TABLE 8-8
SUMMARY OF OIL SPILL CLEANUP LIMITATIONS FOR A CHRONIC PIPELINE LEAK INTO OFFSHORE MARINE WATERS AND ICE

Season	Expected Time of Year [1]	Annual Days of Occurrence	Spill Detection Method	Spill Volume[2]	Oil Recovery Techniques[3]	Recovery of Spilled Oil [4]	Environmental Conditions Reducing Oil Spill Cleanup Effectiveness [5]
Solid Ice	Dec. 16 to May 29	165	Periodic under-ice surveys by drilling holes through ice at intervals over the pipeline route and using instrumentation to detect oil. (Note: BPXA has proposed monthly sampling using 500 ft intervals.)	6,100 - 7,700 bbls	Ice roads built to the spill location; holes, slots, sumps, and trenches cut in the ice above oil pockets (ACS Tactics L-1, R-6, R-13, R-14).	--	Temperatures greater than 0ºF slow construction of ice road; lack of daylight requires use of electric lights.
					Oil recovered from water surface using pumps and rope mop skimmers until free oil no longer rises into cut ice pockets (ACS Tactics R-6, R-13, R-14).	75% [6]	Winds greater than 15 knots 28% of the time (46 days) [7].
					Vacuum trucks and rollagons with tanks transport recovered fluids to West Dock.	--	
					During pipeline repair, sorbents collect any oil appearing on water surface; excavated soil and oiled ice transported by dump truck to West Dock for storage and disposal.	No data available	
					New trenches and sumps cut in surface ice depressions in early June to divert oil; boom installed in the trenches to collect mobile oil; sorbents and shovels are used to recover oil.	No data available	
					In situ burning of pooled and residual oil during spring breakup (ACS Tactics B-2, B-3, B-5, and B-6).	14-63% [8]	Winds greater than 20 knots 13% of the time (21 days) [7].
Unstable Solid Ice	May 30 to July 3	35	None possible during this period.	6,600 - 8,200 bbls	Monitor oil movement as possible and wait until it is possible to employ broken ice recovery techniques.	--	Ice movements away from spill location; ice thicknesses less than 12 inches for light equipment and 20 inches for conventional vehicles [9]; winds greater than 15 knots 23% of the time (8 days) and greater than 20 knots 6% of the time (2 days) [7].
Broken Ice (Ice Concen-tration between 30%	July 4 to July 24 (maximum of 4 to 5	21 to 35	Weekly visual inspections of pipeline route by boat or by air.	3,800 - 5,500 bbls	Workboats, on inflatable boat, mini-barges, a storage barge and a tug used to recover oil in open water areas with LORI skimmer and boom (ACS Tactic	No data available	Booms may be collapsed, overrun, or damaged by drifting ice; containment efficiencies decrease with increasing ice concentrations (70% in 3/10ths ice

TABLE 8-8 (Cont.)
SUMMARY OF OIL SPILL CLEANUP LIMITATIONS FOR A CHRONIC PIPELINE LEAK INTO OFFSHORE MARINE WATERS AND ICE

Season	Expected Time of Year [1]	Annual Days of Occurrence	Spill Detection Method	Spill Volume[2]	Oil Recovery Techniques[3]	Recovery of Spilled Oil [4]	Environmental Conditions Reducing Oil Spill Cleanup Effectiveness [5]
and 100%)	weeks)				R-17).		concentration, 40% in 5/10ths and 20% in 7/10ths [S.L. Ross, 1998:46]); open leads make spill trajectory uncertain.
					Transport recovered oil and water in mini-barge to intermediate storage barge.	--	60% reduction in effective number of response hours due to barge travel [3].
					In situ burning of pooled and residual oil in broken ice while using fire booms to capture oil run-off not ignited (ACS Tactics B-2, B-3, B-4, B-5, and B-6).	55-85%[10] or 50-90%[8] in ice concentrations ≥70%	Winds greater than 20 knots 5% of the time (1 day)[7]; waves greater than 2 to 3 feet.
					Mechanical recovery of residual oil and burn materials from water; sorbents sweeps used to capture remaining sheen on rotting ice (ACS Tactic R-9).	No data available	Winds greater than 15 knots 19% of the time (4 days) [7].
Open Water (Ice Concentration 30% or lower)	July 25 to Oct. 5 (average) June 29 to Oct. 15 (maximum)	73 to 109	Weekly visual inspections of pipeline route by boat or by air.	3,800 - 5,500 bbls	Workboats, mini-barges, a storage barge, and a tug used with booms and skimmers to contain and collect oil (ACS Tactic R-18, R-19, and R-20).	41-72%[11]	Ice invasions decrease containment efficiencies of booms; winds greater than 15 knots 27% of the time (20 days)[7]; waves greater than 2 to 3 feet.
					Transfer recovered oil and water from barges to West Dock for storage and disposal.	--	
					In situ burning of oil (ACS Tactics B-2, B-3, B-4, and B-6).	95-98% or 60-80% for up to 50% oil/water emulsion[12]	Winds greater than 20 knots 11% of the time (8 days)[7]; waves greater than 2 to 3 feet.
Broken Ice (Ice Concentration between 30% and 100%)	Oct. 6 to Nov. 10 (maximum of 6 to 8 weeks)	36 to 56	Weekly visual inspections of pipeline route by boat or by air.	3,800 - 5,500 bbls	Workboats, an inflatable boat, mini-barges, a storage barge, and a tug used to recover oil in open water areas using LORI skimmer and boom (ACS Tactic R-17).	No data available	Booms may be collapsed, overrun, or damaged by drifting ice; containment efficiencies decrease with increasing ice concentrations; open leads make spill trajectory uncertain; winds greater than 15 knots 38% of the time (14 days) [7].
					Transport recovered oil and water in mini-barge to intermediate storage barge.	--	60% reduction in effective number of response hours due to barge travel [3].

TABLE 8-8 (Cont.)
SUMMARY OF OIL SPILL CLEANUP LIMITATIONS FOR A CHRONIC PIPELINE LEAK INTO OFFSHORE MARINE WATERS AND ICE

Season	Expected Time of Year [1]	Annual Days of Occurrence	Spill Detection Method	Spill Volume[2]	Oil Recovery Techniques[3]	Recovery of Spilled Oil [4]	Environmental Conditions Reducing Oil Spill Cleanup Effectiveness [5]
					In situ burning of pooled and residual oil in broken ice while using fire booms to capture oil run-off not ignited (ACS Tactics B-2, B-3, B-4, B-5, and B-6).	55-85%[10] or 50-90%[8] in ice concentrations ≥70%	Winds greater than 20 knots 21% of the time (7 days) [7]; waves greater than 2 to 3 feet.
					Mechanical recovery of residual oil and burn materials from water; sorbent sweeps used to capture remaining sheen on rotting ice (ACS Tactic R-9).	No data available	
Unstable Solid Ice	Nov. 11 to Dec. 15	35	None possible during this period.	6,600 - 8,200 bbls	Employ broken ice oil spill recovery techniques as possible, then monitor oil spill movement and wait until ice is stable enough to support equipment and personnel and apply solid ice oil spill recovery techniques.	No data available	Ice movements away from spill location; ice thicknesses less than 12 inches for light equipment and 20 inches for conventional vehicles [9]; winds greater than 15 knots 35% of the time (12 days) and greater than 20 knots 21% of the time (7 days) [7].

TABLE 8-8 (Cont.)
SUMMARY OF OIL SPILL CLEANUP LIMITATIONS FOR A
CHRONIC PIPELINE LEAK INTO OFFSHORE MARINE WATERS AND ICE

Notes: ACS = Alaska Clean Seas
bbls = Barrels
% = Percent
°F = Degrees Fahrenheit

1 = Offshore ice data for 1953 through 1975 (Cox, 1976:Appendix); 1975 through 1989 (Vaudrey & Associates, 1998:5, 6, and 9).

2 = Range of potential spill volumes from Table 8-5 for Alternatives 2, 3, 4, and 5. Volumes presented here include oil lost through a small leak (less than 0.15% of pipeline flowrate) before detection, plus total drainage of oil in pipeline after leak is detected and pipeline is shutdown.

3 = Oil spill response techniques from ACS, 1998 and BPXA, 1998b and (1998a).

4 = Performance of oil recovery methods is dependent on spilled oil properties, water conditions, surface current speed, and oil slick thickness. Recovery efficiencies presented here represent baseline performance information from literature. Unfavorable environmental conditions that delay or hinder oil spill response could result in lower oil recovery efficiencies. Delays in oil recovery during broken ice or open water conditions would increase the area contacted by the oil slick as it disperses, requiring available oil spill cleanup resources (equipment and personnel) to be spread out over a larger area.

5 = Operating limits that apply to all seasons: ambient temperatures below -35ºF to -40ºF for equipment; wind chill temperatures below -30ºF for personnel; white out conditions for vehicle travel; reduced visibility due to fog for aircraft and vessel traffic; wind speeds exceeding 15 knots for some cleanup equipment; wind speeds exceeding 20 knots for in situ burning..

6 = From Solsberg et al., 1992:99. Recovery efficiency is for a vacuum skimmer used in ice-fast conditions to remove No. 2 fuel oil and small ice pieces near Cleveland in 1977.

7 = Monthly wind speed data (S.L. Ross, 1998:Table B-2) used to calculate average time during seasons that winds exceed 15 and 20 knots.

8 = From USDOI, MMS, 1997: 43-46.

9 = Ice weight bearing capacity relative to ice thickness (ACS, 1998:Tactic L-7, page 5).

10 = From Evans, 1989:51.

11 = From Lichte, 1989:19.

12 = From BPXA, 1997b:61-62 and Table 5-3.