl Produced - P/L



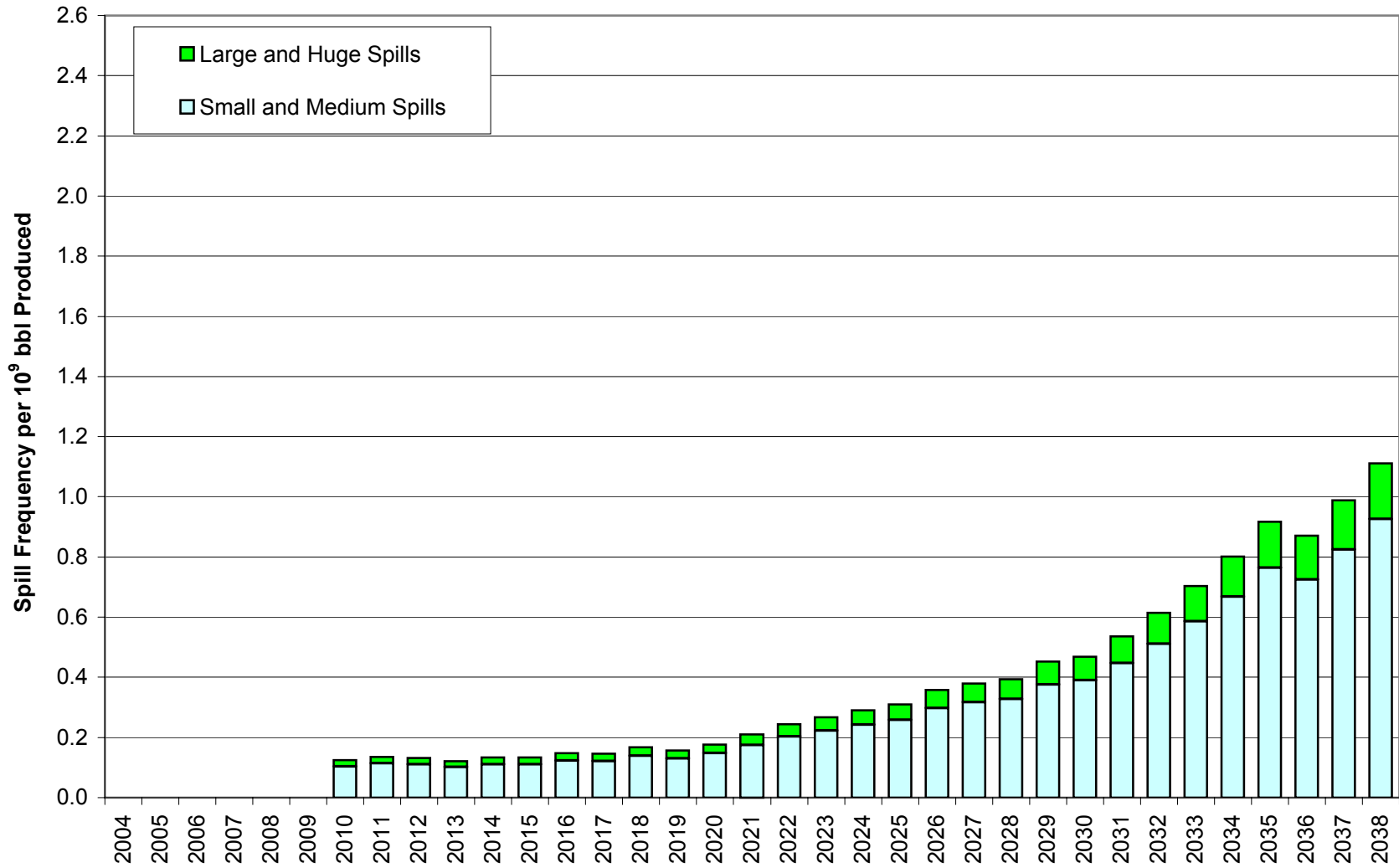
Beaufort Sea Sale All Spill Index - P/L



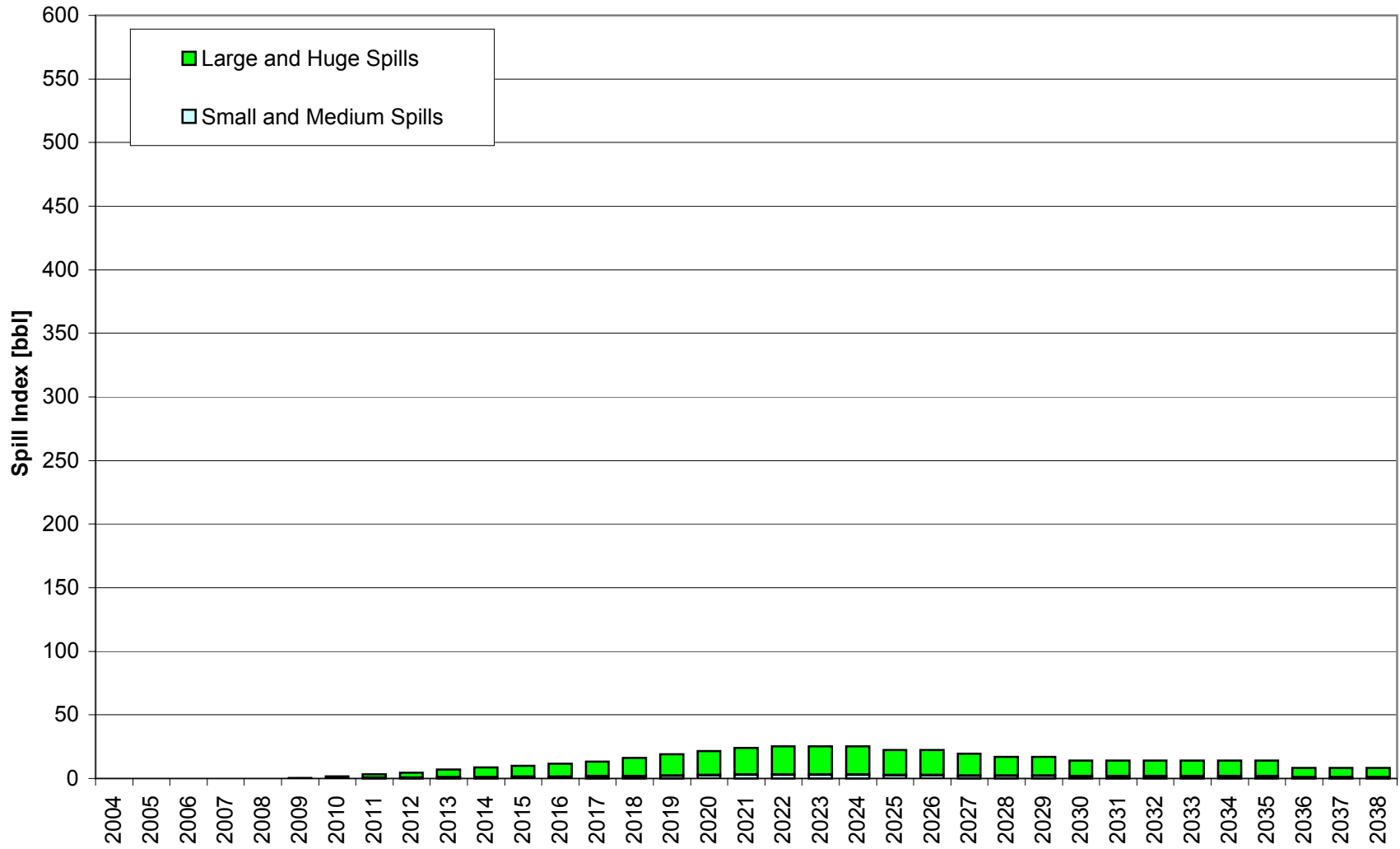
Beaufort Sea Sale All Spill Frequency - Platforms



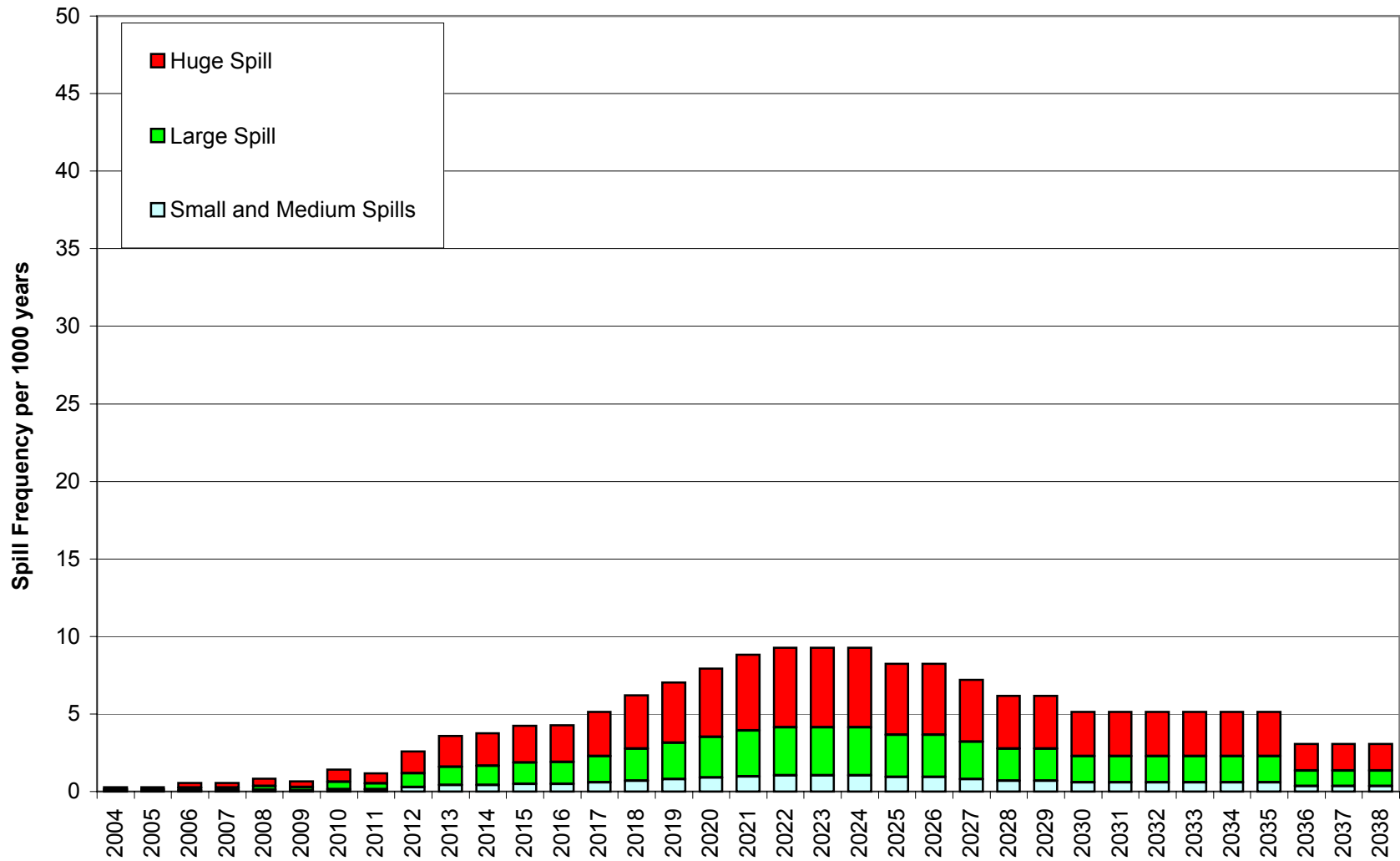
Beaufort Sea Sale All Spill Frequency per 10⁹ bbl Produced - Platforms



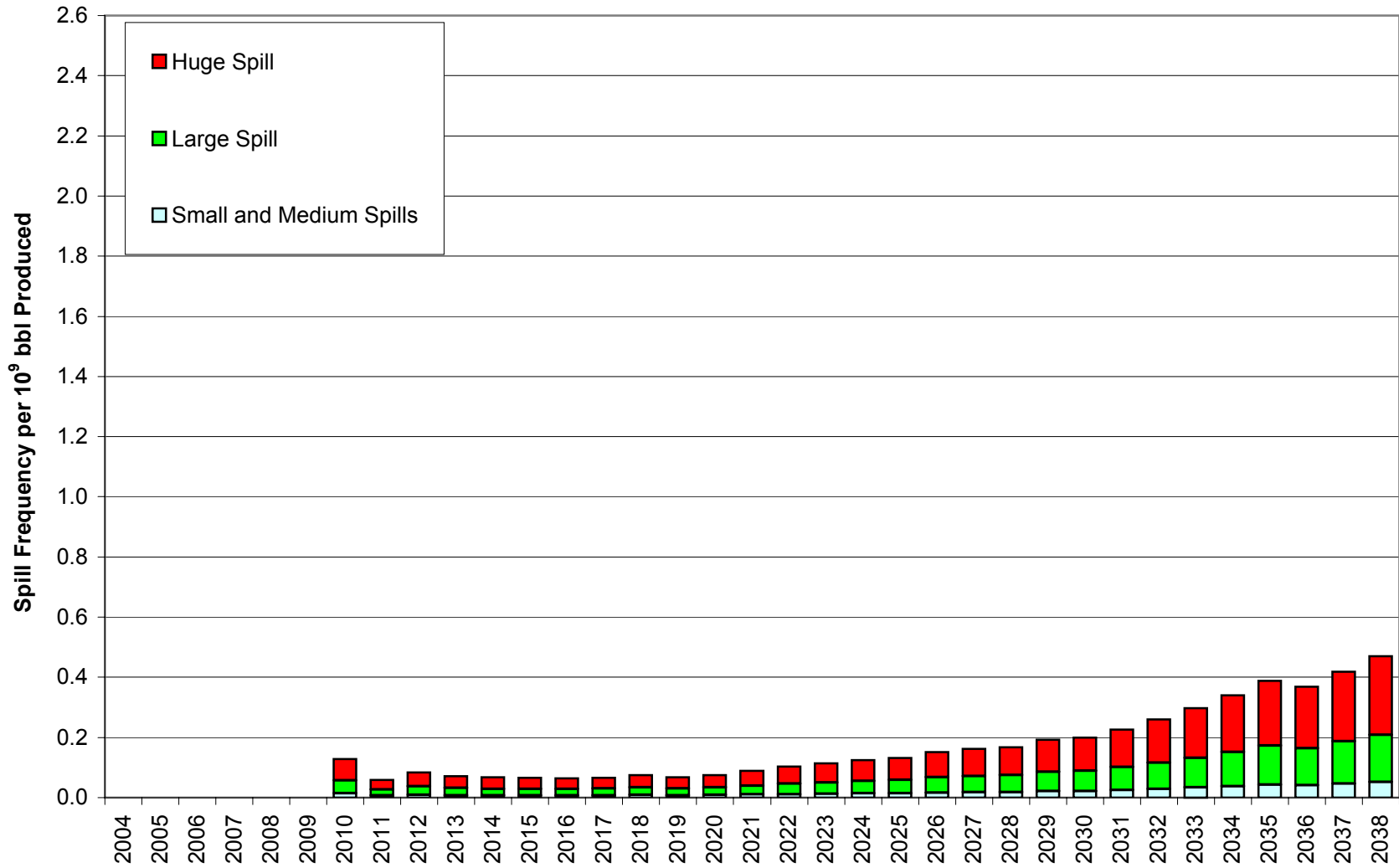
Beaufort Sea Sale All Spill Index - Platforms



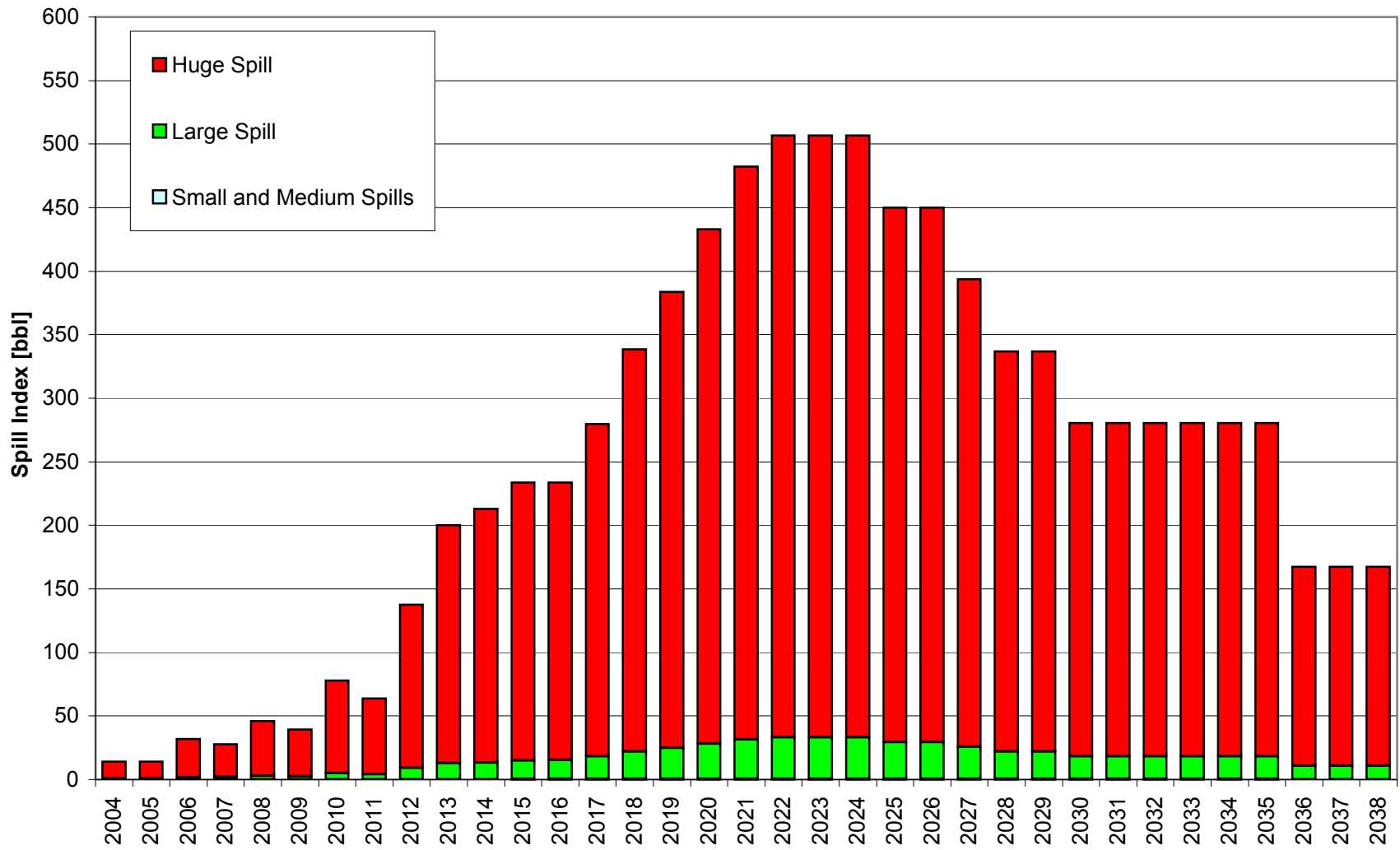
Beaufort Sea Sale All Spill Frequency - Wells



Beaufort Sea Sale All Spill Frequency per 10⁹ bbl Produced - Wells



Beaufort Sea Sale All Spill Index - Wells



**Table 4.5.1
Arctic Spill Occurrence Chukchi Sea BC P/L**

17705
Spill Index bbl
0.82
9.55
20.80
31.18
0.82
9.55
20.80
31.18
0.82
9.55
20.80
31.18
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0.82
9.55
20.80
31.18
0.82
9.55
20.80
31.18

**Table 4.5.2
Arctic Spill Occurrence Chukchi Sea BC P/L Summary**

Year	Production [MMbbl]	Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0																		
1999	0	2.968		0.172	7.383		2.857	10.351		3.029	5.314		20.894	1.761		31.180	17.426		55.103
2000	0	2.968		0.172	7.383		2.857	10.351		3.029	5.314		20.894	1.761		31.180	17.426		55.103
2001	0	2.968		0.172	7.383		2.857	10.351		3.029	5.314		20.894	1.761		31.180	17.426		55.103
2002	101	2.968	0.029	0.172	7.383	0.073	2.857	10.351	0.102	3.029	5.314	0.053	20.894	1.761	0.017	31.180	17.426	0.173	55.103
2003	135	2.968	0.022	0.172	7.383	0.055	2.857	10.351	0.077	3.029	5.314	0.039	20.894	1.761	0.013	31.180	17.426	0.129	55.103
2004	135	2.968	0.022	0.172	7.383	0.055	2.857	10.351	0.077	3.029	5.314	0.039	20.894	1.761	0.013	31.180	17.426	0.129	55.103
2005	135	2.968	0.022	0.172	7.383	0.055	2.857	10.351	0.077	3.029	5.314	0.039	20.894	1.761	0.013	31.180	17.426	0.129	55.103
2006	135	2.968	0.022	0.172	7.383	0.055	2.857	10.351	0.077	3.029	5.314	0.039	20.894	1.761	0.013	31.180	17.426	0.129	55.103
2007	135	2.968	0.022	0.172	7.383	0.055	2.857	10.351	0.077	3.029	5.314	0.039	20.894	1.761	0.013	31.180	17.426	0.129	55.103
2008	119	2.968	0.025	0.172	7.383	0.062	2.857	10.351	0.087	3.029	5.314	0.045	20.894	1.761	0.015	31.180	17.426	0.146	55.103
2009	103	2.968	0.029	0.172	7.383	0.072	2.857	10.351	0.100	3.029	5.314	0.052	20.894	1.761	0.017	31.180	17.426	0.169	55.103
2010	92	2.968	0.032	0.172	7.383	0.080	2.857	10.351	0.113	3.029	5.314	0.058	20.894	1.761	0.019	31.180	17.426	0.189	55.103

**Table 4.5.3
Arctic Spill Occurrence Chukchi Sea BC Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
1999	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2000	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	2	8	0.913	0.730	0.12	0.182	0.146	0.89
	Total	2	8		0.730	0.12		0.146	0.89
2001	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	4	48	0.913	4.380	0.69	0.182	0.875	5.37
	Total	4	48		4.380	0.69		0.875	5.37
2002	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	6	108	0.913	9.855	1.56	0.182	1.970	12.07
	Total	6	108		9.855	1.56		1.970	12.07
2003	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	6	188	0.913	17.156	2.71	0.182	3.428	21.02
	Total	6	188		17.156	2.71		3.428	21.02
2004	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	6	214	0.913	19.528	3.09	0.182	3.903	23.92
	Total	6	214		19.528	3.09		3.903	23.92
2005	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	6	214	0.913	19.528	3.09	0.182	3.903	23.92
	Total	6	214		19.528	3.09		3.903	23.92
2006	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	6	214	0.913	19.528	3.09	0.182	3.903	23.92
	Total	6	214		19.528	3.09		3.903	23.92
2007	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	6	214	0.913	19.528	3.09	0.182	3.903	23.92
	Total	6	214		19.528	3.09		3.903	23.92
2008	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	6	214	0.913	19.528	3.09	0.182	3.903	23.92
	Total	6	214		19.528	3.09		3.903	23.92
2009	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	6	214	0.913	19.528	3.09	0.182	3.903	23.92
	Total	6	214		19.528	3.09		3.903	23.92
2010	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	6	214	0.913	19.528	3.09	0.182	3.903	23.92
	Total	6	214		19.528	3.09		3.903	23.92

**Table 4.5.4
Arctic Spill Occurrence Chukchi Sea BC Platforms Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0									
1999	0									
2000	0	0.730		0.115	0.146		0.894	0.876		1.010
2001	0	4.380		0.692	0.875		5.366	5.255		6.058
2002	101	9.855	0.098	1.557	1.970	0.020	12.073	11.825	0.117	13.630
2003	135	17.156	0.127	2.711	3.428	0.025	21.016	20.584	0.152	23.727
2004	135	19.528	0.145	3.085	3.903	0.029	23.923	23.431	0.174	27.008
2005	135	19.528	0.145	3.085	3.903	0.029	23.923	23.431	0.174	27.008
2006	135	19.528	0.145	3.085	3.903	0.029	23.923	23.431	0.174	27.008
2007	135	19.528	0.145	3.085	3.903	0.029	23.923	23.431	0.174	27.008
2008	119	19.528	0.164	3.085	3.903	0.033	23.923	23.431	0.197	27.008
2009	103	19.528	0.190	3.085	3.903	0.038	23.923	23.431	0.227	27.008
2010	92	19.528	0.212	3.085	3.903	0.042	23.923	23.431	0.255	27.008

**Table 4.5.5
Arctic Spill Occurrence Chukchi Sea BC Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
1999	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2000	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	8	0.500	0.040	0.02	3.500	0.280	1.26	1.500	0.120	2.40	1.000	0.080	16.00
	Total	8		0.040	0.02		0.280	1.26		0.120	2.40		0.080	16.00
2001	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	48	0.500	0.240	0.12	3.500	1.680	7.56	1.500	0.720	14.40	1.000	0.480	96.00
	Total	48		0.240	0.12		1.680	7.56		0.720	14.40		0.480	96.00
2002	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	108	0.500	0.540	0.27	3.500	3.780	17.01	1.500	1.620	32.40	1.000	1.080	216.00
	Total	108		0.540	0.27		3.780	17.01		1.620	32.40		1.080	216.00
2003	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	188	0.500	0.940	0.47	3.500	6.580	29.61	1.500	2.820	56.40	1.000	1.880	376.00
	Total	188		0.940	0.47		6.580	29.61		2.820	56.40		1.880	376.00
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	214	0.500	1.070	0.54	3.500	7.490	33.71	1.500	3.210	64.20	1.000	2.140	428.00
	Total	214		1.070	0.54		7.490	33.71		3.210	64.20		2.140	428.00
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	214	0.500	1.070	0.54	3.500	7.490	33.71	1.500	3.210	64.20	1.000	2.140	428.00
	Total	214		1.070	0.54		7.490	33.71		3.210	64.20		2.140	428.00
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	214	0.500	1.070	0.54	3.500	7.490	33.71	1.500	3.210	64.20	1.000	2.140	428.00
	Total	214		1.070	0.54		7.490	33.71		3.210	64.20		2.140	428.00
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	214	0.500	1.070	0.54	3.500	7.490	33.71	1.500	3.210	64.20	1.000	2.140	428.00
	Total	214		1.070	0.54		7.490	33.71		3.210	64.20		2.140	428.00
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	214	0.500	1.070	0.54	3.500	7.490	33.71	1.500	3.210	64.20	1.000	2.140	428.00
	Total	214		1.070	0.54		7.490	33.71		3.210	64.20		2.140	428.00
2009	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	214	0.500	1.070	0.54	3.500	7.490	33.71	1.500	3.210	64.20	1.000	2.140	428.00
	Total	214		1.070	0.54		7.490	33.71		3.210	64.20		2.140	428.00
2010	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	214	0.500	1.070	0.54	3.500	7.490	33.71	1.500	3.210	64.20	1.000	2.140	428.00
	Total	214		1.070	0.54		7.490	33.71		3.210	64.20		2.140	428.00

Table 4.5.6

Arctic Spill Occurrence Chukchi Sea BC Production Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ³ bbl Produced	Spill Index [bbl]
1998	0												
1999	0												
2000	0	0.040		0.020	0.120		1.260	0.200		18.400	0.360		19.680
2001	0	0.240		0.120	0.720		7.560	1.200		110.400	2.160		118.080
2002	101	0.540	0.005	0.270	1.620	0.016	17.010	2.700	0.027	248.400	4.860	0.048	265.680
2003	135	0.940	0.007	0.470	2.820	0.021	29.610	4.700	0.035	432.400	8.460	0.063	462.480
2004	135	1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
2005	135	1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
2006	135	1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
2007	135	1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
2008	119	1.070	0.009	0.535	3.210	0.027	33.705	5.350	0.045	492.200	9.630	0.081	526.440
2009	103	1.070	0.010	0.535	3.210	0.031	33.705	5.350	0.052	492.200	9.630	0.093	526.440
2010	92	1.070	0.012	0.535	3.210	0.035	33.705	5.350	0.058	492.200	9.630	0.105	526.440

**Table 4.5.7
Arctic Spill Occurrence Chukchi Sea BC Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
1999	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2000	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2001	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2002	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2003	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2004	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2005	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2006	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2007	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2008	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2010	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.5.8

Arctic Spill Occurrence Chukchi Sea BC Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0	0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
1999	0												
2000	0												
2001	0												
2002	101												
2003	135												
2004	135												
2005	135												
2006	135												
2007	135												
2008	119												
2009	103												
2010	92												

**Table 4.5.9
Arctic Spill Occurrence Chukchi Sea BC Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep	2	1.300	0.026	0.01	9.080	0.182	0.82	3.900	0.078	1.56	3.900	0.078	15.60
	Total	2		0.026	0.01		0.182	0.82		0.078	1.56		0.078	15.60
1999	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2000	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2001	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2002	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2003	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2009	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.5.10

Arctic Spill Occurrence Chukchi Sea BC Development Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0	0.026		0.013	0.078		0.817	0.156		17.160	0.260		17.990
1999	0												
2000	0												
2001	0												
2002	101												
2003	135												
2004	135												
2005	135												
2006	135												
2007	135												
2008	119												
2009	103												
2010	92												

**Table 4.5.11
Arctic Spill Occurrence Chukchi Sea BC Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]
1998	Pipeline	0												
	Platforms													
	Production Wells													
	Exploration Wells		0.063	0.032	0.190	1.990	0.300		25.800	0.553		27.822		
	Development Wells		0.026	0.013	0.078	0.817	0.156		17.160	0.260		17.990		
Total	0.089	0.045	0.268	2.807	0.456		42.960	0.813		45.812				
1999	Pipeline	0	10.351	3.029	5.314	20.894	1.761		31.180	17.426	55.103			
	Platforms													
	Production Wells													
	Exploration Wells													
	Development Wells													
Total	10.351	3.029	5.314	20.894	1.761		31.180	17.426		55.103				
2000	Pipeline	0	10.351	3.029	5.314	20.894	1.761		31.180	17.426	55.103			
	Platforms		4.380	0.115	0.146	0.894			0.876		1.010			
	Production Wells		0.040	0.020	0.120	1.260	0.200		18.400	0.360	19.680			
	Exploration Wells													
	Development Wells													
Total	11.121	3.165	5.580	23.048	1.961		49.580	18.662		75.793				
2001	Pipeline	0	10.351	3.029	5.314	20.894	1.761		31.180	17.426	55.103			
	Platforms		4.380	0.692	0.875	5.366			5.255		6.058			
	Production Wells		0.240	0.120	0.720	7.560	1.200		110.400	2.160	118.080			
	Exploration Wells													
	Development Wells													
Total	14.971	3.841	6.909	33.820	2.961		141.580	24.841		179.241				
2002	Pipeline	101.0	10.351	0.102	3.029	5.314	0.053	20.894	1.761	0.017	31.180	17.426	0.173	55.103
	Platforms		9.855	0.098	1.557	1.970	0.020	12.073				11.825	0.117	13.630
	Production Wells		0.540	0.005	0.270	1.620	0.016	17.010	2.700	0.027	248.400	4.860	0.048	265.680
	Exploration Wells													
	Development Wells													
Total	20.746	0.205	4.857	8.903	0.088	49.977	4.461	0.044	279.580	34.110	0.338	334.413		
2003	Pipeline	135.0	10.351	0.077	3.029	5.314	0.039	20.894	1.761	0.013	31.180	17.426	0.129	55.103
	Platforms		17.156	0.127	2.711	3.428	0.025	21.016				20.584	0.152	23.727
	Production Wells		0.940	0.007	0.470	2.820	0.021	29.610	4.700	0.035	432.400	8.460	0.063	462.480
	Exploration Wells													
	Development Wells													
Total	28.446	0.211	6.210	11.562	0.086	71.520	6.461	0.048	463.580	46.470	0.344	541.310		
2004	Pipeline	135.0	10.351	0.077	3.029	5.314	0.039	20.894	1.761	0.013	31.180	17.426	0.129	55.103
	Platforms		19.528	0.145	3.085	3.903	0.029	23.923				23.431	0.174	27.008
	Production Wells		1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
	Exploration Wells													
	Development Wells													
Total	30.949	0.229	6.650	12.426	0.092	78.521	7.111	0.053	523.380	50.486	0.374	608.551		
2005	Pipeline	135.0	10.351	0.077	3.029	5.314	0.039	20.894	1.761	0.013	31.180	17.426	0.129	55.103
	Platforms		19.528	0.145	3.085	3.903	0.029	23.923				23.431	0.174	27.008
	Production Wells		1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
	Exploration Wells													
	Development Wells													
Total	30.949	0.229	6.650	12.426	0.092	78.521	7.111	0.053	523.380	50.486	0.374	608.551		
2006	Pipeline	135.0	10.351	0.077	3.029	5.314	0.039	20.894	1.761	0.013	31.180	17.426	0.129	55.103
	Platforms		19.528	0.145	3.085	3.903	0.029	23.923				23.431	0.174	27.008
	Production Wells		1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
	Exploration Wells													
	Development Wells													
Total	30.949	0.229	6.650	12.426	0.092	78.521	7.111	0.053	523.380	50.486	0.374	608.551		
2007	Pipeline	135.0	10.351	0.077	3.029	5.314	0.039	20.894	1.761	0.013	31.180	17.426	0.129	55.103
	Platforms		19.528	0.145	3.085	3.903	0.029	23.923				23.431	0.174	27.008
	Production Wells		1.070	0.008	0.535	3.210	0.024	33.705	5.350	0.040	492.200	9.630	0.071	526.440
	Exploration Wells													
	Development Wells													
Total	30.949	0.229	6.650	12.426	0.092	78.521	7.111	0.053	523.380	50.486	0.374	608.551		

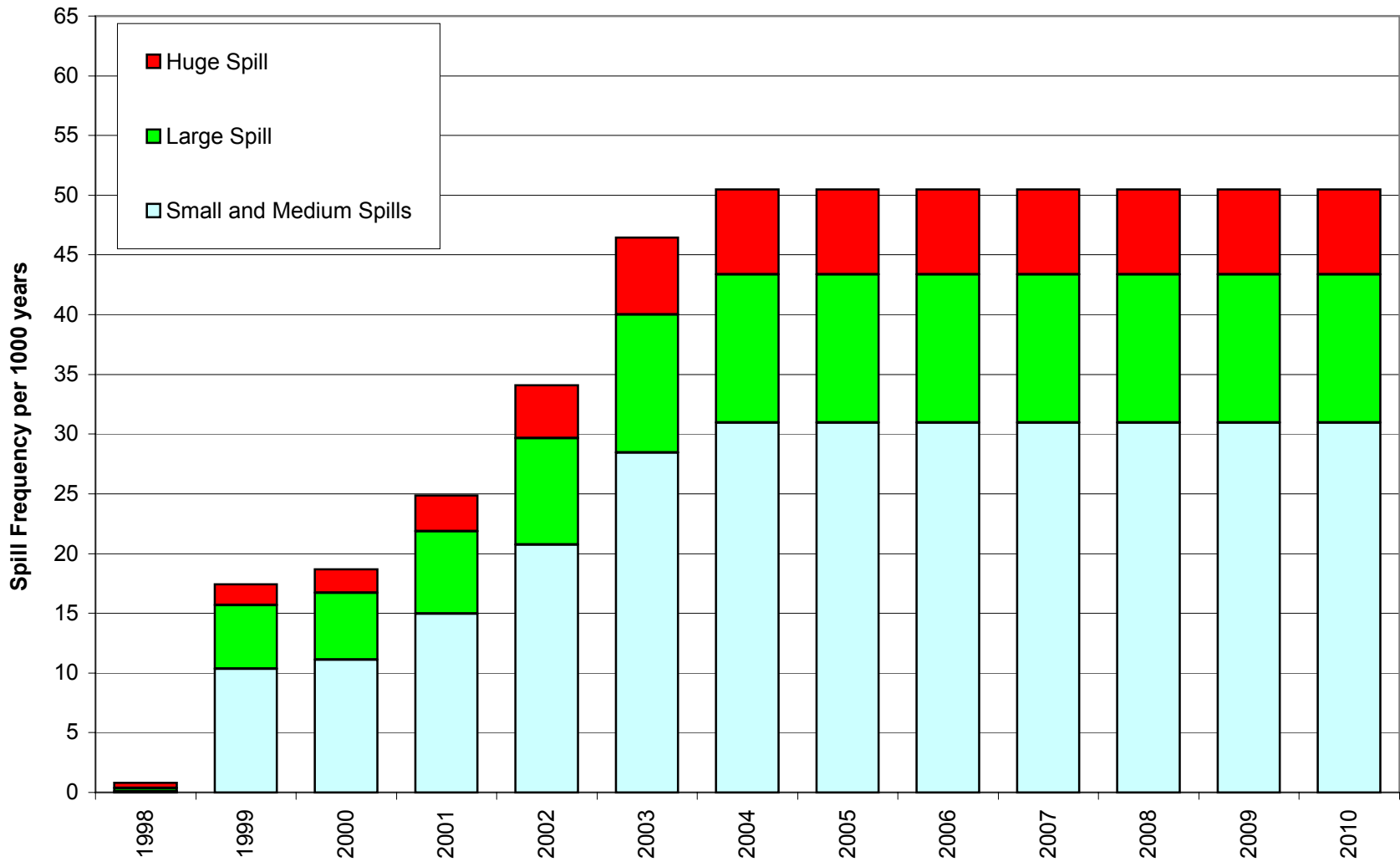
**Table 4.5.11
Arctic Spill Occurrence Chukchi Sea BC Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]
2008	Pipeline	119.0	10.351	0.087	3.029	5.314	0.045	20.894	1.761	0.015	31.180	17.426	0.146	55.103
	Platforms		19.528	0.164	3.085	3.903	0.033	23.923				23.431	0.197	27.008
	Production Wells		1.070	0.009	0.535	3.210	0.027	33.705	5.350	0.045	492.200	9.630	0.081	526.440
	Exploration Wells													
	Development Wells													
	Total		30.949	0.260	6.650	12.426	0.104	78.521	7.111	0.060	523.380	50.486	0.424	608.551
2009	Pipeline	103.0	10.351	0.100	3.029	5.314	0.052	20.894	1.761	0.017	31.180	17.426	0.169	55.103
	Platforms		19.528	0.190	3.085	3.903	0.038	23.923				23.431	0.227	27.008
	Production Wells		1.070	0.010	0.535	3.210	0.031	33.705	5.350	0.052	492.200	9.630	0.093	526.440
	Exploration Wells													
	Development Wells													
	Total		30.949	0.300	6.650	12.426	0.121	78.521	7.111	0.069	523.380	50.486	0.490	608.551
2010	Pipeline	92.0	10.351	0.113	3.029	5.314	0.058	20.894	1.761	0.019	31.180	17.426	0.189	55.103
	Platforms		19.528	0.212	3.085	3.903	0.042	23.923				23.431	0.255	27.008
	Production Wells		1.070	0.012	0.535	3.210	0.035	33.705	5.350	0.058	492.200	9.630	0.105	526.440
	Exploration Wells													
	Development Wells													
	Total		30.949	0.336	6.650	12.426	0.135	78.521	7.111	0.077	523.380	50.486	0.549	608.551

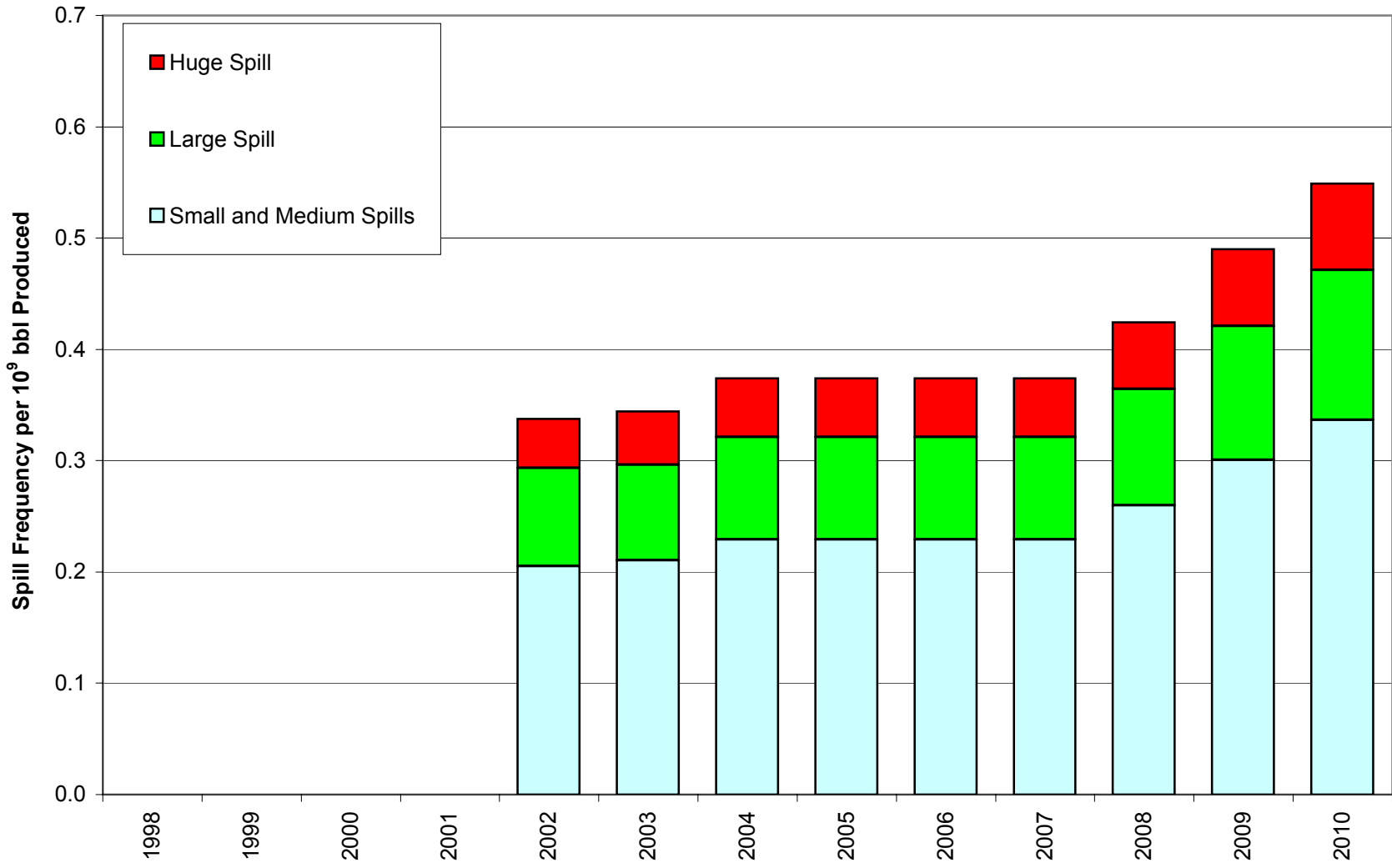
**Table 4.5.12
Arctic Spill Occurrence Chukchi Sea BC Annual Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
1998	0	0.09		0.045	0.27		2.807	0.456		42.96	0.813		45.812
1999	0	10.35		3.029	5.31		20.894	1.761		31.18	17.426		55.103
2000	0	11.12		3.165	5.58		23.048	1.961		49.58	18.662		75.793
2001	0	14.97		3.841	6.91		33.820	2.961		141.58	24.841		179.241
2002	101.0	20.75	0.205	4.857	8.90	0.088	49.977	4.461	0.044	279.58	34.110	0.338	334.413
2003	135.0	28.45	0.211	6.210	11.56	0.086	71.520	6.461	0.048	463.58	46.470	0.344	541.310
2004	135.0	30.95	0.229	6.650	12.43	0.092	78.521	7.111	0.053	523.38	50.486	0.374	608.551
2005	135.0	30.95	0.229	6.650	12.43	0.092	78.521	7.111	0.053	523.38	50.486	0.374	608.551
2006	135.0	30.95	0.229	6.650	12.43	0.092	78.521	7.111	0.053	523.38	50.486	0.374	608.551
2007	135.0	30.95	0.229	6.650	12.43	0.092	78.521	7.111	0.053	523.38	50.486	0.374	608.551
2008	119.0	30.95	0.260	6.650	12.43	0.104	78.521	7.111	0.060	523.38	50.486	0.424	608.551
2009	103.0	30.95	0.300	6.650	12.43	0.121	78.521	7.111	0.069	523.38	50.486	0.490	608.551
2010	92.0	30.95	0.336	6.650	12.43	0.135	78.521	7.111	0.077	523.38	50.486	0.549	608.551

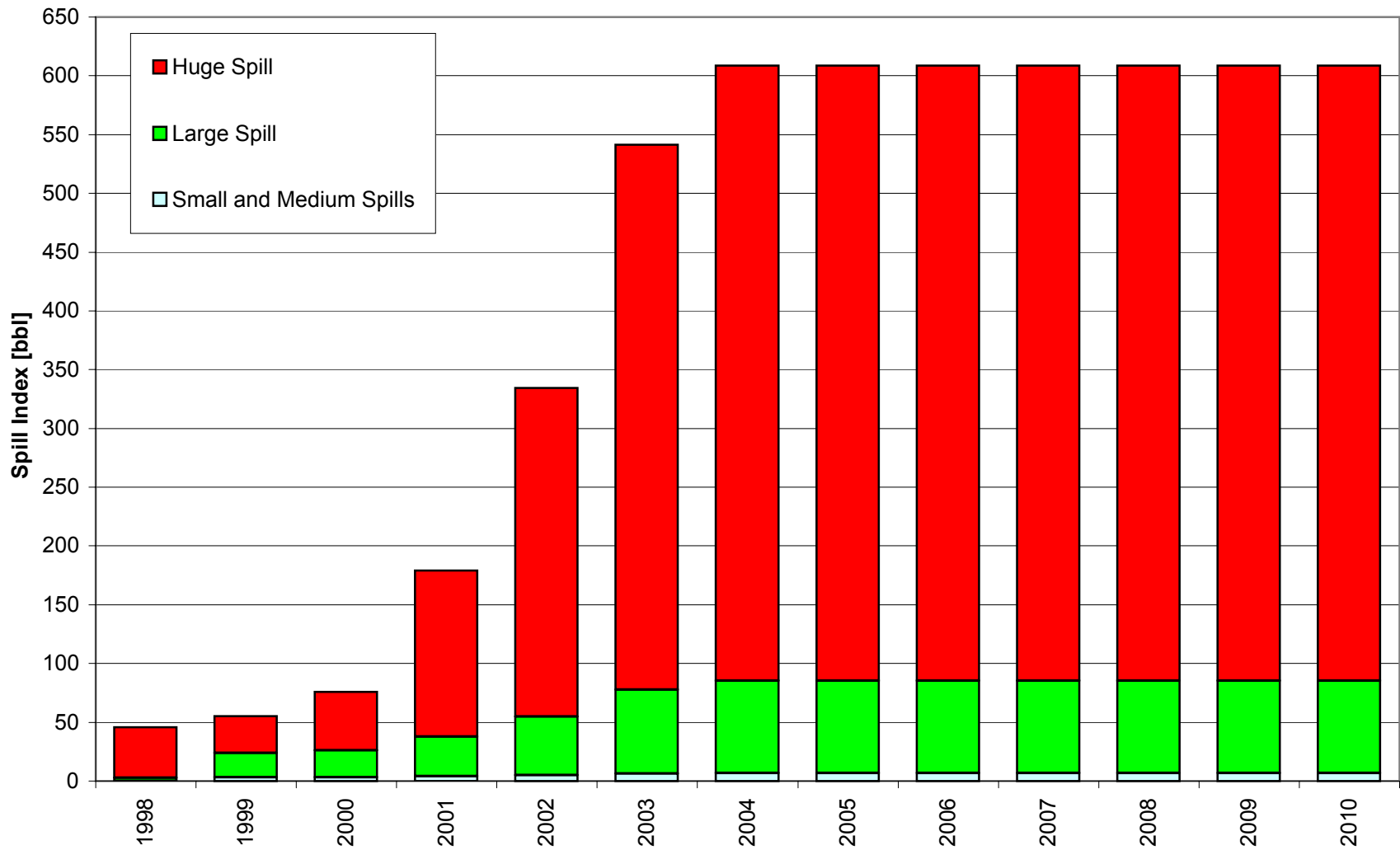
Chukchi Sea BC Spill Frequency



Chukchi Sea BC Spill Frequency per 10⁹ bbl Produced



Chukchi Sea BC Spill Index



**Table 4.6.1
Arctic Spill Occurrence Chukchi Sea HC P/L**

Year	Water Depth	P/L Dia <10"												P/L Dia >= 10"																					
		P/L [miles]	Small Spills			Medium Spills			Large Spills			Huge Spills			P/L [miles]	Small Spills			Medium Spills			Large Spills			Huge Spills										
			Average Spill [bbl] = 58	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Average Spill [bbl] = 266	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Average Spill [bbl] = 4436	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl		Average Spill [bbl] = 14423	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Average Spill [bbl] = 58	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Average Spill [bbl] = 387	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Average Spill [bbl] = 3932	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl	Average Spill [bbl] =	Frequency spills per 10 ³ km-year	Frequency spills per 10 ³ years	Spill Index bbl
			Cumm.				Cumm.				Cumm.					Cumm.				Cumm.				Cumm.				Cumm.				Cumm.			
1998	Shallow	1.393				2.441				1.087				0.282				0.928				2.256				1.789				0.578					
	Medium	1.411				2.471				0.962				0.245				0.924				2.278				1.703				0.559					
	Deep	1.431				2.505				0.841				0.210				0.921				2.303				1.623				0.541					
	Total																																		
1999	Shallow	1.393				2.441				1.087				0.282				0.928				2.256				1.789				0.578					
	Medium	1.411				2.471				0.962				0.245				0.924				2.278				1.703				0.559					
	Deep	1.431				2.505				0.841				0.210				0.921				2.303				1.623				0.541					
	Total																																		
2000	Shallow	1.393				2.441				1.087				0.282			5	0.928	0.075	0.00	2.256	0.182	0.07	1.789	0.144	0.57	0.578	0.047							
	Medium	1.411				2.471				0.962				0.245		60	0.924	0.892	0.05	2.278	2.200	0.85	1.703	1.644	6.46	0.559	0.540								
	Deep	1.431				2.505				0.841				0.210		135	0.921	2.001	0.12	2.303	5.002	1.94	1.623	3.526	13.86	0.541	1.175								
	Total															200		2.968	0.17		7.383	2.86		5.314	20.89		1.761								
2001	Shallow	1.393				2.441				1.087				0.282		5	0.928	0.075	0.00	2.256	0.182	0.07	1.789	0.144	0.57	0.578	0.047								
	Medium	1.411				2.471				0.962				0.245		60	0.924	0.892	0.05	2.278	2.200	0.85	1.703	1.644	6.46	0.559	0.540								
	Deep	1.431				2.505				0.841				0.210		135	0.921	2.001	0.12	2.303	5.002	1.94	1.623	3.526	13.86	0.541	1.175								
	Total															200		2.968	0.17		7.383	2.86		5.314	20.89		1.761								
2002	Shallow	1.393				2.441				1.087				0.282		5	0.928	0.075	0.00	2.256	0.182	0.07	1.789	0.144	0.57	0.578	0.047								
	Medium	1.411				2.471				0.962				0.245		60	0.924	0.892	0.05	2.278	2.200	0.85	1.703	1.644	6.46	0.559	0.540								
	Deep	1.431				2.505				0.841				0.210		135	0.921	2.001	0.12	2.303	5.002	1.94	1.623	3.526	13.86	0.541	1.175								
	Total															200		2.968	0.17		7.383	2.86		5.314	20.89		1.761								
2003	Shallow	1.393				2.441				1.087				0.282		5	0.928	0.075	0.00	2.256	0.182	0.07	1.789	0.144	0.57	0.578	0.047								
	Medium	1.411				2.471				0.962				0.245		60	0.924	0.892	0.05	2.278	2.200	0.85	1.703	1.644	6.46	0.559	0.540								
	Deep	1.431				2.505				0.841				0.210		135	0.921	2.001	0.12	2.303	5.002	1.94	1.623	3.526	13.86	0.541	1.175								
	Total															200		2.968	0.17		7.383	2.86		5.314	20.89		1.761								
2004	Shallow	1.393				2.441				1.087				0.282		5	0.928	0.075	0.00	2.256	0.182	0.07	1.789	0.144	0.57	0.578	0.047								
	Medium	1.411				2.471				0.962				0.245		60	0.924	0.892	0.05	2.278	2.200	0.85	1.703	1.644	6.46	0.559	0.540								
	Deep	1.431				2.505				0.841				0.210		135	0.921	2.001	0.12	2.303	5.002	1.94	1.623	3.526	13.86	0.541	1.175								
	Total															200		2.968	0.17		7.383	2.86		5.314	20.89		1.761								
2005	Shallow	1.393				2.441				1.087				0.282		5	0.928	0.075	0.00	2.256	0.182	0.07	1.789	0.144	0.57	0.578	0.047								
	Medium	1.411				2.471				0.962				0.245		60	0.924	0.892	0.05	2.278	2.200	0.85	1.703	1.644	6.46	0.559	0.540								
	Deep	1.431				2.505				0.841				0.210		135	0.921	2.001	0.12	2.303	5.002	1.94	1.623	3.526	13.86	0.541	1.175								
	Total															200		2.968	0.17		7.383	2.86		5.314	20.89		1.761								
2006	Shallow	1.393				2.441				1.087				0.282		5	0.928	0.075	0.00	2.256	0.182	0.07	1.789	0.144	0.57	0.578	0.047								
	Medium	1.411				2.471				0.962				0.245		60	0.924	0.892	0.05	2.278	2.200	0.85	1.703	1.644	6.46	0.559	0.540								
	Deep	1.431				2.505				0.841				0.210		135	0.921	2.001	0.12	2.303	5.002	1.94	1.623	3.526	13.86	0.541	1.175								
	Total															200		2.968	0.17		7.383	2.86		5.314	20.89		1.761								
2007	Shallow	1.393				2.441				1.087				0.282		5	0.928	0.075	0.00	2.256	0.182	0.07	1.789	0.144	0.57	0.578	0.047								
	Medium	1.411				2.471				0.962				0.245		60	0.924	0.892	0.05	2.278	2.200	0.85	1.703	1.644	6.46	0.559	0.540								
	Deep	1.431				2.505				0.841				0.210		135	0.921	2.001	0.12	2.303	5.002	1.94	1.623	3.526	13.86	0.541	1.175								
	Total															200		2.968	0.17		7.383	2.86		5.314	20.89		1.761								
2008	Shallow	1.393				2.441				1.087				0.282		5	0.928	0.075	0.00	2.256	0.182	0.07	1.789	0.144	0.57	0.578	0.047								
	Medium	1.411				2.471				0.962				0.245		60	0.924	0.892	0.05	2.278	2.200	0.85	1.703	1.644	6.46	0.559	0.540								
	Deep	1.431				2.505				0.841				0.210		135	0.921	2.001	0.12	2.303	5.002	1.94	1.623	3.526	13.86	0.541	1.175								
	Total															200		2.968	0.17		7.383	2.86		5.314	20.89		1.761								
2009	Shallow	1.393				2.441				1.087				0.282		5	0.928	0.075	0.00	2.256	0.182	0.07	1.789	0.144	0.57	0.578	0.047								

Table 4.6.1
Arctic Spill Occurrence Chukchi Sea HC P/L

17705
Spill Index bbi
0.82
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0.82
9.55
20.80
31.18

**Table 4.6.2
Arctic Spill Occurrence Chukchi Sea HC P/L Summary**

Year	Production [MMbbl]	Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0																		
1999	0																		
2000	0	2.968		0.172	7.383		2.857	10.351		3.029	5.314		20.894	1.761		31.180	17.426		55.103
2001	0	2.968		0.172	7.383		2.857	10.351		3.029	5.314		20.894	1.761		31.180	17.426		55.103
2002	0	2.968		0.172	7.383		2.857	10.351		3.029	5.314		20.894	1.761		31.180	17.426		55.103
2003	223	2.968	0.013	0.172	7.383	0.033	2.857	10.351	0.046	3.029	5.314	0.024	20.894	1.761	0.008	31.180	17.426	0.078	55.103
2004	297	2.968	0.010	0.172	7.383	0.025	2.857	10.351	0.035	3.029	5.314	0.018	20.894	1.761	0.006	31.180	17.426	0.059	55.103
2005	297	2.968	0.010	0.172	7.383	0.025	2.857	10.351	0.035	3.029	5.314	0.018	20.894	1.761	0.006	31.180	17.426	0.059	55.103
2006	297	2.968	0.010	0.172	7.383	0.025	2.857	10.351	0.035	3.029	5.314	0.018	20.894	1.761	0.006	31.180	17.426	0.059	55.103
2007	297	2.968	0.010	0.172	7.383	0.025	2.857	10.351	0.035	3.029	5.314	0.018	20.894	1.761	0.006	31.180	17.426	0.059	55.103
2008	297	2.968	0.010	0.172	7.383	0.025	2.857	10.351	0.035	3.029	5.314	0.018	20.894	1.761	0.006	31.180	17.426	0.059	55.103
2009	262	2.968	0.011	0.172	7.383	0.028	2.857	10.351	0.040	3.029	5.314	0.020	20.894	1.761	0.007	31.180	17.426	0.067	55.103
2010	227	2.968	0.013	0.172	7.383	0.033	2.857	10.351	0.046	3.029	5.314	0.023	20.894	1.761	0.008	31.180	17.426	0.077	55.103

**Table 4.6.3
Arctic Spill Occurrence Chukchi Sea HC Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
1999	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep			0.913			0.182		
	Total								
2000	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	2		0.913			0.182		
	Total	2							
2001	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	8	50	0.913	4.563	0.72	0.182	0.912	5.59
	Total	8	50		4.563	0.72		0.912	5.59
2002	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	12	130	0.913	11.863	1.87	0.182	2.371	14.53
	Total	12	130		11.863	1.87		2.371	14.53
2003	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	12	270	0.913	24.638	3.89	0.182	4.924	30.18
	Total	12	270		24.638	3.89		4.924	30.18
2004	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	12	410	0.913	37.414	5.91	0.182	7.477	45.83
	Total	12	410		37.414	5.91		7.477	45.83
2005	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	12	482	0.913	43.984	6.95	0.182	8.790	53.88
	Total	12	482		43.984	6.95		8.790	53.88
2006	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	12	482	0.913	43.984	6.95	0.182	8.790	53.88
	Total	12	482		43.984	6.95		8.790	53.88
2007	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	12	482	0.913	43.984	6.95	0.182	8.790	53.88
	Total	12	482		43.984	6.95		8.790	53.88
2008	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	12	482	0.913	43.984	6.95	0.182	8.790	53.88
	Total	12	482		43.984	6.95		8.790	53.88
2009	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	12	482	0.913	43.984	6.95	0.182	8.790	53.88
	Total	12	482		43.984	6.95		8.790	53.88
2010	Shallow			0.866			0.174		
	Medium			0.884			0.177		
	Deep	12	482	0.913	43.984	6.95	0.182	8.790	53.88
	Total	12	482		43.984	6.95		8.790	53.88

**Table 4.6.4
Arctic Spill Occurrence Chukchi Sea HC Platforms Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
1998	0									
1999	0									
2000	0									
2001	0	4.563		0.721	0.912		5.589	5.474		6.310
2002	0	11.863		1.874	2.371		14.532	14.234		16.407
2003	223	24.638	0.110	3.893	4.924	0.022	30.183	29.562	0.133	34.076
2004	297	37.414	0.126	5.911	7.477	0.025	45.833	44.891	0.151	51.744
2005	297	43.984	0.148	6.949	8.790	0.030	53.882	52.774	0.178	60.831
2006	297	43.984	0.148	6.949	8.790	0.030	53.882	52.774	0.178	60.831
2007	297	43.984	0.148	6.949	8.790	0.030	53.882	52.774	0.178	60.831
2008	297	43.984	0.148	6.949	8.790	0.030	53.882	52.774	0.178	60.831
2009	262	43.984	0.168	6.949	8.790	0.034	53.882	52.774	0.201	60.831
2010	227	43.984	0.194	6.949	8.790	0.039	53.882	52.774	0.232	60.831

**Table 4.6.5
Arctic Spill Occurrence Chukchi Sea HC Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
1999	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2000	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2001	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	50	0.500	0.250	0.13	3.500	1.750	7.88	1.500	0.750	15.00	1.000	0.500	100.00
	Total	50		0.250	0.13		1.750	7.88		0.750	15.00		0.500	100.00
2002	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	130	0.500	0.650	0.33	3.500	4.550	20.48	1.500	1.950	39.00	1.000	1.300	260.00
	Total	130		0.650	0.33		4.550	20.48		1.950	39.00		1.300	260.00
2003	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	270	0.500	1.350	0.68	3.500	9.450	42.53	1.500	4.050	81.00	1.000	2.700	540.00
	Total	270		1.350	0.68		9.450	42.53		4.050	81.00		2.700	540.00
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	410	0.500	2.050	1.03	3.500	14.350	64.58	1.500	6.150	123.00	1.000	4.100	820.00
	Total	410		2.050	1.03		14.350	64.58		6.150	123.00		4.100	820.00
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2009	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2010	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00

Table 4.6.6

Arctic Spill Occurrence Chukchi Sea HC Production Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0												
1999	0												
2000	0												
2001	0	0.250		0.125	0.750		7.875	1.250		115.000	2.250		123.000
2002	0	0.650		0.325	1.950		20.475	3.250		299.000	5.850		319.800
2003	223	1.350	0.006	0.675	4.050	0.018	42.525	6.750	0.030	621.000	12.150	0.054	664.200
2004	297	2.050	0.007	1.025	6.150	0.021	64.575	10.250	0.035	943.000	18.450	0.062	1008.600
2005	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2006	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2007	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2008	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2009	262	2.410	0.009	1.205	7.230	0.028	75.915	12.050	0.046	1108.600	21.690	0.083	1185.720
2010	227	2.410	0.011	1.205	7.230	0.032	75.915	12.050	0.053	1108.600	21.690	0.096	1185.720

**Table 4.6.7
Arctic Spill Occurrence Chukchi Sea HC Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =	500		Average Spill [bbl] =	4500		Average Spill [bbl] =	20000		Average Spill [bbl] =	200000	
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	3	3.160	0.095	0.05	22.110	0.663	2.98	9.500	0.285	5.70	5.500	0.165	33.00
	Total	3		0.095	0.05		0.663	2.98		0.285	5.70		0.165	33.00
1999	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2000	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2001	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2002	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2003	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2004	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2005	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2006	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2007	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2008	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2010	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.6.8

Arctic Spill Occurrence Chukchi Sea HC Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0	0.095		0.047	0.285		2.985	0.450		38.700	0.830		41.732
1999	0	0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2000	0	0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2001	0												
2002	0												
2003	223												
2004	297												
2005	297												
2006	297												
2007	297												
2008	297												
2009	262												
2010	227												

**Table 4.6.9
Arctic Spill Occurrence Chukchi Sea HC Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep	1	1.300	0.013	0.01	9.080	0.091	0.41	3.900	0.039	0.78	3.900	0.039	7.80
	Total	1		0.013	0.01		0.091	0.41		0.039	0.78		0.039	7.80
1999	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep	1	1.300	0.013	0.01	9.080	0.091	0.41	3.900	0.039	0.78	3.900	0.039	7.80
	Total	1		0.013	0.01		0.091	0.41		0.039	0.78		0.039	7.80
2000	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2001	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2002	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2003	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2009	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.6.10

Arctic Spill Occurrence Chukchi Sea HC Development Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0	0.013		0.007	0.039		0.409	0.078		8.580	0.130		8.995
1999	0	0.013		0.007	0.039		0.409	0.078		8.580	0.130		8.995
2000	0												
2001	0												
2002	0												
2003	223												
2004	297												
2005	297												
2006	297												
2007	297												
2008	297												
2009	262												
2010	227												

**Table 4.6.11
Arctic Spill Occurrence Chukchi Sea HC Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]
1998	Pipeline	0												
	Platforms													
	Production Wells													
	Exploration Wells		0.095	0.047	0.285	2.985	0.450	38.700	0.830	41.732				
	Development Wells		0.013	0.007	0.039	0.409	0.078	8.580	0.130	8.995				
Total	0.108	0.054	0.324	3.393	0.528	47.280	0.960	50.727						
1999	Pipeline	0												
	Platforms													
	Production Wells													
	Exploration Wells		0.063	0.032	0.190	1.990	0.300	25.800	0.553	27.822				
	Development Wells		0.013	0.007	0.039	0.409	0.078	8.580	0.130	8.995				
Total	0.076	0.038	0.229	2.399	0.378	34.380	0.683	36.817						
2000	Pipeline	0	10.351	3.029	5.314	20.894	1.761	31.180	17.426	55.103				
	Platforms													
	Production Wells													
	Exploration Wells		0.063	0.032	0.190	1.990	0.300	25.800	0.553	27.822				
	Development Wells													
Total	10.414	3.061	5.504	22.884	2.061	56.980	17.979	82.925						
2001	Pipeline	0	10.351	3.029	5.314	20.894	1.761	31.180	17.426	55.103				
	Platforms		4.563	0.721	0.912	5.589			5.474	6.310				
	Production Wells		0.250	0.125	0.750	7.875	1.250	115.000	2.250	123.000				
	Exploration Wells													
	Development Wells													
Total	15.163	3.875	6.976	34.358	3.011	146.180	25.150	184.414						
2002	Pipeline	0	10.351	3.029	5.314	20.894	1.761	31.180	17.426	55.103				
	Platforms		11.863	1.874	2.371	14.532			14.234	16.407				
	Production Wells		0.650	0.325	1.950	20.475	3.250	299.000	5.850	319.800				
	Exploration Wells													
	Development Wells													
Total	22.864	5.229	9.634	55.901	5.011	330.180	37.509	391.310						
2003	Pipeline	223.0	10.351	0.046	3.029	5.314	0.024	20.894	1.761	0.008	31.180	17.426	0.078	55.103
	Platforms		24.638	0.110	3.893	4.924	0.022	30.183				29.562	0.133	34.076
	Production Wells		1.350	0.006	0.675	4.050	0.018	42.525	6.750	0.030	621.000	12.150	0.054	664.200
	Exploration Wells													
	Development Wells													
Total	36.339	0.163	7.597	14.288	0.064	93.601	8.511	0.038	652.180	59.138	0.265	753.379		
2004	Pipeline	297.0	10.351	0.035	3.029	5.314	0.018	20.894	1.761	0.006	31.180	17.426	0.059	55.103
	Platforms		37.414	0.126	5.911	7.477	0.025	45.833				44.891	0.151	51.744
	Production Wells		2.050	0.007	1.025	6.150	0.021	64.575	10.250	0.035	943.000	18.450	0.062	1008.600
	Exploration Wells													
	Development Wells													
Total	49.814	0.168	9.966	18.941	0.064	131.302	12.011	0.040	974.180	80.766	0.272	1115.448		
2005	Pipeline	297.0	10.351	0.035	3.029	5.314	0.018	20.894	1.761	0.006	31.180	17.426	0.059	55.103
	Platforms		43.984	0.148	6.949	8.790	0.030	53.882				52.774	0.178	60.831
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
	Exploration Wells													
	Development Wells													
Total	56.745	0.191	11.184	21.334	0.072	150.690	13.811	0.047	1139.780	91.889	0.309	1301.654		
2006	Pipeline	297.0	10.351	0.035	3.029	5.314	0.018	20.894	1.761	0.006	31.180	17.426	0.059	55.103
	Platforms		43.984	0.148	6.949	8.790	0.030	53.882				52.774	0.178	60.831
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
	Exploration Wells													
	Development Wells													
Total	56.745	0.191	11.184	21.334	0.072	150.690	13.811	0.047	1139.780	91.889	0.309	1301.654		
2007	Pipeline	297.0	10.351	0.035	3.029	5.314	0.018	20.894	1.761	0.006	31.180	17.426	0.059	55.103
	Platforms		43.984	0.148	6.949	8.790	0.030	53.882				52.774	0.178	60.831
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
	Exploration Wells													
	Development Wells													
Total	56.745	0.191	11.184	21.334	0.072	150.690	13.811	0.047	1139.780	91.889	0.309	1301.654		

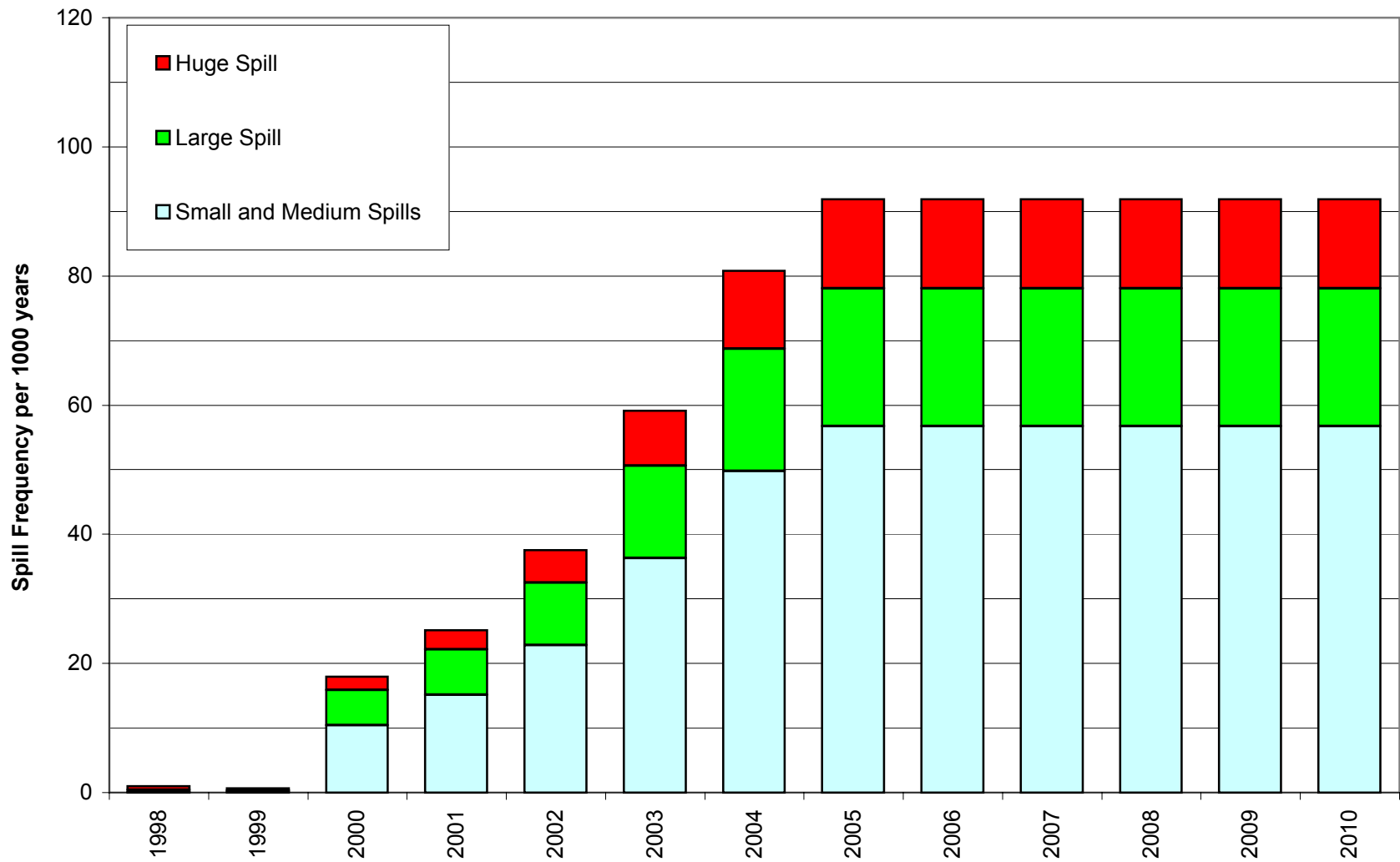
**Table 4.6.11
Arctic Spill Occurrence Chukchi Sea HC Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills			
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	
2008	Pipeline	297.0	10.351	0.035	3.029	5.314	0.018	20.894	1.761	0.006	31.180	17.426	0.059	55.103	
	Platforms		43.984	0.148	6.949	8.790	0.030	53.882				52.774	0.178	60.831	
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720	
	Exploration Wells														
	Development Wells														
	Total		56.745	0.191	11.184	21.334	0.072	150.690	13.811	0.047	1139.780	91.889	0.309	1301.654	
2009	Pipeline	262.0	10.351	0.040	3.029	5.314	0.020	20.894	1.761	0.007	31.180	17.426	0.067	55.103	
	Platforms		43.984	0.168	6.949	8.790	0.034	53.882				52.774	0.201	60.831	
	Production Wells		2.410	0.009	1.205	7.230	0.028	75.915	12.050	0.046	1108.600	21.690	0.083	1185.720	
	Exploration Wells														
	Development Wells														
	Total		56.745	0.217	11.184	21.334	0.081	150.690	13.811	0.053	1139.780	91.889	0.351	1301.654	
2010	Pipeline	227.0	10.351	0.046	3.029	5.314	0.023	20.894	1.761	0.008	31.180	17.426	0.077	55.103	
	Platforms		43.984	0.194	6.949	8.790	0.039	53.882				52.774	0.232	60.831	
	Production Wells		2.410	0.011	1.205	7.230	0.032	75.915	12.050	0.053	1108.600	21.690	0.096	1185.720	
	Exploration Wells														
	Development Wells														
	Total		56.745	0.250	11.184	21.334	0.094	150.690	13.811	0.061	1139.780	91.889	0.405	1301.654	

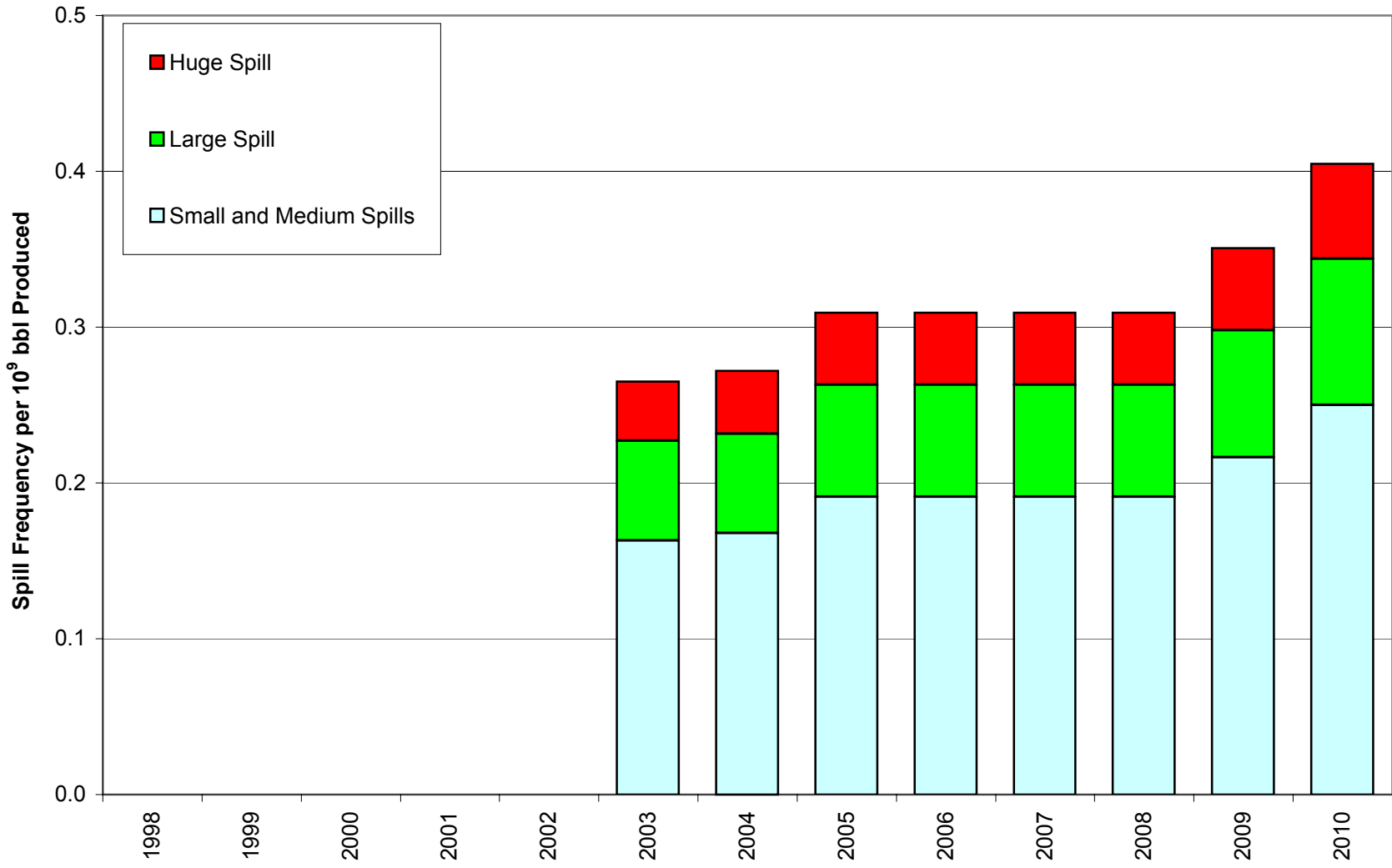
**Table 4.6.12
Arctic Spill Occurrence Chukchi Sea HC Annual Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
1998	0	0.11		0.054	0.32		3.393	0.528		47.28	0.960		50.727
1999	0	0.08		0.038	0.23		2.399	0.378		34.38	0.683		36.817
2000	0	10.41		3.061	5.50		22.884	2.061		56.98	17.979		82.925
2001	0	15.16		3.875	6.98		34.358	3.011		146.18	25.150		184.414
2002	0	22.86		5.229	9.63		55.901	5.011		330.18	37.509		391.310
2003	223	36.34	0.163	7.597	14.29	0.064	93.601	8.511	0.038	652.18	59.138	0.265	753.379
2004	297	49.81	0.168	9.966	18.94	0.064	131.302	12.011	0.040	974.18	80.766	0.272	1115.448
2005	297	56.74	0.191	11.184	21.33	0.072	150.690	13.811	0.047	1139.78	91.889	0.309	1301.654
2006	297	56.74	0.191	11.184	21.33	0.072	150.690	13.811	0.047	1139.78	91.889	0.309	1301.654
2007	297	56.74	0.191	11.184	21.33	0.072	150.690	13.811	0.047	1139.78	91.889	0.309	1301.654
2008	297	56.74	0.191	11.184	21.33	0.072	150.690	13.811	0.047	1139.78	91.889	0.309	1301.654
2009	262	56.74	0.217	11.184	21.33	0.081	150.690	13.811	0.053	1139.78	91.889	0.351	1301.654
2010	227	56.74	0.250	11.184	21.33	0.094	150.690	13.811	0.061	1139.78	91.889	0.405	1301.654

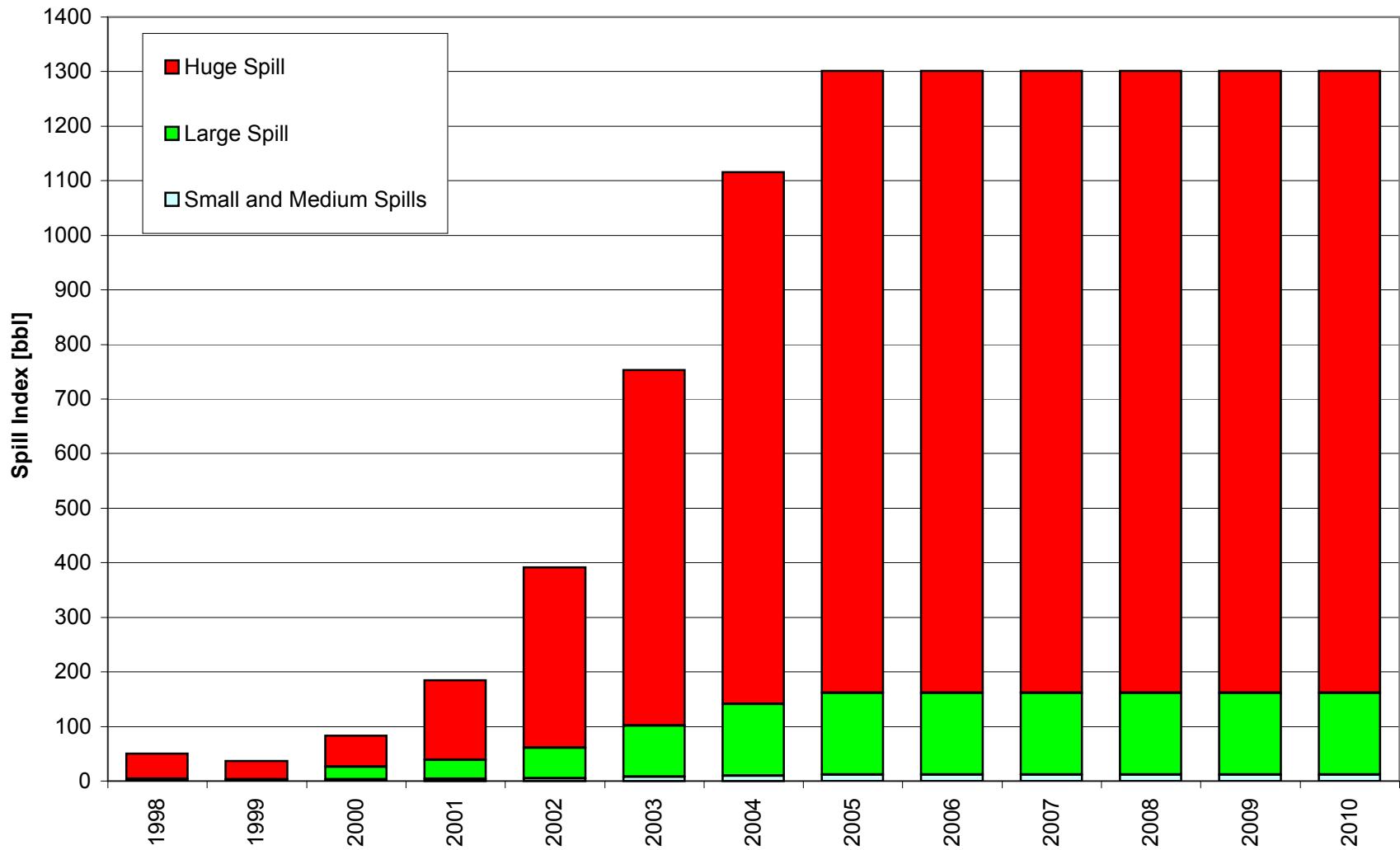
Chukchi Sea HC Spill Frequency



Chukchi Sea HC Spill Frequency per 10⁹ bbl Produced



Chukchi Sea HC Spill Index



**Table 4.6A.2
Non Arctic Spill Occurrence Chukchi Sea HC P/L Summary**

Year	Production [MMbbbl]	Small Spill			Medium Spill			Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0																		
1999	0																		
2000	0	5.798		0.336	14.494		5.609	20.292		5.945	17.393		68.389	5.798		102.647	43.482		176.982
2001	0	5.798		0.336	14.494		5.609	20.292		5.945	17.393		68.389	5.798		102.647	43.482		176.982
2002	0	5.798		0.336	14.494		5.609	20.292		5.945	17.393		68.389	5.798		102.647	43.482		176.982
2003	223	5.798	0.026	0.336	14.494	0.065	5.609	20.292	0.091	5.945	17.393	0.078	68.389	5.798	0.026	102.647	43.482	0.195	176.982
2004	297	5.798	0.020	0.336	14.494	0.049	5.609	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
2005	297	5.798	0.020	0.336	14.494	0.049	5.609	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
2006	297	5.798	0.020	0.336	14.494	0.049	5.609	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
2007	297	5.798	0.020	0.336	14.494	0.049	5.609	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
2008	297	5.798	0.020	0.336	14.494	0.049	5.609	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
2009	262	5.798	0.022	0.336	14.494	0.055	5.609	20.292	0.077	5.945	17.393	0.066	68.389	5.798	0.022	102.647	43.482	0.166	176.982
2010	227	5.798	0.026	0.336	14.494	0.064	5.609	20.292	0.089	5.945	17.393	0.077	68.389	5.798	0.026	102.647	43.482	0.192	176.982

**Table 4.6A.3
Non Arctic Spill Occurrence Chukchi Sea HC Platforms**

Year	Water Depth	N Platforms	N P Wells	Small and Medium Spills			Large and Huge Spills		
				Average Spill [bbl] =		158	Average Spill [bbl] =		6130
		Cum.	Cum.	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁴ well-year	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep			1.504			0.251		
	Total								
1999	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep			1.504			0.251		
	Total								
2000	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	2		1.504			0.251		
	Total	2							
2001	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	8	50	1.504	7.518	1.19	0.251	1.253	7.68
	Total	8	50		7.518	1.19		1.253	7.68
2002	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	130	1.504	19.547	3.09	0.251	3.258	19.97
	Total	12	130		19.547	3.09		3.258	19.97
2003	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	270	1.504	40.597	6.41	0.251	6.766	41.48
	Total	12	270		40.597	6.41		6.766	41.48
2004	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	410	1.504	61.647	9.74	0.251	10.274	62.98
	Total	12	410		61.647	9.74		10.274	62.98
2005	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	482	1.504	72.473	11.45	0.251	12.079	74.04
	Total	12	482		72.473	11.45		12.079	74.04
2006	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	482	1.504	72.473	11.45	0.251	12.079	74.04
	Total	12	482		72.473	11.45		12.079	74.04
2007	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	482	1.504	72.473	11.45	0.251	12.079	74.04
	Total	12	482		72.473	11.45		12.079	74.04
2008	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	482	1.504	72.473	11.45	0.251	12.079	74.04
	Total	12	482		72.473	11.45		12.079	74.04
2009	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	482	1.504	72.473	11.45	0.251	12.079	74.04
	Total	12	482		72.473	11.45		12.079	74.04
2010	Shallow			1.504			0.251		
	Medium			1.504			0.251		
	Deep	12	482	1.504	72.473	11.45	0.251	12.079	74.04
	Total	12	482		72.473	11.45		12.079	74.04

**Table 4.6A.4
Non Artic Spill Occurrence Chukchi Sea HC Platforms Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large and Huge Spills			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]
1998	0									
1999	0									
2000	0									
2001	0	7.518		1.188	1.253		7.681	8.771		8.869
2002	0	19.547		3.088	3.258		19.970	22.804		23.058
2003	223	40.597	0.182	6.414	6.766	0.030	41.476	47.363	0.212	47.891
2004	297	61.647	0.208	9.740	10.274	0.035	62.983	71.921	0.242	72.723
2005	297	72.473	0.244	11.451	12.079	0.041	74.043	84.552	0.285	85.494
2006	297	72.473	0.244	11.451	12.079	0.041	74.043	84.552	0.285	85.494
2007	297	72.473	0.244	11.451	12.079	0.041	74.043	84.552	0.285	85.494
2008	297	72.473	0.244	11.451	12.079	0.041	74.043	84.552	0.285	85.494
2009	262	72.473	0.277	11.451	12.079	0.046	74.043	84.552	0.323	85.494
2010	227	72.473	0.319	11.451	12.079	0.053	74.043	84.552	0.372	85.494

**Table 4.6A.5
Non Arctic Spill Occurrence Chukchi Sea HC Production Wells**

Year	Water Depth	Production Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ well-year	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
1999	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2000	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep		0.500			3.500			1.500			1.000		
	Total													
2001	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	50	0.500	0.250	0.13	3.500	1.750	7.88	1.500	0.750	15.00	1.000	0.500	100.00
	Total	50		0.250	0.13		1.750	7.88		0.750	15.00		0.500	100.00
2002	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	130	0.500	0.650	0.33	3.500	4.550	20.48	1.500	1.950	39.00	1.000	1.300	260.00
	Total	130		0.650	0.33		4.550	20.48		1.950	39.00		1.300	260.00
2003	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	270	0.500	1.350	0.68	3.500	9.450	42.53	1.500	4.050	81.00	1.000	2.700	540.00
	Total	270		1.350	0.68		9.450	42.53		4.050	81.00		2.700	540.00
2004	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	410	0.500	2.050	1.03	3.500	14.350	64.58	1.500	6.150	123.00	1.000	4.100	820.00
	Total	410		2.050	1.03		14.350	64.58		6.150	123.00		4.100	820.00
2005	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2006	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2007	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2008	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2009	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00
2010	Shallow		0.500			3.500			1.500			1.000		
	Medium		0.500			3.500			1.500			1.000		
	Deep	482	0.500	2.410	1.21	3.500	16.870	75.92	1.500	7.230	144.60	1.000	4.820	964.00
	Total	482		2.410	1.21		16.870	75.92		7.230	144.60		4.820	964.00

Table 4.6A.6

Non Artic Spill Occurrence Chukchi Sea HC Production Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0												
1999	0												
2000	0												
2001	0	0.250		0.125	0.750		7.875	1.250		115.000	2.250		123.000
2002	0	0.650		0.325	1.950		20.475	3.250		299.000	5.850		319.800
2003	223	1.350	0.006	0.675	4.050	0.018	42.525	6.750	0.030	621.000	12.150	0.054	664.200
2004	297	2.050	0.007	1.025	6.150	0.021	64.575	10.250	0.035	943.000	18.450	0.062	1008.600
2005	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2006	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2007	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2008	297	2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
2009	262	2.410	0.009	1.205	7.230	0.028	75.915	12.050	0.046	1108.600	21.690	0.083	1185.720
2010	227	2.410	0.011	1.205	7.230	0.032	75.915	12.050	0.053	1108.600	21.690	0.096	1185.720

**Table 4.6A.7
Non Arctic Spill Occurrence Chukchi Sea HC Exploration Wells**

Year	Water Depth	Exploration Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	3	3.160	0.095	0.05	22.110	0.663	2.98	9.500	0.285	5.70	5.500	0.165	33.00
	Total	3		0.095	0.05		0.663	2.98		0.285	5.70		0.165	33.00
1999	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2000	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep	2	3.160	0.063	0.03	22.110	0.442	1.99	9.500	0.190	3.80	5.500	0.110	22.00
	Total	2		0.063	0.03		0.442	1.99		0.190	3.80		0.110	22.00
2001	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2002	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2003	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2004	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2005	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2006	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2007	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2008	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2009	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													
2010	Shallow		3.160			22.110			9.500			5.500		
	Medium		3.160			22.110			9.500			5.500		
	Deep		3.160			22.110			9.500			5.500		
	Total													

Table 4.6A.8

Non Arctic Spill Occurrence Chukchi Sea HC Exploration Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0	0.095		0.047	0.285		2.985	0.450		38.700	0.830		41.732
1999	0	0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2000	0	0.063		0.032	0.190		1.990	0.300		25.800	0.553		27.822
2001	0												
2002	0												
2003	223												
2004	297												
2005	297												
2006	297												
2007	297												
2008	297												
2009	262												
2010	227												

**Table 4.6A.9
Non Arctic Spill Occurrence Chukchi Sea HC Development Wells**

Year	Water Depth	Development Wells Blowout												
		N Wells	Small and Medium Spills			Large Spill			Spill >=10000 < 150000 bbl			Spill >=150000 bbl		
			Average Spill [bbl] =		500	Average Spill [bbl] =		4500	Average Spill [bbl] =		20000	Average Spill [bbl] =		200000
		Cum.	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl	Frequency spills per 10 ⁵ wells	Frequency spills per 10 ³ years	Spill Index bbl
1998	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep	1	1.300	0.013	0.01	9.080	0.091	0.41	3.900	0.039	0.78	3.900	0.039	7.80
	Total	1		0.013	0.01		0.091	0.41		0.039	0.78		0.039	7.80
1999	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep	1	1.300	0.013	0.01	9.080	0.091	0.41	3.900	0.039	0.78	3.900	0.039	7.80
	Total	1		0.013	0.01		0.091	0.41		0.039	0.78		0.039	7.80
2000	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2001	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2002	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2003	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2004	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2005	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2006	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2007	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2008	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2009	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													
2010	Shallow		1.300			9.080			3.900			3.900		
	Medium		1.300			9.080			3.900			3.900		
	Deep		1.300			9.080			3.900			3.900		
	Total													

Table 4.6A.10

Non Arctic Spill Occurrence Chukchi Sea HC Development Wells Summary

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁹ bbl Produced	Spill Index [bbl]
1998	0	0.013		0.007	0.039		0.409	0.078		8.580	0.130		8.995
1999	0	0.013		0.007	0.039		0.409	0.078		8.580	0.130		8.995
2000	0												
2001	0												
2002	0												
2003	223												
2004	297												
2005	297												
2006	297												
2007	297												
2008	297												
2009	262												
2010	227												

**Table 4.6A.11
Non Arctic Spill Occurrence Chukchi Sea HC Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]
1998	Pipeline	0												
	Platforms													
	Production Wells													
	Exploration Wells		0.095	0.047	0.285	2.985	0.450	38.700	0.830	41.732				
	Development Wells		0.013	0.007	0.039	0.409	0.078	8.580	0.130	8.995				
Total	0.108	0.054	0.324	3.393	0.528	47.280	0.960	50.727						
1999	Pipeline	0												
	Platforms													
	Production Wells													
	Exploration Wells		0.063	0.032	0.190	1.990	0.300	25.800	0.553	27.822				
	Development Wells		0.013	0.007	0.039	0.409	0.078	8.580	0.130	8.995				
Total	0.076	0.038	0.229	2.399	0.378	34.380	0.683	36.817						
2000	Pipeline	0	20.292	5.945	17.393	68.389	5.798	102.647	43.482	176.982				
	Platforms													
	Production Wells													
	Exploration Wells		0.063	0.032	0.190	1.990	0.300	25.800	0.553	27.822				
	Development Wells													
Total	20.355	5.977	17.583	70.379	6.098	128.447	44.035	204.803						
2001	Pipeline	0	20.292	5.945	17.393	68.389	5.798	102.647	43.482	176.982				
	Platforms		7.518	1.188	1.253	7.681			8.771	8.869				
	Production Wells		0.250	0.125	0.750	7.875	1.250	115.000	2.250	123.000				
	Exploration Wells													
	Development Wells													
Total	28.060	7.258	19.396	83.945	7.048	217.647	54.503	308.850						
2002	Pipeline	0	20.292	5.945	17.393	68.389	5.798	102.647	43.482	176.982				
	Platforms		19.547	3.088	3.258	19.970			22.804	23.058				
	Production Wells		0.650	0.325	1.950	20.475	3.250	299.000	5.850	319.800				
	Exploration Wells													
	Development Wells													
Total	40.488	9.359	22.601	108.834	9.048	401.647	72.137	519.840						
2003	Pipeline	223.0	20.292	0.091	5.945	17.393	0.078	68.389	5.798	0.026	102.647	43.482	0.195	176.982
	Platforms		40.597	0.182	6.414	6.766	0.030	41.476				47.363	0.212	47.891
	Production Wells		1.350	0.006	0.675	4.050	0.018	42.525	6.750	0.030	621.000	12.150	0.054	664.200
	Exploration Wells													
	Development Wells													
Total	62.238	0.279	13.035	28.209	0.126	152.390	12.548	0.056	723.647	102.995	0.462	889.072		
2004	Pipeline	297.0	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
	Platforms		61.647	0.208	9.740	10.274	0.035	62.983				71.921	0.242	72.723
	Production Wells		2.050	0.007	1.025	6.150	0.021	64.575	10.250	0.035	943.000	18.450	0.062	1008.600
	Exploration Wells													
	Development Wells													
Total	83.989	0.283	16.711	33.817	0.114	195.947	16.048	0.054	1045.647	133.854	0.451	1258.304		
2005	Pipeline	297.0	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
	Platforms		72.473	0.244	11.451	12.079	0.041	74.043				84.552	0.285	85.494
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
	Exploration Wells													
	Development Wells													
Total	95.174	0.320	18.601	36.702	0.124	218.347	17.848	0.060	1211.247	149.724	0.504	1448.195		
2006	Pipeline	297.0	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
	Platforms		72.473	0.244	11.451	12.079	0.041	74.043				84.552	0.285	85.494
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
	Exploration Wells													
	Development Wells													
Total	95.174	0.320	18.601	36.702	0.124	218.347	17.848	0.060	1211.247	149.724	0.504	1448.195		
2007	Pipeline	297.0	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982
	Platforms		72.473	0.244	11.451	12.079	0.041	74.043				84.552	0.285	85.494
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720
	Exploration Wells													
	Development Wells													
Total	95.174	0.320	18.601	36.702	0.124	218.347	17.848	0.060	1211.247	149.724	0.504	1448.195		

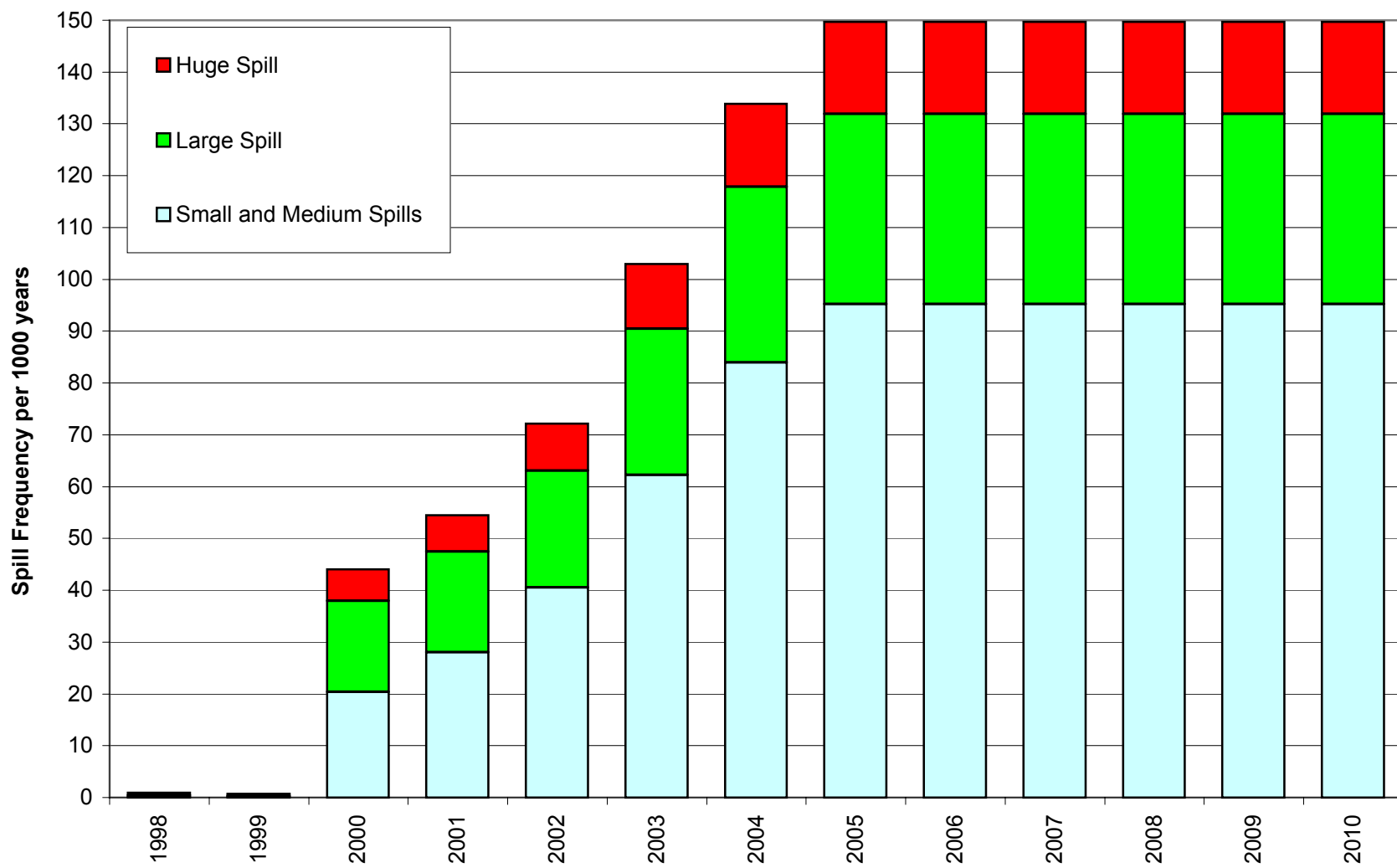
**Table 4.6A.11
Non Arctic Spill Occurrence Chukchi Sea HC Summary**

Year	Facility	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills			
			Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁸ bbl P Produced	Spill Index [bbl]	
2008	Pipeline	297.0	20.292	0.068	5.945	17.393	0.059	68.389	5.798	0.020	102.647	43.482	0.146	176.982	
	Platforms		72.473	0.244	11.451	12.079	0.041	74.043				84.552	0.285	85.494	
	Production Wells		2.410	0.008	1.205	7.230	0.024	75.915	12.050	0.041	1108.600	21.690	0.073	1185.720	
	Exploration Wells														
	Development Wells														
	Total		95.174	0.320	18.601	36.702	0.124	218.347	17.848	0.060	1211.247	149.724	0.504	1448.195	
2009	Pipeline	262.0	20.292	0.077	5.945	17.393	0.066	68.389	5.798	0.022	102.647	43.482	0.166	176.982	
	Platforms		72.473	0.277	11.451	12.079	0.046	74.043				84.552	0.323	85.494	
	Production Wells		2.410	0.009	1.205	7.230	0.028	75.915	12.050	0.046	1108.600	21.690	0.083	1185.720	
	Exploration Wells														
	Development Wells														
	Total		95.174	0.363	18.601	36.702	0.140	218.347	17.848	0.068	1211.247	149.724	0.571	1448.195	
2010	Pipeline	227.0	20.292	0.089	5.945	17.393	0.077	68.389	5.798	0.026	102.647	43.482	0.192	176.982	
	Platforms		72.473	0.319	11.451	12.079	0.053	74.043				84.552	0.372	85.494	
	Production Wells		2.410	0.011	1.205	7.230	0.032	75.915	12.050	0.053	1108.600	21.690	0.096	1185.720	
	Exploration Wells														
	Development Wells														
	Total		95.174	0.419	18.601	36.702	0.162	218.347	17.848	0.079	1211.247	149.724	0.660	1448.195	

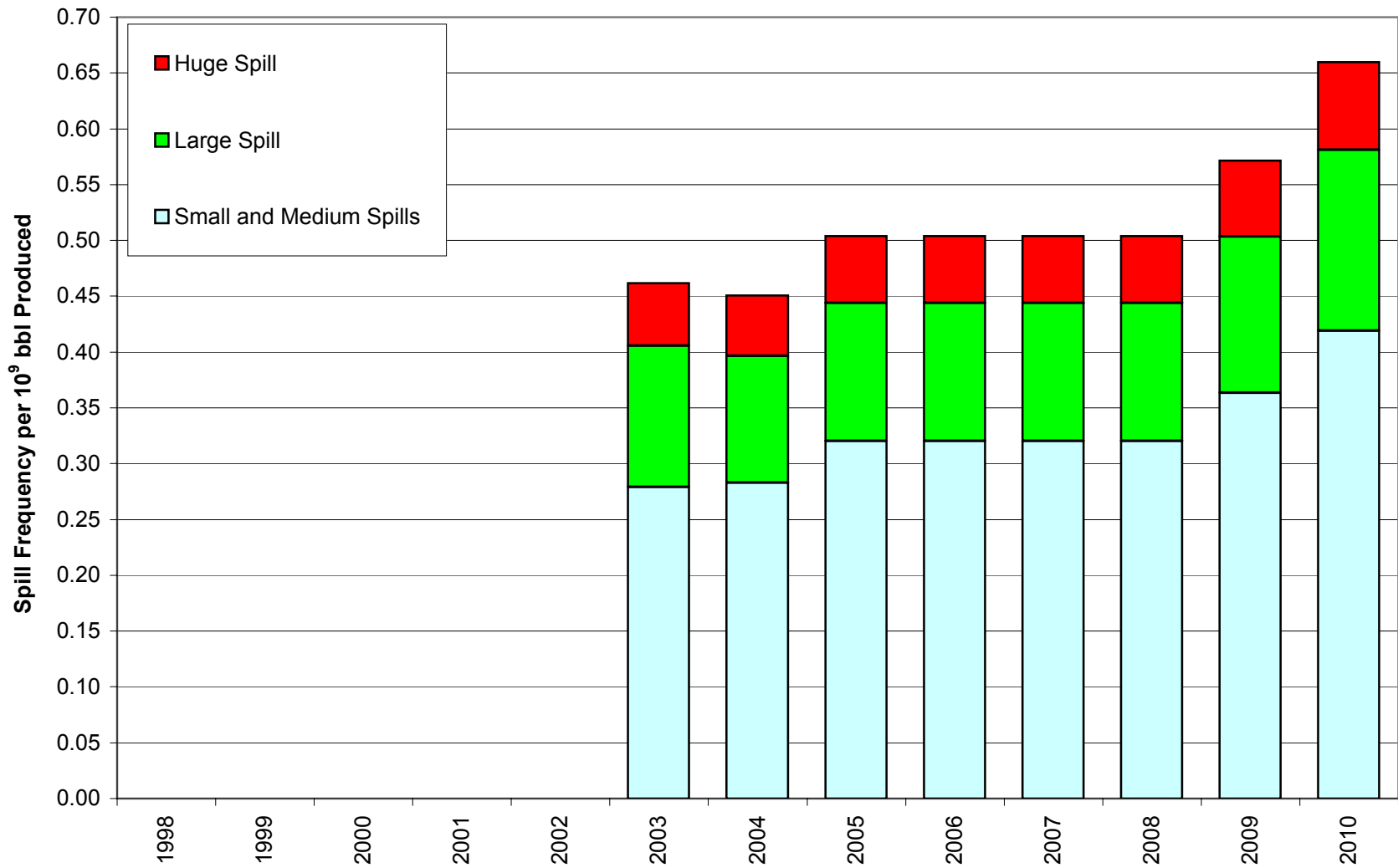
**Table 4.6A.12
Non Arctic Spill Occurrence Chukchi Sea HC Annual Summary**

Year	Production [MMbbl]	Small and Medium Spills			Large Spill			Huge Spill			All Spills		
		Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]	Frequency Spills per 10 ³ years	Frequency Spills per 10 ⁶ bbl Produced	Spill Index [bbl]
1998	0	0.11		0.054	0.32		3.393	0.528		47.28	0.960		50.727
1999	0	0.08		0.038	0.23		2.399	0.378		34.38	0.683		36.817
2000	0	20.35		5.977	17.58		70.379	6.098		128.45	44.035		204.803
2001	0	28.06		7.258	19.40		83.945	7.048		217.65	54.503		308.850
2002	0	40.49		9.359	22.60		108.834	9.048		401.65	72.137		519.840
2003	223	62.24	0.279	13.035	28.21	0.126	152.390	12.548	0.056	723.65	102.995	0.462	889.072
2004	297	83.99	0.283	16.711	33.82	0.114	195.947	16.048	0.054	1045.65	133.854	0.451	1258.304
2005	297	95.17	0.320	18.601	36.70	0.124	218.347	17.848	0.060	1211.25	149.724	0.504	1448.195
2006	297	95.17	0.320	18.601	36.70	0.124	218.347	17.848	0.060	1211.25	149.724	0.504	1448.195
2007	297	95.17	0.320	18.601	36.70	0.124	218.347	17.848	0.060	1211.25	149.724	0.504	1448.195
2008	297	95.17	0.320	18.601	36.70	0.124	218.347	17.848	0.060	1211.25	149.724	0.504	1448.195
2009	262	95.17	0.363	18.601	36.70	0.140	218.347	17.848	0.068	1211.25	149.724	0.571	1448.195
2010	227	95.17	0.419	18.601	36.70	0.162	218.347	17.848	0.079	1211.25	149.724	0.660	1448.195

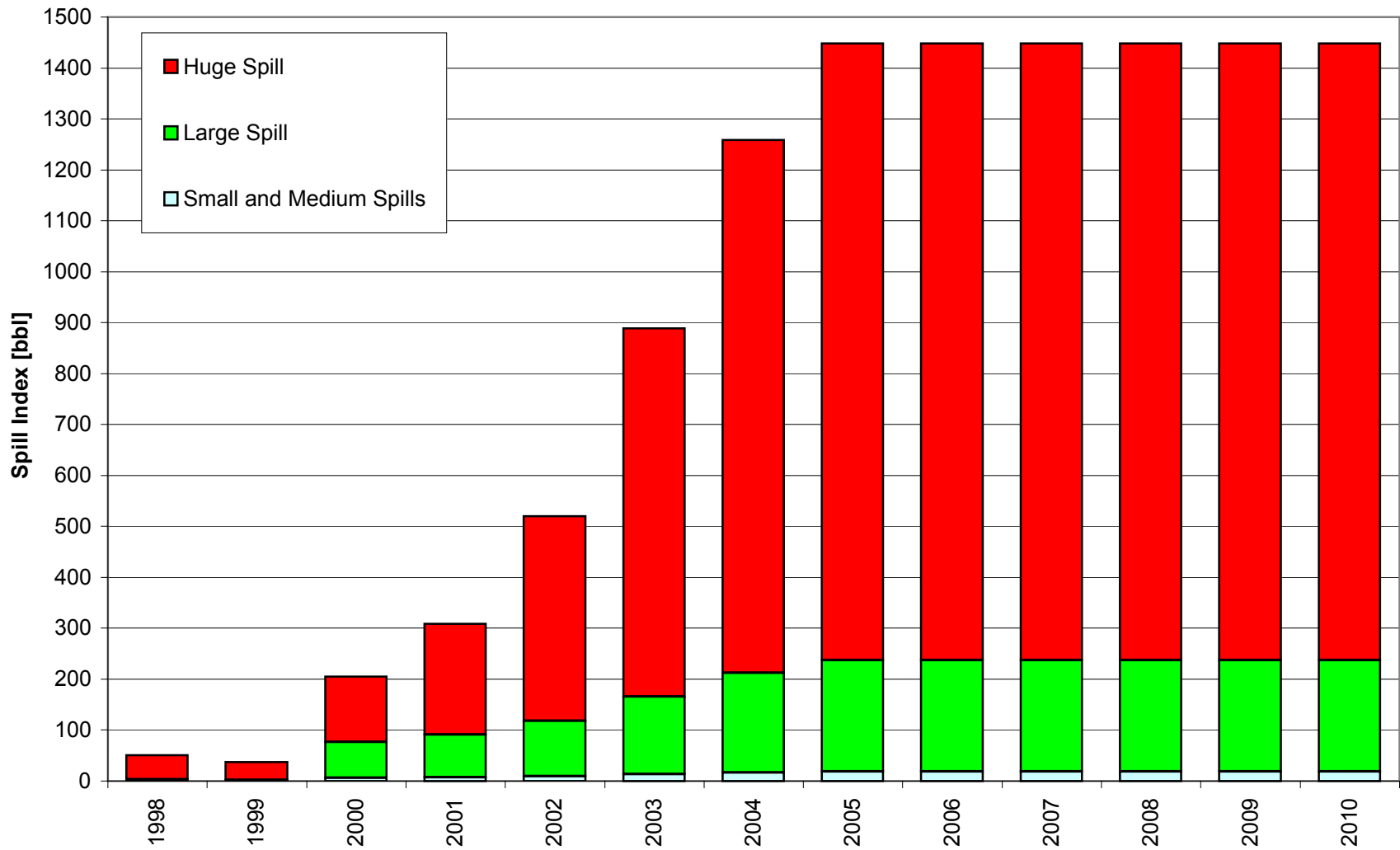
Chukchi Sea HC Spill Frequency - Non Arctic



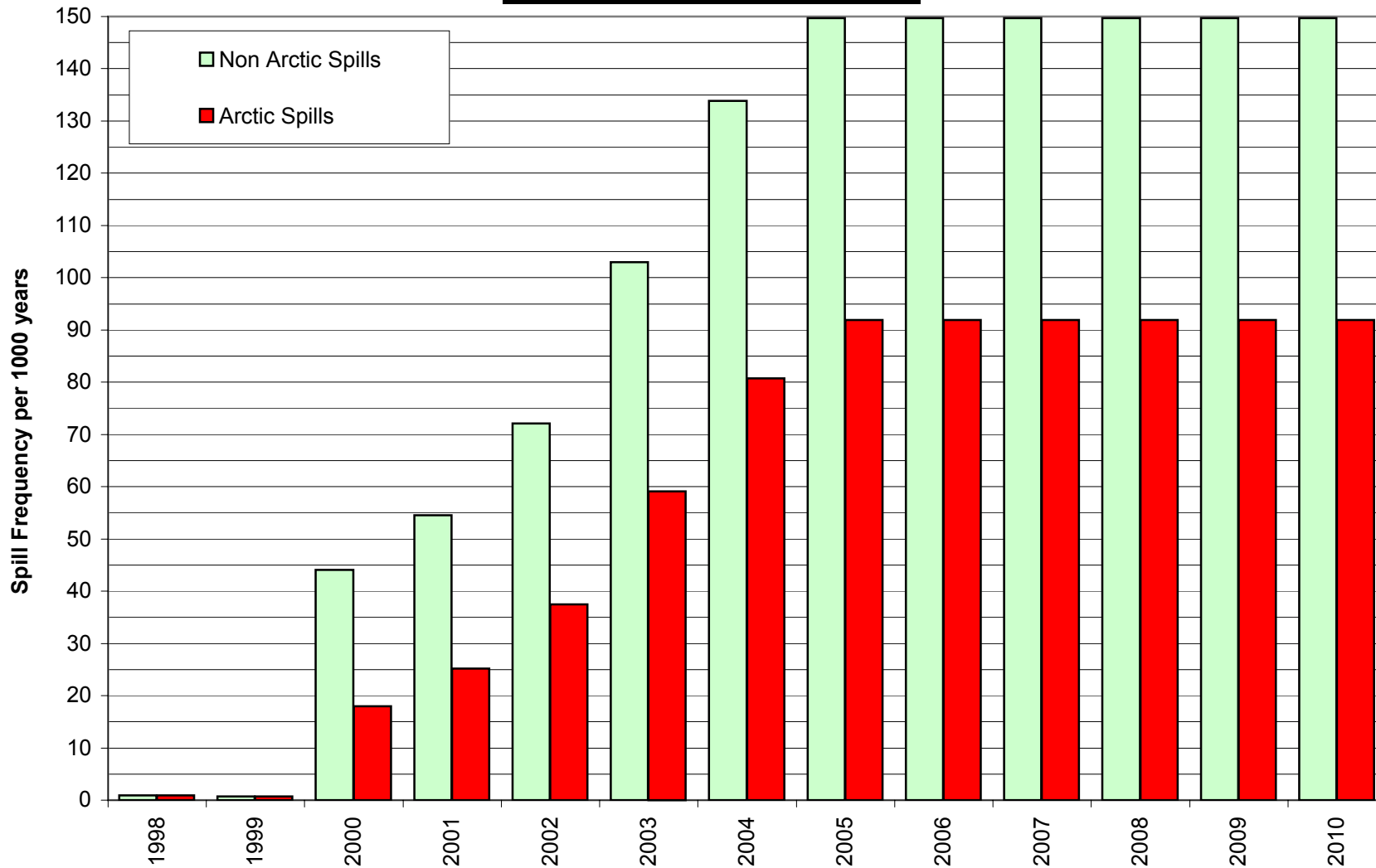
Chukchi Sea HC Spill Frequency per 10⁹ bbl Produced - Non Arctic



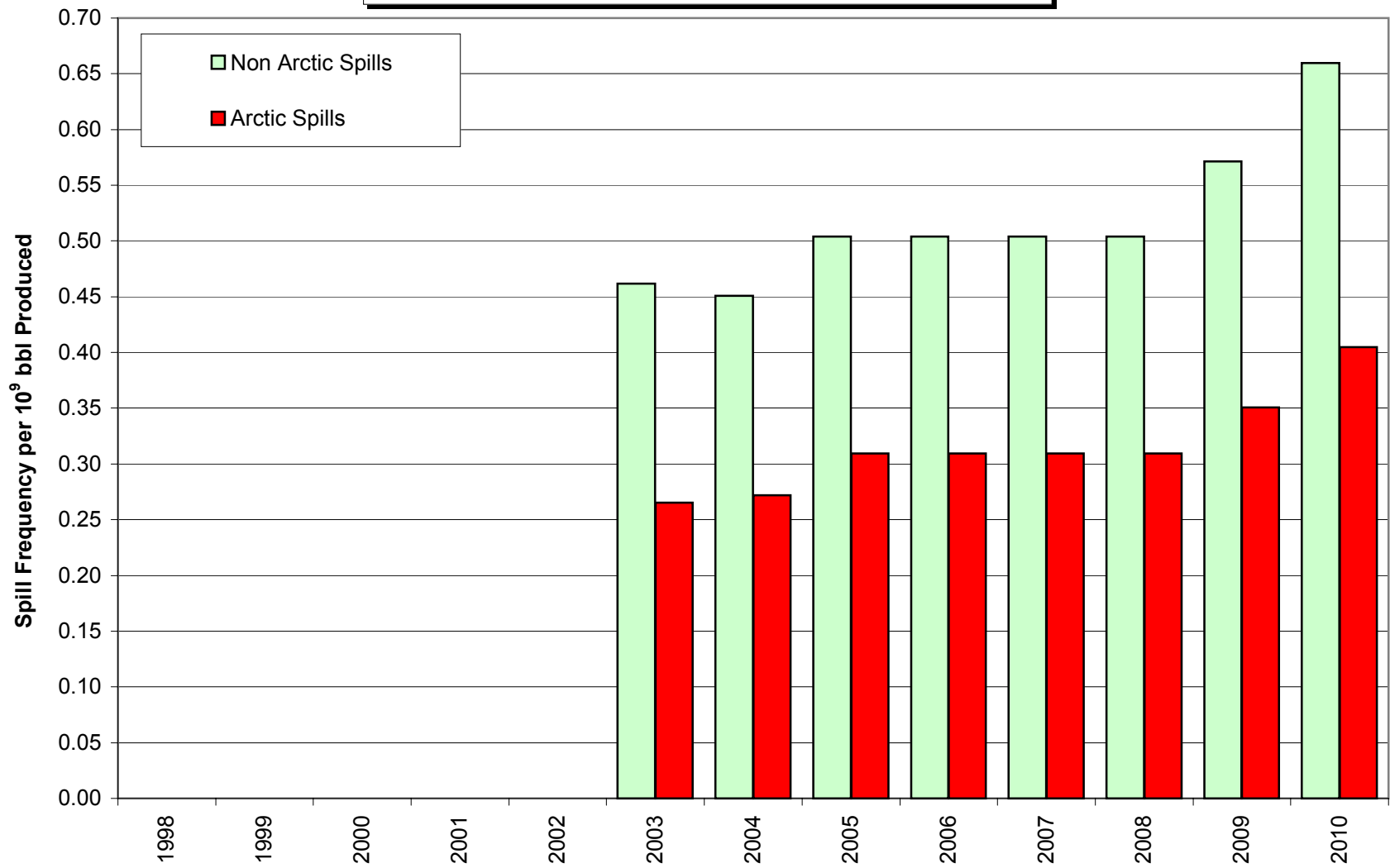
Chukchi Sea HC Spill Index - Non Arctic



Chukchi Sea HC Spill Frequency



Chukchi Sea HC Spill Frequency per 10⁹ bbl Produced



Chukchi Sea HC Spill Index

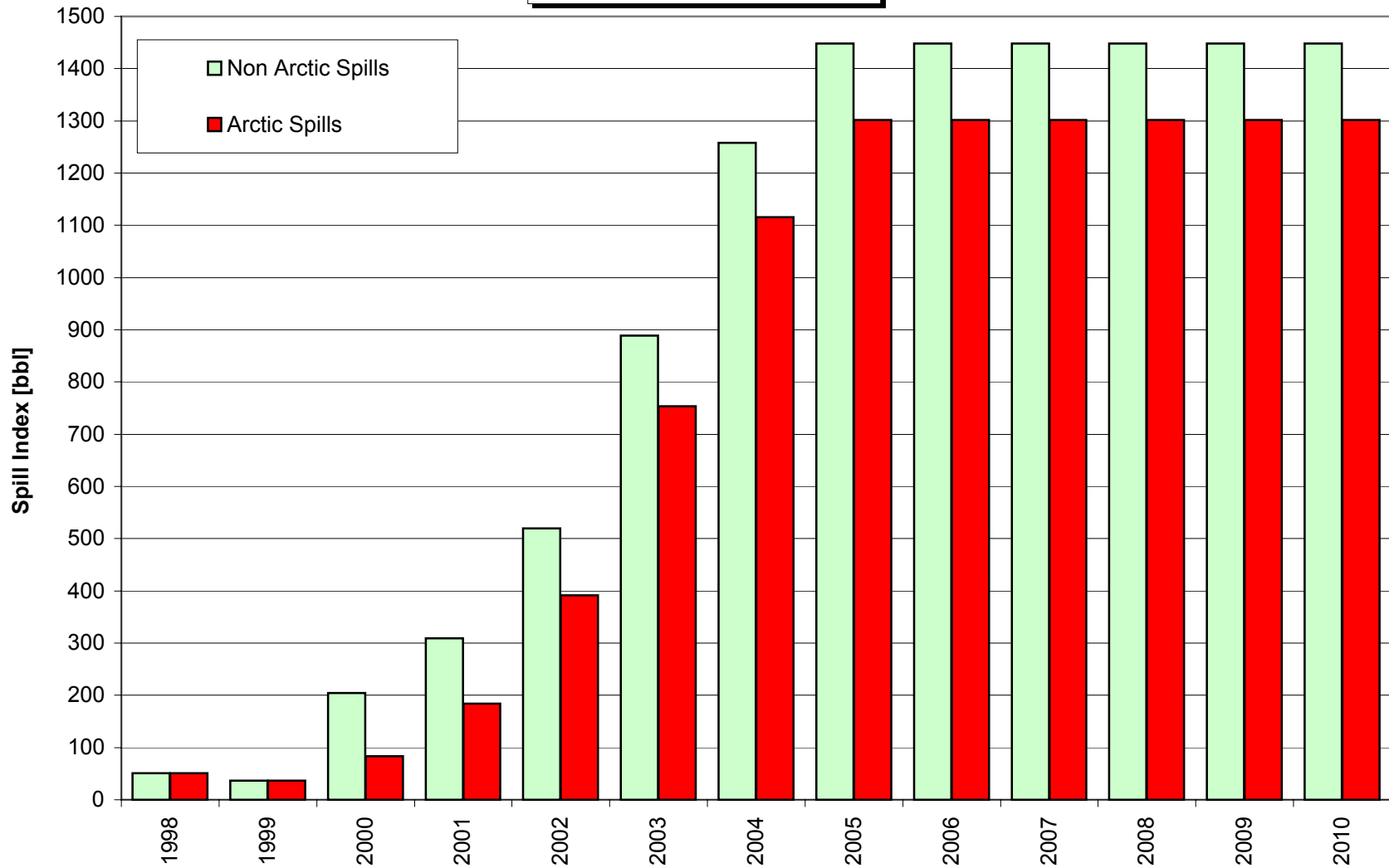


Table 5.1
Summary of Spill Indicators for All Scenarios

SPILL INDICATORS	Spill Size bbl x 1000	Beaufort Sea					Chukchi Sea		
		Year 2016	Year 2019	Year 2024	Year 2024	Year 2024	Year 2010	Year 2010	Year 2010
		Sale 1	Sale 2	Sale 3	Sale All	Sale All Non Arctic	Base Case	High Case	High C Non Arctic
Spill Frequency per 10 ³ years	SM	8.41	8.51	8.21	25.14	43.11	30.95	56.74	95.17
	L	3.38	3.32	3.15	9.85	17.83	12.43	21.33	36.70
	H	2.09	2.07	1.99	6.16	8.31	7.11	13.81	17.85
	All	13.89	13.90	13.35	41.14	69.25	50.49	91.89	149.72
Spill Frequency per 10 ⁹ bbl produced	SM	0.18	0.20	0.21	0.34	0.58	0.34	0.25	0.42
	L	0.07	0.08	0.08	0.13	0.24	0.14	0.09	0.16
	H	0.04	0.05	0.05	0.08	0.11	0.08	0.06	0.08
	All	0.29	0.33	0.35	0.55	0.93	0.55	0.40	0.66
Maximum Spill Frequency per 10 ⁹ bbl produced (year varies)	All	2.02	2.47	2.05	2.05	3.39	0.55	0.40	0.66
Spill Index [bbl]	SM	2	2	2	5	9	7	11	19
	L	23	23	22	67	102	79	151	218
	H	165	165	162	491	529	523	1140	1211
	All	190	189	185	564	640	609	1302	1448

**Table 5.2
Composition of Spill Indicators**

SPILL INDICATORS	Beaufort Sea				Chukchi Sea			
	Sale All - Year 2024				High Case - Year 2010			
	P/L	Platforms	Wells	TOTAL	P/L	Platforms	Wells	TOTAL
Spill Frequency per 10 ³ years	10.15	21.72	9.27	41.14	17.43	52.77	21.69	91.89
	25%	53%	23%	100%	19%	57%	24%	100%
Spill Frequency per 10 ⁹ bbl produced	0.14	0.29	0.12	0.55	0.08	0.23	0.10	0.40
	25%	53%	23%	100%	19%	57%	24%	100%
Spill Index [bbl]	32	25	507	564	55	61	1186	1302
	6%	4%	90%	100%	4%	5%	91%	100%

**Table 5.3
Composition of Spill Indicators**

SPILL INDICATORS	ITEM	Beaufort Sea				Chukchi Sea			
		Sale All - Year 2024				High Case - Year 2010			
		P/L	Platforms	Wells	TOTAL	P/L	Platforms	Wells	TOTAL
Spill Frequency per 10 ³ years	Monte Carlo	15.55	25.11	9.27	49.93	21.18	67.03	21.69	109.91
	Expected Value	10.15	21.72	9.27	41.14	17.43	52.77	21.69	91.89
	Difference	53%	16%	0%	21%	22%	27%	0%	20%
Spill Frequency per 10 ⁹ bbl produced	Monte Carlo	0.21	0.34	0.12	0.67	0.09	0.3	0.1	0.48
	Expected Value	0.14	0.29	0.12	0.55	0.08	0.23	0.10	0.41
	Difference	55%	17%	0%	23%	17%	29%	0%	17%
Spill Index [bbl]	Monte Carlo	56	29	507	592	73	76	1186	1335
	Expected Value	32	25	507	564	55	61	1186	1302
	Difference	76%	15%	0%	5%	32%	25%	0%	3%

Figure 5.1
Baufort Sea Sale All - 2024 year - Spill Indicators

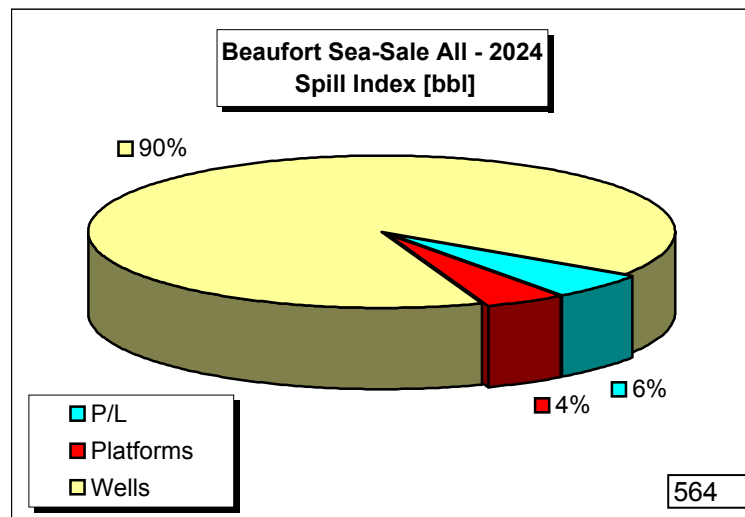
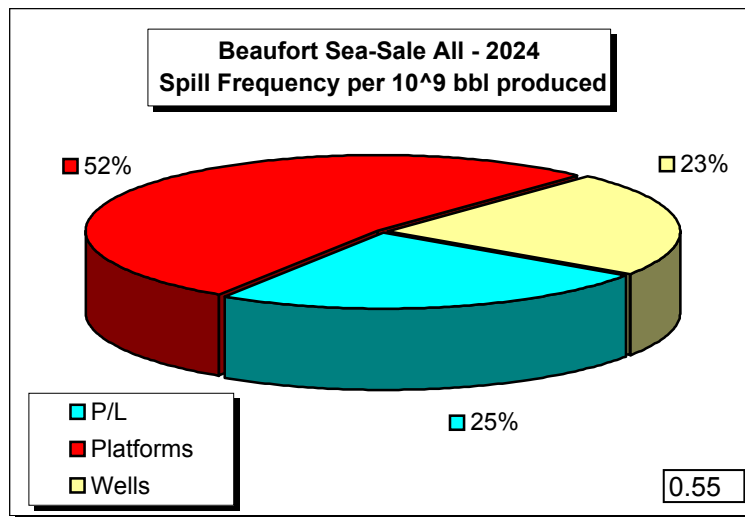
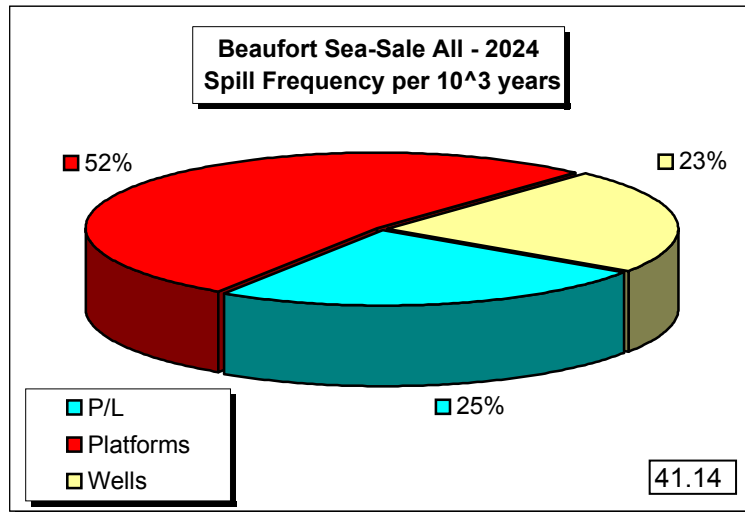


Figure 5.2
 Beaufort Sea Sale All - 2024 year - Spill Indicators

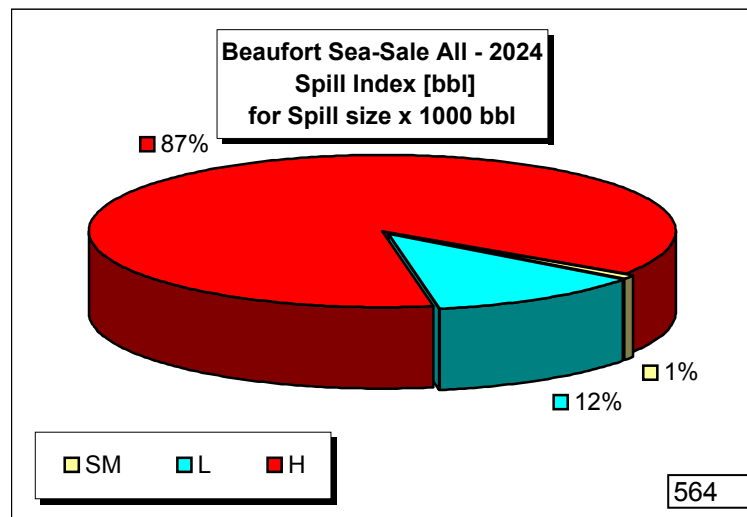
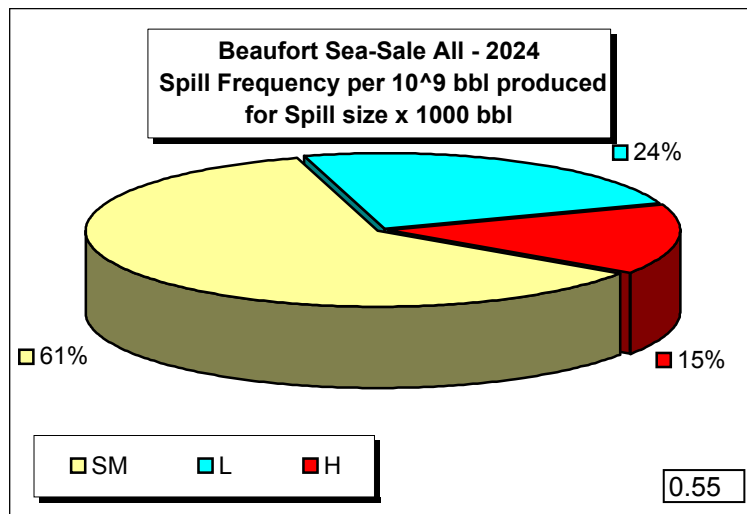
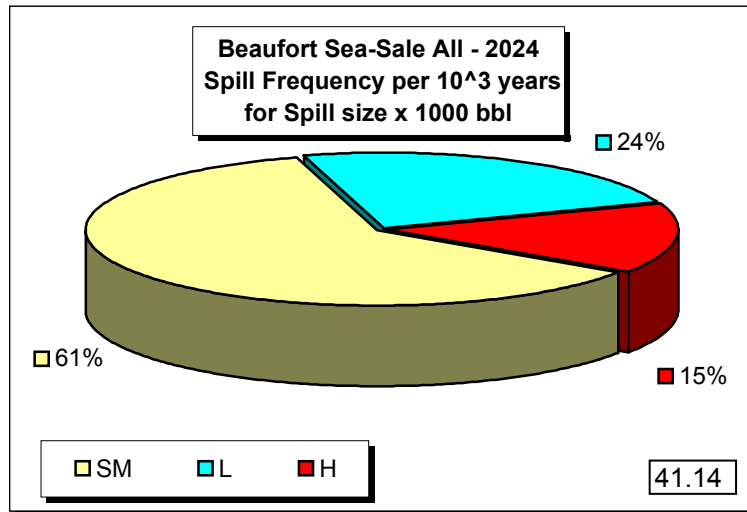


Figure 5.3
Chukchi Sea High Case - 2010 year - Spill Indicators

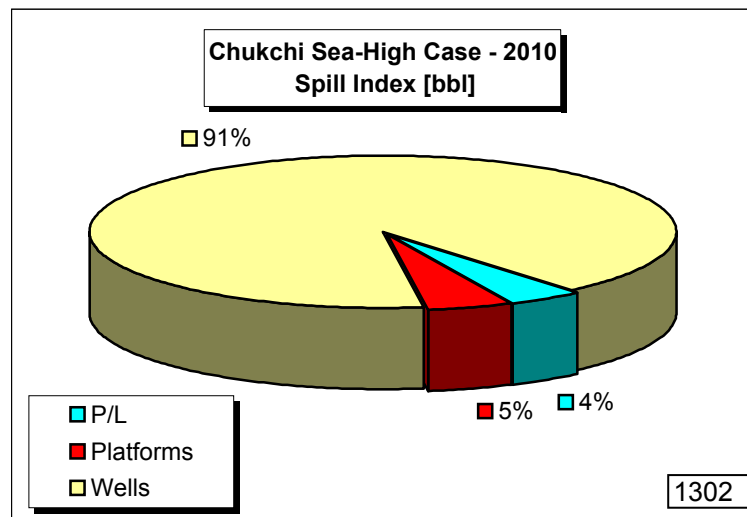
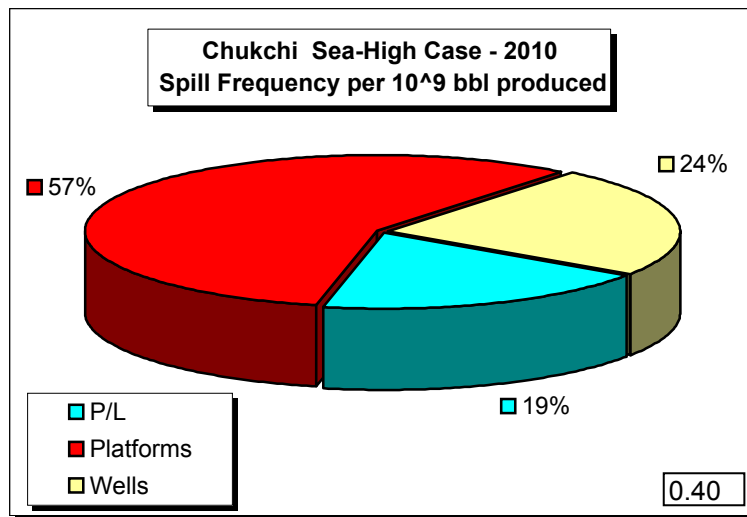
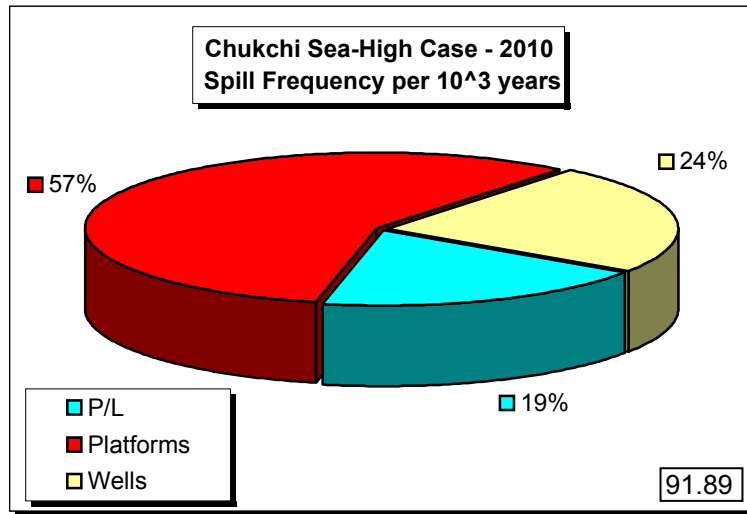


Figure 5.4
Chukchi Sea High Case - 2010 year - Spill Indicators

