Noise Control Directive User Guide

November 1999

Contents

(continued)

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1 Introduction

1.1 What's New

Guide 38: Noise Control Directive User Guide has been revised in 1999 to assist in the interpretation and application of *Interim Directive (ID) 99-8: Noise Control Directive*. This 1999 edition of *Guide 38,* which replaces earlier editions, integrates the section formerly identified as "Supplement to the Interim Directive" into the guide itself.

Although the technical requirements in this edition of the directive and *Guide 38* have not changed, many enhancements have been made to help users better understand the complexities of this policy. Some of the more significant areas of interest are as follows:

- Construction Noise (Section 5.1)—Industrial operators must consider construction noise. This guide provides a number of suggestions that operators can implement to help minimize the noise impact on nearby residents.

- Complaint Investigation Process (Section 6)—The directive and guide now provide tools to assist operators and their neighbours in determining the conditions when industrial noise is a problem so that noise surveys can be performed under similar representative conditions.

- Noise Impact Assessments (Section 7)—The improved section on noise impact assessments enables operators to better understand EUB expectations and carry out assessments as part of their facility applications.

- Measurement Instrumentation and Techniques (Appendix 2)—Calibration requirements have been added for sound level meters in accordance with the appropriate American Noise Standards Institute requirements.

1.2 What *Guide 38* Includes

Composed of nine sections and four appendices, the guide introduces the 1999 interim directive on noise control and provides details for its implementation.

- Section 2 is an overview of the 1999 noise control directive.

- Section 3 gives a description of the Leq concept and some other basic acoustics, including how to add sound levels and extrapolate sound levels to different distances. For those not familiar with noise and related terminology, reviewing this section before applying the directive is especially useful.

- Section 4 defines sound levels and adjustments and explains how they are determined.

- The three flowcharts in Section 5 identify the different appropriate responses when designing a new facility, modifying an existing facility, or responding to a public complaint. Reference numbers in the bottom right corner of each flowchart box correspond to a matching explanatory note in Section 5.1. Each note gives more detail as to what is required for that step or background on the rationale behind the directive.

- Responding to noise complaints is one of the events that trigger *ID 99-8*. Section 6 outlines some basic expectations for complaint investigation. A sample Complaint Investigation Form is included to help concerned parties understand the technical aspects of the noise and handle any complaints.

- As stated in *ID 99-8*, a noise impact assessment is required to be completed for applications for new permanent facilities or for modifications to existing permanent facilities where there is a reasonable expectation of a continuous noise source. Section 7 has information on what should be included in a noise impact assessment.

- Section 8 explains compliance and EUB enforcement processes.

- Section 9 provides example problems that demonstrate how the flowcharts in Section 5 are used in applying *ID 99-8*.

- There are four appendices:

    1) Glossary of noise-related technical terms

    2) Minimum requirements for measurement instrumentation and techniques that must be used to conduct appropriate sound surveys

    3) Sound levels of familiar noise sources

    4) *ID 99-8: Noise Control Directive*

2 Overview of *ID 99-8: Noise Control Directive*

2.1 Background

With the continued widespread growth of energy operations throughout the province, additional sources of sound related to the energy industry are appearing. While residents, particularly in rural areas, would generally prefer no increase in sound levels resulting from energy-related developments, it is sometimes not possible to completely eliminate these increases. However, if proper sound control features are incorporated into facility design in the planning stages, increases in sound levels can be kept to acceptable minimums.

Interim Directive (ID) 99-8 views noise from a receptor viewpoint, rather than considering sound levels at the property line. Criteria based on property line measurements were considered to be too restrictive in rural settings, since a natural buffer often exists between operating facilities and any occupied dwellings.

The directive applies to all facilities under the EUB's jurisdiction or where the EUB will issue or has issued a permit to operate. Facilities approved prior to April 1988 will be dealt with on a case-by-case basis, while post-April 1988 facilities will be designed to meet this directive. Although the directive is comprehensive, it is expected some cases will need to be dealt with on a site-specific, issues-oriented basis. For example, while the directive is not applicable to construction activity, these activities must be conducted with some consideration for noise. Any related complaints must be dealt with by the facility operator.

2.2 Sound Levels and Measurements

2.2.1 Permissible Sound Level

The permissible sound level (PSL) is the maximum integrated (averaged) sound level that a facility must not exceed at the nearest or most impacted residence. Even for remote facilities where there are no impacted dwellings, uncontrolled sound generation is not allowed, particularly since retrofit may be required if a residence is built and the facility is no longer remote. New facilities planned for remote areas should be designed to meet a target sound level of 40 dBA Leq at a distance of 1.5 km, although this is not a mandatory requirement. (Using the rule of 6 dBA loss per doubling of distance from the source, the facility would generate a sound level of approximately 70 dBA at 50 m.) As a target, this does not establish compliance should infringement occur.

2.2.2 Comprehensive Sound Level

In most noise-related complaint situations, the comprehensive sound level (CSL) must be measured and compared to the PSL. (See Appendix 2 for the requirements for measurement instrumentation and techniques.) Modelling of the industrial noise source component can be used as a diagnostic tool to assist in the timely resolution of noise concerns but not to demonstrate compliance.

The CSL for the facility must not exceed the PSL. The CSL is determined by conducting a continuous sound-monitoring survey, which must encompass a representative portion of the times of day or night on typical days when the noise causing the complaints occurs over a minimum 6-hour to maximum 24-hour period. The maximum survey time may exceed 24 hours where warranted. These exceptional circumstances should be discussed with the EUB before proceeding. If the required survey period straddles the daytime/nighttime periods, then a minimum of three survey hours must be conducted within each of the daytime and nighttime periods. The measurements are to be conducted 15 m from the complainant's dwelling in the direction of the noise source. The 15 m requirement may be altered if it is physically impossible or acoustically illogical.

If a complainant has highlighted specific weather conditions, plant operating conditions, or seasons, the monitoring should take place under these representative conditions. Representative conditions do not constitute absolute worst-case conditions or the exact conditions the complainant has highlighted if those conditions are not easily duplicated. In order to expedite complaint resolution, sound measurements should be conducted at the earliest opportunity when sound propagation towards the impacted dwelling is likely and representative conditions might exist. An extended duration survey (greater than 24 hours) may be considered to ensure representative conditions have been met if they are frequent but difficult to predict.

The local EUB field centre can be consulted to help establish criteria for determining when favourable conditions exist.

When the measured CSL exceeds the PSL but noise from the facility and its related activities is not considered to be responsible for the accedence, then a further assessment using an appropriate isolation analysis technique to separate the facility noise contribution from the measured CSL may be carried out. This will, in effect, separate noises not related to the facility. This isolated facility contribution can then be compared to the PSL for compliance.

Invalid data, such as those collected during periods with unacceptable meteorological conditions or nonrepresentative ground cover, and abnormal data, such as those from nontypical noise events, should be extracted from the measured CSL. The extraction of data from the measured CSL must be justified and supported by an appropriate reference, such as high-fidelity video cassette

recorder (VCR) recording, digital analogue tape (DAT) recording, operational log, event log, etc. The accumulated isolated facility contribution data must encompass the previously stipulated minimum time period.

2.2.3 Responsibility for Sound Control

For drilling and servicing rigs, the responsibility for sound control belongs to the well licensee. The EUB believes it is the responsibility of the well licensee to contract an appropriately equipped rig for sensitive situations and that the rig contractor is responsible for suitably equipping and maintaining rigs contracted for sensitive situations. Compliance for drilling and servicing rigs is on a complaint basis only. All parties are expected to act quickly to remedy any complaints.

While noise impact from facility-related heavy truck traffic and vibration impact from energy facility operations are not specifically addressed in this directive, it should be noted that receipt of a public complaint with regard to these impacts may require corrective action from the operator. The EUB acknowledges the special nature of these impacts and is prepared to consider these on a site-specific basis. Industry is expected to take every reasonable measure to avoid or minimize the impact of heavy truck traffic or vibration concerns in an area.

Compliance with the noise control directive for pre-1988 facilities occurs when a valid comprehensive sound survey indicates the energy facility contribution is equal to or less than the PSL. When a facility is found to be noncompliant, the operator is allowed reasonable time to undertake corrective action (see Section 5.1, note 10.2). However, if in the opinion of the EUB the operator is not working in the spirit of this directive to resolve the issue, the EUB will intervene. Consequences may include curtailing production to reduce sound generation and possible shutdown of the facility. Communication with the complainant through all phases of corrective action is required.

2.2.4 Resolution of Disagreements

The PSLs set out in this directive are receptor oriented. However, the EUB does not believe that industry has the right to arbitrarily reduce a landowner's right to the use of his own property. This approach allows industry to take maximum advantage of the normally substantial distance in rural areas between a facility and any residences. The receptor-oriented approach does not protect industry against eventual infringement; therefore, industry is advised to consider the magnitude of this risk when choosing sites, designing facilities, and negotiating leases. Operators are strongly encouraged to communicate with their neighbours to identify potential developments that may infringe upon their facility. Once identified, industry representatives are expected to work proactively to minimize potential impacts.

If there is disagreement, the EUB considers each case of infringement on its own merits before requiring compliance. Furthermore, EUB staff are available to work with both parties in the event of a dispute. Developers (anyone building a dwelling) knowingly infringing upon existing energy facilities by ignoring the obvious impacts may not be eligible for redress under this directive. If redress is deemed appropriate, the EUB expects an operator to be prepared to comply expeditiously with the requirements of this directive once aware that infringing developments resulted in the facility exceeding the PSL.

In certain situations when it is difficult for both sides to agree on an acceptable course of action, the EUB should be contacted to mediate and, if necessary, make recommendations or give specific direction.

Overall, public benefit and impacts of energy development are taken into consideration by the EUB when resolving complaints. The public desire for a no-impact (zero industry noise) solution is essentially unattainable. Sometimes the benefits are not as apparent as the detractions to those living near energy facilities. Should a successful resolution not be achieved through mediation, both the facility owner and the landowner continue to have the right to request a hearing before the EUB under the appropriate sections of the Energy Resources Conservation Act.

2.2.5 Special Cases

The EUB recognizes that there will be situations that do not fit into the categories in this policy; it will judge such cases on an individual basis.

Under special circumstances the PSLs calculated using this directive may need to be reviewed. A higher or lower sound emission from a resource facility may be deemed appropriate in such exceptional circumstances. One such exception is Alberta's Industrial Heartland area in the Fort Saskatchewan region. The PSL for the Industrial Heartland area is based in part on ambient sound level data dating back as far as 1980, when there were few EUB-regulated facilities. New or existing operators contemplating expansion and required to comply with this directive should consult the Fort Saskatchewan Regional Industrial Association office, the local municipal noise bylaw, and the EUB for information relevant in determining the PSL for the area.

ID 99-8 will be reviewed in November 2001 or as required and revised if necessary.

3 The Leq Concept and Basic Acoustics

3.1 dB and dBA

The human ear is capable of hearing a large range of levels of sound pressure from 2 x 10^{-5} pascals (Pa) (just audible, 0 dB) to 2 x 10^{2} Pa (sensation of pain, 140 dB) — a difference of seven orders of magnitude. Because of this large range, the decibel (dB) is used to compress the range into a more meaningful scale. The symbol used to represent the linear decibel scale is dB(lin), or simply dB.

The A-weighted decibel scale is represented by dB(A), or dBA. The A-weighting network approximates the way the human ear hears different frequency sounds. Low frequency sounds (hum) are harder for the human ear to hear than higher frequency sounds (whine). This means a low frequency sound would have a higher sound level on the linear scale (dB) than a high frequency sound and yet would sound equally loud to the ear. These two sounds would have the same dBA rating on the A-weighting scale because they sound equally loud.

3.2 Leq Concept

This guide uses Leq measurements, which represent energy equivalent sound levels. The Leq is the average A-weighted sound level over a specified period of time—a single-number representation of the cumulative acoustical energy measured over the interval. The time interval used should be specified in brackets following the Leq (e.g., Leq (9) is a 9-hour Leq). If a sound level is constant over the measurement period, the Leq will equal the constant sound level. Figure 1 illustrates this concept.

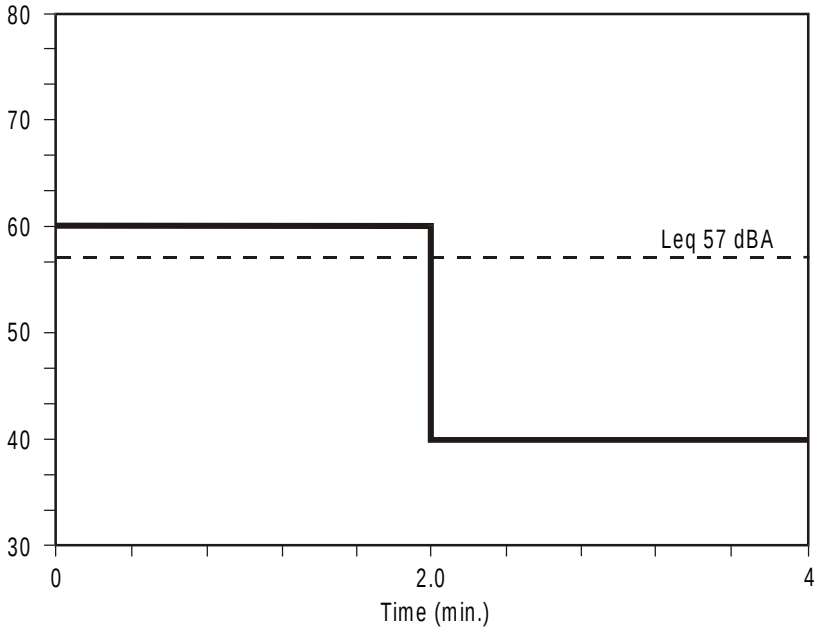


Figure 1. Illustration of Leq concept

In Figure 1, the equivalent energy during the 4-minute period is not 50 dBA, as one might expect, but 57 dBA. This is due to the way in which sound energies are added, which is logarithmical rather than arithmetic. A quick look at the mathematics shows this:

$$Leq = 10 \log\left(\sum_{i=1}^{n} f_i \times 10^{L_i/10} \right)$$

where: f_i = fraction of total time the constant level L_i is present

L_i = sound level in dBA

For Figure 1, which has 4 minutes of 1-second Leq values:

$$Leq = 10 \log\left(\sum_{i=1}^{n} f_i \times 10^{L_i/10} \right)$$

$$= 10 \log\left(\sum_{1}^{240} f_i \times 10^{L_i/10} \right)$$

$$= 10 \log\left(\frac{120}{240} \times 10^{60/10} + \frac{120}{240} \times 10^{40/10} \right)$$

$$= 10 \log (505\,000)$$

$$= 57 \text{ dBA Leq (4 min)}$$

In these calculations, we are adding numbers that are proportional to the corresponding sound energies. For example, the energy associated with the 60 dBA level is 100 times greater than the energy associated with the 50 dBA level (10^6 versus 10^4).

Another example of a Leq calculation is useful to demonstrate how a loud noise event, such as a train passing by, can alter the Leq value. Assume we measure the sound level for 1 hour. For 59 minutes, the sound level is 40 dBA (fairly quiet), and for 1 minute it is 90 dBA while a train passes:

$$Leq = 10 \log\left(f_1 \times 10^{L_1/10} + f_2 \times 10^{L_2/10} \right)$$

$$= 10 \log\left(\frac{59}{60} \times 10^{40/10} + \frac{1}{60} \times 10^{90/10} \right)$$

$$= 10 \log (0.98 \times 10^4 + 0.02 \times 10^9)$$

$$= 73 \text{ dBA Leq (1 hour)}$$

This example demonstrates how loud noise events, such as train passings, can dominate the Leq values.

3.3 Sound Power and Sound Pressure Levels

Sound power is a physical property of the source alone and is an important absolute parameter used for rating and comparing sound sources. Sound power levels for specific equipment may be obtained from the manufacturer or by modelling the source using near-field sound pressure level measurements.

Sound pressure levels can be calculated using sound power levels. The formula for a free field is

$$L_{pressure} = L_{power} + 10 \log_{10} Q - 20 \log_{10} r - 10.8 - A_{NC} - A_{air} - A_{ground} - ....$$

where r = distance, in metres
Q = directivity factor of source, composed of inherent directivity of the source, Q_s, and the geometry of location, Q_g
A = attenuation from noise control, air absorption, ground effects, etc.

For simplicity with an exposed source in a free field (i.e., the distance, r, is greater than 5 times the size of the source and there are no significant reflections of sound) where additional attenuation factors are to be neglected, this calculation can be done using A-weighted power and pressure levels. This gives a conservative estimate of the sound pressure level at a distance, but not necessarily the "worst-case" level that may occur under weather conditions favouring noise propagation in a given direction, which can be considered as a negative attenuation.

Where any noise control measures are to be added to the source (such as a silencer or a building that will enclose the source), or where environmental conditions (such as the barrier effect of the topography) are to be included, the calculations must be done using octave or ⅓-octave frequency bands and the sound pressure levels added together and A-weighted afterwards. Noise controls and environmental effects are strongly frequency dependent, and a calculation using A-weighted data is not adequate.

The directivity factor, Q, can be thought of as the portion of a sphere into which the source radiates its sound energy. Some sources radiate uniformly in all directions, while others, notably fans, are very directional. For example, a fan in a vertical plane radiates most of the sound energy in a narrow beam to the front ($Q_s \approx 5 - 8$).

The directionality of the source is also affected by the geometry of its immediate surroundings, largely due to the presence of reflecting surfaces. The directivity of the location may or may not be significant due to the inherent directivity of the source. How the directivity factors Q_s and Q_g combine depends on the layout of the equipment and its surroundings. Table 1 below gives examples of values of Q for a variety of location geometries.

Table 1. Q Values

Q	Radiation pattern	Examples
1	Spherical	Elevated sources, flares, aircraft
2	Hemispherical	Source near or on ground surface
4	¼-spherical	Source on ground beside taller building
8	⅛-spherical	In a corner of three surfaces

3.4 Addition of Sound Power or Sound Pressure Levels

A similar formula to the one used in Section 3.3 can be used to add sound levels together both for the A-weighted levels and in frequency bands. This formula is useful for adding together sound power or sound pressure levels from different components of a plant, for example, to arrive at a composite sound level for the plant.

Sound pressure levels can be added together in this way only if they are measured or calculated for the same location.

Sound power levels can be added together and the composite source can be thought of as being at the acoustic centre of the individual sources (similar to the concept of the centre of mass of an object).

The formula for the addition of sound levels is

$$L_{TOTAL} = 10 \log_{10} \left(\sum_{i=1}^{n} f_i \times 10^{L_i/10} \right)$$

where L_i = individual component sound levels (power or pressure)**.**

Example Calculation of Addition of Sound Power Levels

You are building a compressor station. You are told by the manufacturer that the A-weighted sound power levels (referred to as 10^{-12} watts, also written 1 picowatt, or 1 pW) for the different components are as follows:

Engine exhaust, with muffler	106 dBA
Aerial cooler (nondirectional)	113 dBA
Piping noise	79 dBA

$$L_{POWER,\ TOTAL} = 10 \log_{10}\left(\sum_{i=1}^{n} f_i \times 10^{L_i/10}\right)$$

$$= 10 \log_{10}\left(10^{106/10} + 10^{113/10} + 10^{79/10}\right)$$

$$= 10 \log_{10}\left(10^{10.6} + 10^{11.3} + 10^{7.9}\right)$$

$$= 10 \log_{10}\left(2.394 \times 10^{11}\right)$$

$$= 10\ 11.38$$

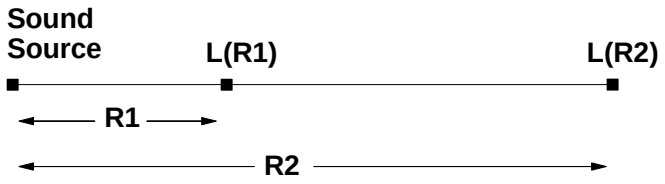
$$= 113.8 \text{ dBA (ref 1 pW)}$$

When adding sound pressure levels, note that these levels are only valid for the specific location. To add the sound pressure levels, they must all be calculated or measured at the same location.

3.5 Calculation of Sound Levels for Different Distances

This calculation assumes hemispherical spreading of the sound waves and equates to a 6 dBA loss per doubling of distance from the sound source. The calculation does not account for any attenuation (or loss) due to atmospheric or ground absorption. The basic equation is

$$L(R_2) = L(R_1) - 20 \log_{10}\left(\frac{R_2}{R_1}\right)$$



with: R_1 = distance R_1 in metres
R_2 = distance R_2 in metres
L = sound level in dBA

Note that if R_2 is less than R_1, the second term in the equation is negative and $L(R_2)$ is higher than $L(R_1)$. Also, under certain source-receiver configurations, the loss per doubling of distance can be less than 6 dBA.

The inverse square law (6 dBA loss per doubling of distance) for sound dissipation over distance does not apply for "near-field" measurements. The near field is the area where the dimensions of the source are significant; it applies to sound pressure levels measured at distances less than about five times the size of the source object.

The data supplied by manufacturers are often provided as sound pressure levels measured very close to the equipment (i.e., in the near field) and are intended for use under occupational hearing requirements rather than for environmental assessment. Note that such measurements are often conducted using conditions that may not reflect field or operational conditions. Therefore, this type of measurement cannot be used in the equation above. However, given additional information about the dimensions of the equipment and the conditions of the measurement, an expert can determine the sound power level of the equipment, and the equation from Section 3.3 can be used instead.

An acceptable distance for applying the inverse square law depends on the sound source dimensions and the wavelength of the sound. The formula is usually safe to use as long as R_1 and R_2 are about five times the size of the source. Alternately, a minimum distance of 50 m can be used as a rule of thumb.

Example Calculation of Determining the Sound Level at a Different Distance

The sound level specification you are given is 75 dBA for the compressor package at 50 m away. You have a residence 800 m away from your facility. What is the compressor sound level as measured at the residence?

You know L (50 m) = 75 dBA.

$$L(R_2) = L(R_1) - 20 \log\left(\frac{R_2}{R_1}\right)$$

$$L(800\ m) = L(50\ m) - 20 \log\left(\frac{800}{50}\right)$$

$$L(800\ m) = 75\ dBA - 20 \log\left(\frac{800}{50}\right)$$

$$L(800\ m) = 75\ dBA - 24\ dBA$$

$$L(800\ m) = 51\ dBA$$

So the sound level contribution due to the compressor is 51 dBA at 800 m.

A simpler, more intuitive way to do the calculation is illustrated below.

Alternate Method of Determining the Sound Level at a Different Distance—Simple Table Approach

A simplified way to estimate the sound level is based upon using the rule of 6 dBA lost per doubling of distance. With this method, you simply make a table and subtract 6 dBA for each time you double the distance from the noise source.

If we use the 75 dBA at 50 m specification:

Distance (m)	Sound level (dBA)
50	75
100	69
200	63
400	57
800	51
1600	45

From this simple method, you get 51 dBA at 800 m. This matches the calculation above. The table method only allows you to get sound values at discrete distance points. If sound values between the distance points are required, use the calculation method.

3.5.1 Line Sources

Where a long, narrow source radiates noise, the radiation pattern is that of a cylinder, not a sphere. Examples include pipes, conveyor belts, and transportation corridors such as roads. Calculations using the spherical spreading of sound from point like sources would involve a final step of integration over the length of the sound. It is more convenient to treat the sound as a line radiating into a cylinder. The pressure level at distance r is considered below. If the length, L, of the line source is limited, once the distance, r, exceeds three to five times the length, the source can be considered as a point source, and the equations in Sections 3.3 and 3.5 above can be used.

For a line source, the sound spread equates to a 3 dBA loss per doubling of distance. The formula for noise levels at different distances from a line source is as follows:

$$L(R_2) = L(R_1) - 10 \log_{10}\left(\frac{R_2}{R_1}\right)$$

with: R_1 = distance R_1 in metres
R_2 = distance R_2 in metres, and
L = sound level in dB (for octave bands) or dBA

Note that if $R_2 < R_1$, the second term in the equation is negative, and $L(R_2)$ is higher than $L(R_1)$.

4 Determining Sound Levels and Adjustments

This section provides insight into the tables to be used to determine PSLs, basic sound levels (BSL), and adjustments. (See Appendix 1: Glossary for an explanation of related terminology.)

4.1 Permissible Sound Level

The PSL is derived from a base value (the BSL) that includes a 5 dBA Leq allowance for industrial presence plus adjustments intended to more accurately reflect specific aspects of the facility and the environment. The minimum PSL for rural Alberta would not be expected to be less than 40 dBA Leq during nighttime. However, there may be pristine (pure natural) areas where an ambient adjustment may result in a lower PSL, while more developed areas may result in a higher PSL. The PSL is calculated as follows:

Permissible sound level	=	Basic sound level (Table 2)	+	Daytime adjustment	+	Class A adjustment (Table 3)	+	Class B adjustment (Table 4)

The PSLs do not apply in emergency situations. An emergency is defined as an unplanned event requiring immediate action to prevent loss of life or property. Events occurring more than four times a year are not considered unplanned. Planned maintenance or operational events (e.g., blowdowns, catalyst changes) may be considered temporary activities and thus qualify for a Class B adjustment. Prior to such events, operators should inform nearby residents of the potential for increased sound levels and should attempt to schedule the events during daytime hours to reduce the noise impact on neighbours.

4.2 Basic Sound Level

Nighttime BSLs are determined from Table 2 below. See 4.3.1 for the adjustment used for daytime values. The average rural ambient sound level in Alberta is approximately 35 dBA Leq at night. By adding 5 dBA Leq for industrial presence, the EUB arrives at the minimum PSL. Moving down each column, 5 dBA is added for closer proximity to transportation noise sources. Moving across each row, 3 dBA is added for higher population density.

Table 2. Basic sound levels for nighttime

Proximity to transportation	Dwelling unit density per quarter section of land		
	1 - 8 dwellings; 22:00 - 07:00 (nighttime) dBA Leq	9 - 160 dwellings; 22:00 - 07:00 (nighttime) dBA Leq	>160 dwellings; 22:-00 - 07:00 (nighttime) dBA Leq
Category 1	40	43	46
Category 2	45	48	51
Category 3	50	53	56

Terms Used in Table 2

Category 1	Dwelling units more than 500 m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers.
Category 2	Dwelling units more than 30 m but less than 500 m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers.
Category 3	Dwelling units less than 30 m from heavily travelled roads and/or rail lines and/or subject to frequent aircraft flyovers.
Dwelling Unit	Any permanently or seasonally occupied dwelling with the exception of an employee or worker residence, dormitory, or construction camp located within an industrial plant boundary. In the latter cases, occupational noise standards may be applicable.
Seasonally Occupied Dwelling*	A fixed residence with a conventional foundation that, while not being occupied full time, is occupied on a regular basis (approximately six weeks per year or more).
Density per Quarter Section	Refers to a quarter section with the affected dwelling at the centre (a quarter mile/400 m radius). For quarter sections with various land uses or with mixed densities, the density chosen is then averaged for the area under consideration.
Heavily Travelled Roads	Generally includes primary and secondary highways and any other road where the average traffic count is at least 10 vehicles/hour over the nighttime period.
Rail Lines	Includes any rail line where there is a minimum of one 25-car train passage during every nighttime period.
Frequent Aircraft Flyovers*	Dwellings that lie within a noise exposure forecast (NEF) 25 or greater contour, as designated by Transport Canada, require a site-specific analysis. In the absence of NEF contours for a local airport, Transport Canada is referenced for current air traffic statistics. To qualify for this adjustment, a dwelling must be within 5 km of an airport that has a minimum of nine aircraft takeoffs or landings over the nighttime period. See Noise Exposure Forecast in the Glossary (Appendix 1).

*Note: For more detailed explanation of these definitions, see Appendix 1: Glossary.

4.3 Adjustments to Basic Sound Level

4.3.1 Daytime Adjustment

This adjustment recognizes that daytime ambient sound levels are commonly 10 dBA higher than nighttime levels and that nighttime noise disturbances are generally considered less acceptable. The daytime period is 07:00 to 22:00, and the daytime adjustment is +10 dBA.

4.3.2 Class A Adjustment

These adjustment values permit adjustment of the BSLs based upon the nature of the activity and/or the actual ambient sound level (ASL) in an area. Technical verification must be supplied to use any of these adjustments. More than one Class A adjustment can be claimed if applicable to a maximum of 10 dBA.

Table 3. Class A adjustments*

Class	Reason for adjustment	Value (dBA Leq)
A1	Seasonal adjustment (1 November - 31 March)	+ 5
A2	Absence of both tonal and impulse/impact components	+ 5
A3	Ambient monitoring adjustment	- 10 to + 10

*Class A adjustment = Sum of A1, A2, and A3 (as applicable), but not to exceed a maximum of 10 dBA Leq

A1 — Seasonal Adjustment

This adjustment is applicable for facilities operating during the 1 November to 31 March period. Facilities that operate year round should not add this adjustment when determining the sound level to design for. If a complaint were limited to only the winter period, the use of this adjustment would be allowed at year-round facilities to determine the PSL.

A2 — Absence of Both Tonal and Impulse/Impact Components

This adjustment is applicable only to existing facilities and cannot be used in the design of new facilities, because most energy industry facilities typically exhibit either a tonal or an impulse/impact component. Sound measurements to determine if the facility meets the test must be conducted 15 m from the nearest or most impacted dwelling unit. These measurements must be conducted at appropriate intervals during the comprehensive survey when sound propagation from the facility is representative of the conditions causing the complaint. A minimum of three measurements must be obtained.

The test for the absence of tonal components consists of two parts:

- The first must demonstrate that the sound pressure level of any one of the slow-response, A-weighted, ⅓ octave bands between 20 and 16 000 Hz is 10 dBA or more than the sound pressure level of at least one of the adjacent bands within ⅓ octave bandwidths. In addition, there must be a minimum of a 5 dBA drop from the band containing the tone within 2 bandwidths on the opposite side.

- The second part is that the tonal component peak must be a pronounced peak clearly obvious within the spectrum.

There is considered to be an absence of impulse/impact components when the difference between the A-weighted impulse response sound level measurement and the A-weighted slow-response sound level measurement is 10 dBA or less (see Section 5, note 4.0, for further clarification).

A3 — Ambient Monitoring Adjustment

The ASL is considered to be the average sound environment in a given area. An adjustment for an incremental change to the basic sound level is applicable only when BSLs (Table 2) are thought not to be representative of the actual sound environment and when ASLs have been measured (i.e., without any energy-related industrial component).

An ambient sound monitoring survey consists of a 24-hour continuous sound monitoring survey, with measured ASLs presented for the daytime and nighttime periods, conducted 15 m from the nearest or most impacted dwelling unit and under representative conditions. The 15-m requirement may be altered if it is physically impossible or acoustically illogical. Recall that an ambient sound survey must be conducted without any energy-related industrial component. Another measurement location may be chosen if the affected dwelling unit is not an appropriate location. Refer to Figure 2 to determine the appropriate adjustment value A3, which will be added to any other applicable Class A adjustment factors.

4.3.3 Class B Adjustment

These adjustment values are intended to permit adjustment of the BSLs based upon people's responses to temporary activities. If it is known that an activity will only be of a temporary duration, there may be some additional tolerance of it. However, in order to utilize this additional tolerance, it is important to fully inform the potentially impacted residents of the duration and character of the noise. Note that, for the purposes of this directive, any activity lasting longer than two months is not considered temporary.

Table 4. Class B adjustment*

Class	Duration of activity	Value (dBA Leq)
B1	1 day	+ 15
B2	1 week	+ 10
B3	≤ 2 months	+ 5
B4	> 2 months	0

*Class B adjustment = one only of B1, B2, B3, or B4

To use Figure 2:

1. Determine the difference between the BSL (Table 2) for the appropriate dwelling density and transportation proximity and the measured ASL to the nearest whole number.

2. Look up this difference on the x-axis of Figure 2.

3. Move up on the figure until the plotted line is intersected.

4. Move left on the figure and read off the applicable A3 adjustment factor. This number can be either positive or negative.

5. Add this adjustment factor to any other applicable Class A adjustment factors to arrive at the Class A adjustment. Note that if the sign of A3 is negative, you will be adding a negative number to arrive at the Class A adjustment.

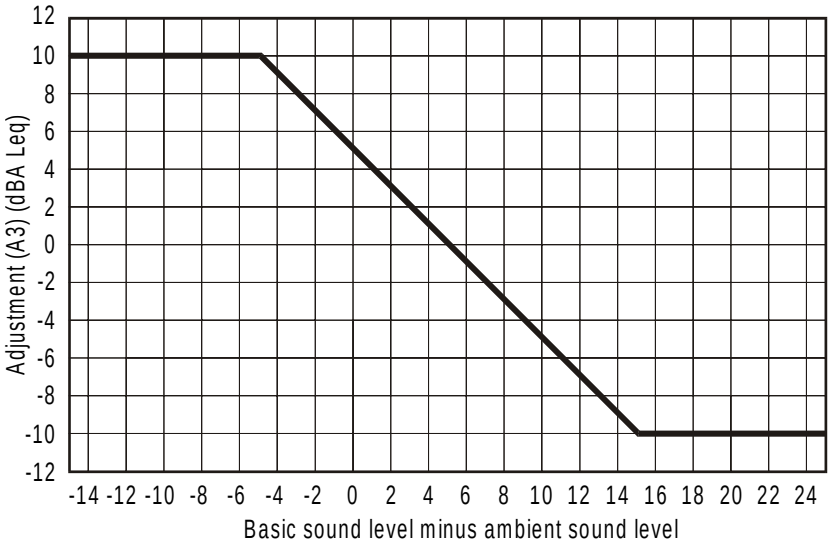
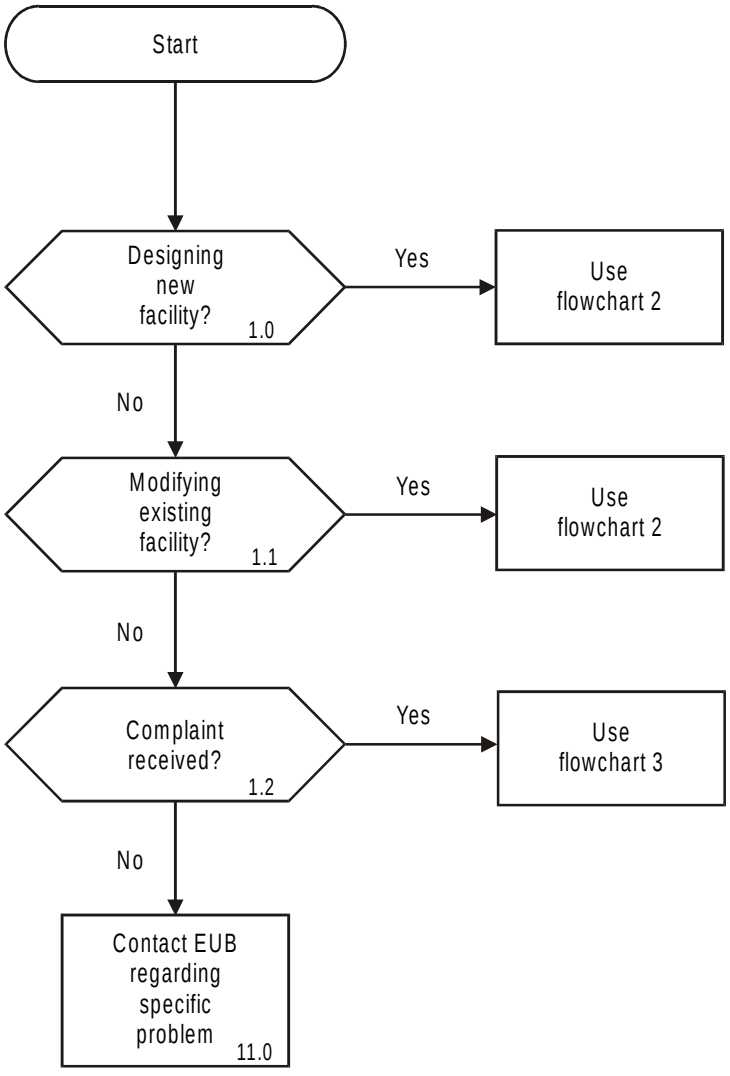


Figure 2. Ambient monitoring adjustment - A3

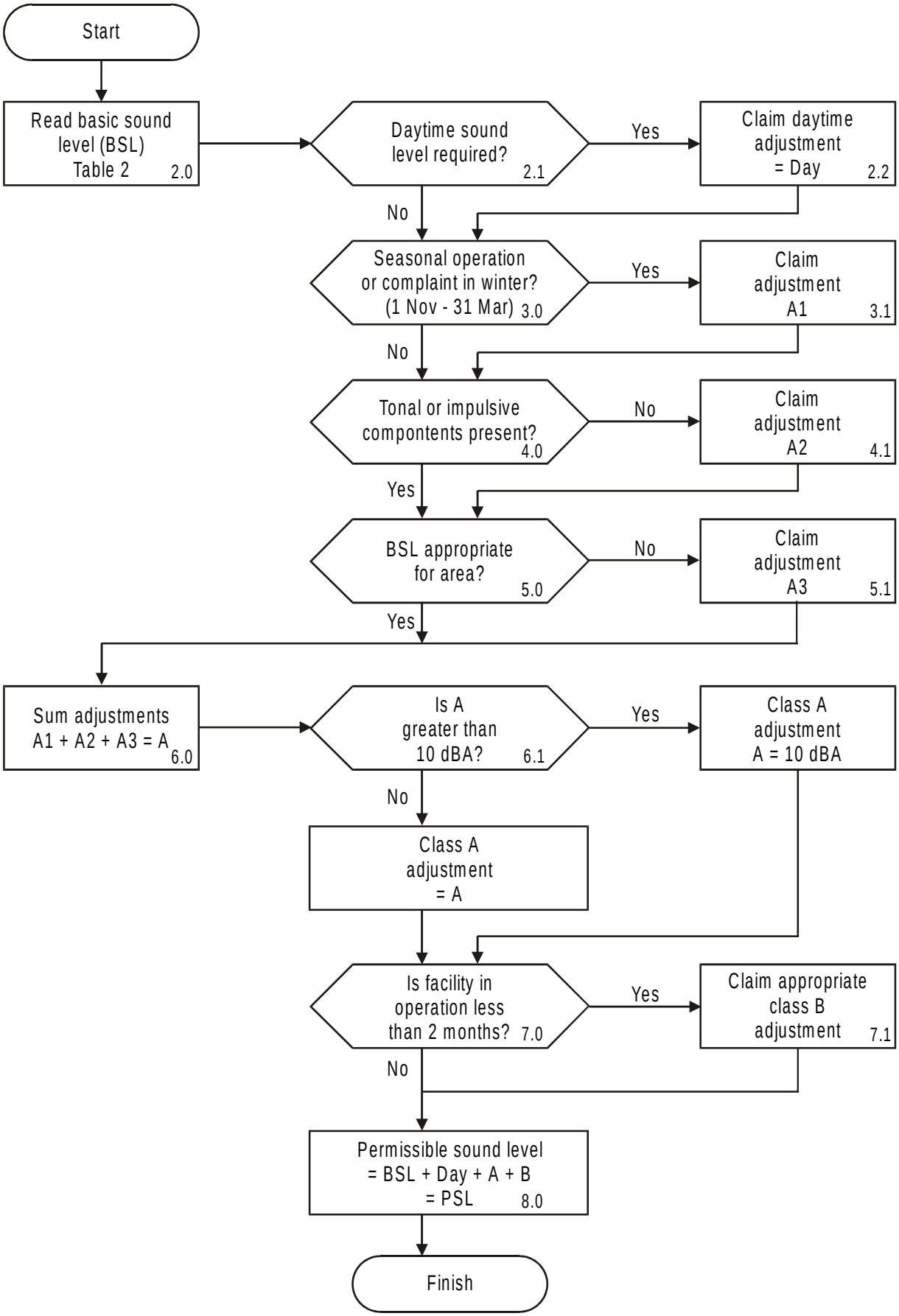
5 Flowcharts for Facility Design and Modification

The following flowcharts identify the different appropriate responses when designing a new facility, modifying an existing facility, or responding to a public complaint.

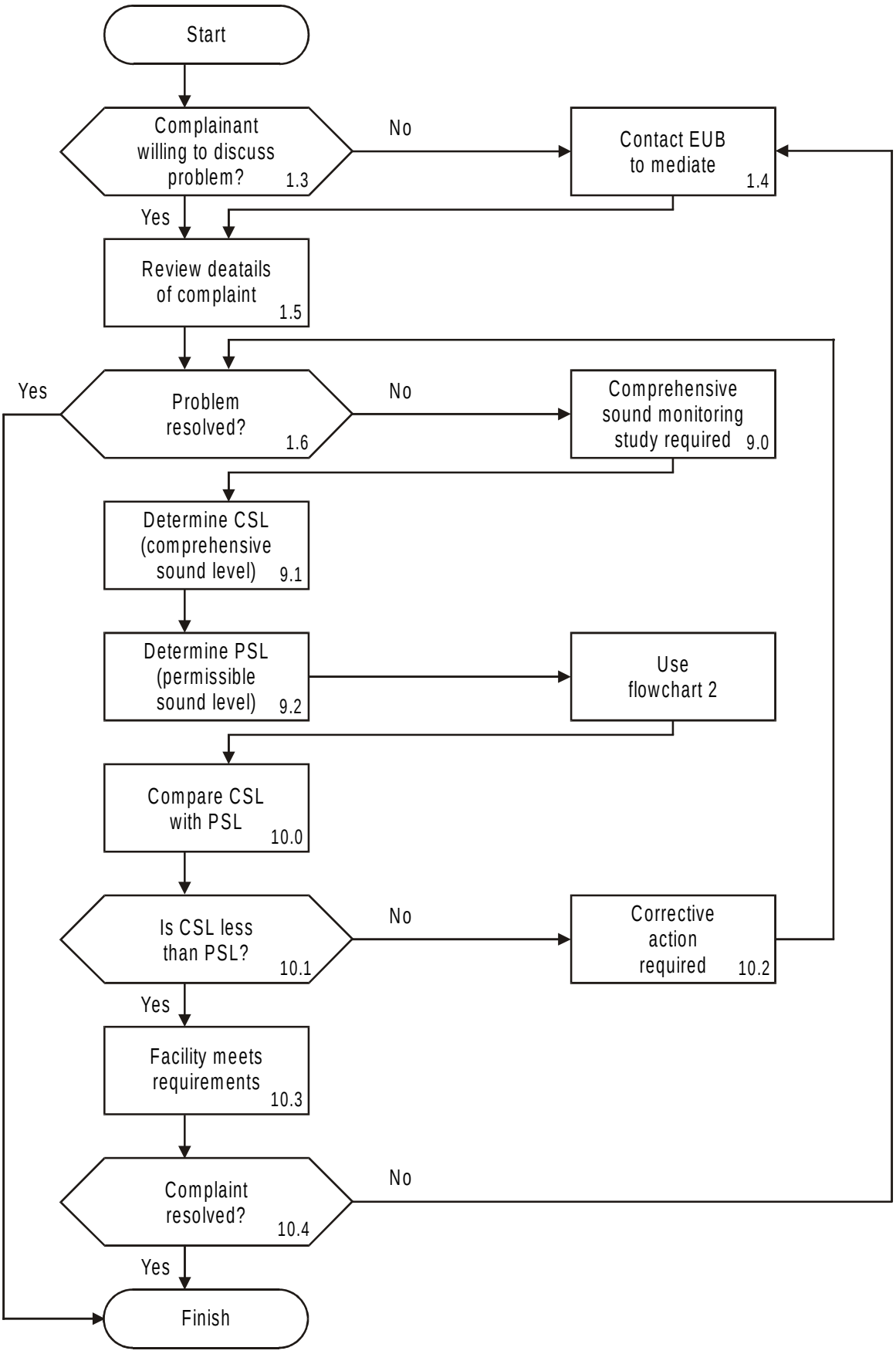
Note that numbers appearing in the lower portion of each box in the flowcharts refer to corresponding notes in Section 5.1: Explanatory Notes.



Flowchart 1. Initial flowchart



Flowchart 2. Permissible sound levels



Flowchart 3. Compliance

5.1 Explanatory Notes

These explanatory notes correspond to the reference numbers in the bottom right corners of the boxes in the preceding flowcharts. Each note gives more detail as to what is required for that step or background on the rationale behind the directive.

1.0 For the purposes of *ID 99-8*, a new facility is any new operation in the exploration for and the processing, development, and transportation of energy resources and energy-related functions. A new facility does not include the drilling and completion of wells. Other operations or facilities that do not require applications should nevertheless be designed to comply with this directive.

A primary objective of *ID 99-8* is to encourage the consideration of noise in the design stage of facility development. Modest levels of noise control introduced at the design stage are often a small portion of the capital cost, while retrofit solutions can be very expensive. Operators should discuss noise matters with residents during the design, construction, and operation phases of a facility.

Best practical technology (accounting for cost versus benefit) should be considered to minimize the potential for noise impacts to existing dwellings and future infringement. Operators should discuss noise matters with area residents during the design, construction, and operating phases of an energy facility. Should a valid complaint be registered after the facility is constructed and in operation, the operator must meet the PSL referenced in the noise impact assessment.

While *ID 99-8* is not applicable to construction noise, operators should attempt to take the following reasonable mitigative measures to reduce the impact of construction noise at nearby residences from new facilities or modifications to existing facilities:

- Limit construction activity between the hours of 07:00 and 22:00 to reduce the potential impact of construction noise.
- Advise nearby residents of significant noise-causing activities and schedule these to create the least disruption to neighbours.
- Ensure all internal combustion engines are fitted with appropriate muffler systems.
- Take advantage of acoustical screening from existing on-site buildings to shield residential locations from construction equipment noise.

1.1 As 1.0, except that a facility already exists and some modification, expansion, repair, or servicing operation is to take place. Applications for modifications to existing facilities where there is a reasonable expectation of a continuous noise source require a noise impact assessment. See 1.0 and Section 7 for further information on noise impact assessments. Regardless of whether an application is required, it is advised that the *Noise Control Directive* be adhered to.

In reviewing *ID 99-8* sound requirements at existing facilities, the EUB considers the ASLs of the area if necessary (recall that ASLs in rural Alberta are approximately 35 dBA at night and do not include the existing facility), as well as the technical difficulty involved in meeting the requirements. Reasonable time for modifications is allowed when necessary. It is acknowledged that under special circumstances the PSLs calculated using *ID 99-8* may need to be reviewed. A higher or lower sound emission from a resource facility may be deemed appropriate in exceptional circumstances.

1.2 A complainant may register a complaint in a number of ways. Once the operator of the facility is aware of the complaint, the operator must make direct contact with the complainant in order to understand the concerns and to establish a dialogue to set reasonable expectations and a time frame for action to resolve the issue.

While the EUB does review and assess information on noise control as part of energy facility application processing, investigation of compliance with this directive will only be done on a complaint basis or when an audit is conducted on the facility application, which includes the noise impact assessment.

1.3 In certain situations when it is difficult for both sides to agree on an acceptable course of action, the EUB should be contacted to mediate and, if necessary, make recommendations or give specific direction.

Overall public benefits and impacts of energy development are considered when resolving complaints. The public desire for a no-impact (zero industry noise) solution is essentially unattainable. Sometimes the benefits are not as apparent as the detractions to those living near energy facilities. See Section 6 for more information about complaint investigation.

1.4 The EUB is willing to act as a mediator in situations where a resolution satisfactory to both parties is not possible.

1.5 Such factors as the time of the complaint, direction, duration, and character of the noise, weather conditions, facility operating conditions, and unrelated activities should all be recorded and reviewed to determine the cause of the complaint.

1.6 A mutual agreement between facility and complainant is far preferable to an imposed solution. Every effort should be made to come to an equitable solution. For temporary facilities, the option of conducting detailed sound surveys may not

be feasible. Should a successful resolution not be achieved through mediation, the facility owner or landowner continues to have the right to request a hearing before the EUB under the appropriate sections of the Energy Resources Conservation Act.

2.0 Table 2 gives typical ambient (Leq) sound levels for various types of areas based on population density and nearness to busy transportation routes, plus an additional 5 dBA (Leq) for the presence of industry. Thus, using Table 2 alone, industry is permitted 5 dBA (Leq) over and above the Leq values observed in the various types of areas.

For the majority of the cases the EUB deals with, the BSLs are 40 dBA Leq during nighttime and 50 dBA Leq during daytime, i.e., Category 1 and low dwelling unit density. These sound levels would be used in a typical rural setting not close to any major roads. Typically, for the vast majority of rural Alberta areas, the minimum PSL would not be expected to be less than 40 dBA Leq during nighttime; however, there may be pristine (pure natural) areas where an ambient adjustment may result in a lower PSL, while more developed areas may result in a higher PSL.

In order to use Table 2, the dwelling unit density per quarter section of land affected by the potential or existing sound source must be determined. A dwelling unit is any permanently or seasonally occupied dwelling. The quarter section of land to be considered is not the location where the sound source is or will be located; it is the quarter section with the affected dwelling at the centre (a quarter mile/400 m radius). The quarter section chosen must surround the nearest or most impacted dwelling in the area. If the quarter section under consideration has various land uses or mixed densities, the appropriate density will be factored. Once again, the most sensitive density will be the one selected. (See Example Problem 1 in Section 9.)

Next, the appropriate transportation proximity category must be selected. The key here is determining the type of area and whether the road is heavily travelled. Obviously, a quieter area will be more easily affected by traffic than a noisier area. The daytime category may also vary from the nighttime category. If a road has been designated as a primary or secondary highway by Alberta Transportation or is one where the average traffic count is at least 10 vehicles/hour over the nighttime period, it may be designated as heavily travelled. If the road is not heavily travelled, use Category 1. Since primary and secondary highways are sometimes lightly travelled during the nighttime period, which is usually the period of greatest concern, the EUB uses the 10-vehicles/hour criterion to determine whether primary and secondary highways qualify as heavily travelled during the nighttime period.

Finally, the appropriate nighttime BSL is found in Table 2 using the dwelling unit density per quarter section and transportation proximity category determined previously.

2.1 In this directive, the time spans are those between the hours of 07:00 and 22:00 (daytime Leq) and between 22:00 and 07:00 (nighttime Leq).

3.0 If the facility in question operates only during the period 1 November through 31 March, a +5 dBA Leq adjustment may be claimed. If a complaint is received during the applicable period for any facility (permanent or temporary, year-round or seasonal operation), this adjustment can be claimed in determining the PSL the facility must be below. For permanent facilities that operate year round, this adjustment cannot be used in the design stage to determine what PSL to design for, as this would not be a representative scenario. For permanent facilities that operate only during this winter period (e.g., compressors used only for high nominations in the winter), this adjustment could be used for design.

The rationale behind this adjustment is that people generally have their windows closed during this period and outdoor activities are greatly reduced. Therefore, a slightly higher sound level is tolerable. If it is demonstrated that the facility may impact a winter recreation area in which a quiet environment is a key aspect, the seasonal adjustment may be disallowed.

3.1 See 3.0, above. Claim +5 dBA Leq for adjustment A1. This adjustment is added to the other applicable A adjustments (see 4.0 and 5.0 below), and a maximum Class A adjustment of 10 dBA Leq is permitted.

4.0 An adjustment of +5 dBA Leq is permitted if it can be demonstrated that both tonal and impulse/impact sound components are not present. This adjustment is applicable only to existing facilities and cannot be used in the design of new facilities, because most energy industry facilities typically exhibit either a tonal or impulse/impact component. Sound measurements can be made to determine if the facility meets the test; they are to be conducted 15 m from the nearest or most-impacted dwelling unit. These measurements must be conducted at appropriate intervals during the comprehensive survey when sound propagation from the facility is representative of the conditions causing the complaint. A minimum of three measurements must be obtained.

The test for the absence of tonal components consists of two parts. The first must demonstrate that the sound pressure level of any one of the slow-response, A-weighted, ⅓ octave bands between 20 and 16 000 Hz is 10 dBA or more than the sound pressure level of at least one of the adjacent bands within two ⅓ octave bandwidths. In addition, there must be a minimum of a 5 dBA drop from the band containing the tone within 2 bandwidths on the opposite side.

The second part is that the tonal component must be a pronounced peak clearly obvious within the spectrum.

Figure 3 shows some examples of tonal components and Table 5 shows how the presence of tonal components was determined. There are qualifying tonals at 250 Hz ($\geq$10 dBA within 2 bandwidths on one side and $\geq$5 dBA drop within

2 bandwidths on the other side, in addition to being pronounced within the spectrum) and at 2000 Hz (≥10 dBA within 1 bandwidth on one side and ≥5 dBA drop within 1 bandwidth on the other side, in addition to being pronounced within the spectrum). Note that the 630 Hz component meets part of the test (≥5 dBA difference within 2 bandwidths in addition to being pronounced within the spectrum), but it does not meet the full test of having a drop of 10 dBA or more within two bandwidths on at least one side. A facility causing a frequency spectrum with tones such as those in the 250 and 2000 Hz bands would not qualify for the A2 adjustment.

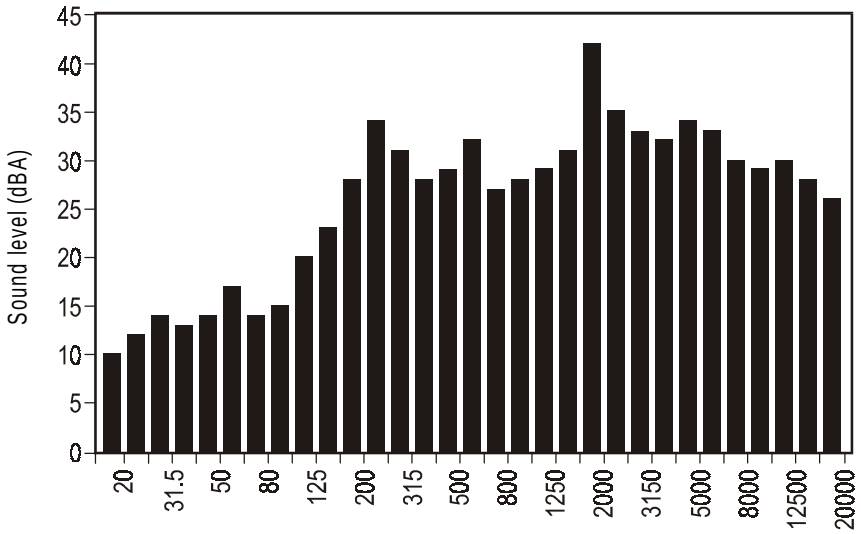


Figure 3. 1/3 octave band centre frequency (Hz)

There is considered to be an absence of impulse/impact components when the difference between the A-weighted impulse response sound level measurement and the A-weighted slow-response sound level measurement is 10 dBA or less.

Note that adjustment A2 applies to existing permanent facilities only.

Operators planning facilities in an area where there is already an energy industry presence are responsible for ensuring that their facility will either not cause the overall sound levels to exceed the PSL or, in situations where the existing sound levels are acceptable to residents even though it may be higher than the PSL, that it will not cause an increase in overall sound levels. The applicant may wish to discuss the proposed project with adjacent operators to examine potential sound attenuation measures that are both effective and economical. For example, it may be more cost effective to install silencers on existing equipment rather than design additional sound attenuation measures into the proposed facility.

Table 5. 1/3 octave band frequency spectrum analysis for tonal components

		Part 1		Part 2			Part 1		Part 2
Band (Hz)	Sound level (dBA)	Maximum Δ dBA within 2 bandwidths	$\geq$5 dBA on other side?	Pronounced within the spectrum	Band (Hz)	Sound level (dBA)	Maximum Δ dBA within 2 bandwidths	$\geq$5 dBA on other side?	Pronounced within the spectrum
20	10	-4	n/a	n/a	800	27	-5	n/a	n/a
25	12	-2	n/a	n/a	1000	28	-3	n/a	n/a
31.5	14	4	n/a	n/a	1250	29	-13	n/a	n/a
40	13	-4	n/a	n/a	1600	31	-11	n/a	n/a
50	14	-3	n/a	n/a	2000	42	13	**yes**	**yes**
63	17	4	n/a	n/a	2500	35	-7	n/a	n/a
80	14	-6	n/a	n/a	3150	33	-9	n/a	n/a
100	15	-8	n/a	n/a	4000	32	-3	n/a	n/a
125	20	-8	n/a	n/a	5000	34	4	n/a	n/a
160	23	-11	n/a	n/a	6300	33	4	n/a	n/a
200	28	8	n/a	n/a	8000	30	-4	n/a	n/a
250	34	11	**yes**	**yes**	10000	29	-4	n/a	n/a
315	31	3	n/a	n/a	12500	30	4	n/a	n/a
400	28	-6	n/a	n/a	16000	28	-2	n/a	n/a
500	29	-3	n/a	n/a	20000	26	-4	n/a	n/a
630	32	5	n/a	**yes**					

For operators proposing projects in an area with established energy facilities, a comprehensive sound survey or modelling using measurements from similar existing sources should be considered to determine the existing sound environment. For areas with no energy industry presence, operators may want to conduct an ambient sound survey to identify existing sound levels. However, for either case a sound survey is not required to conduct a noise impact assessment.

The noise impact assessment should indicate what the predicted design sound level from the facility will be at the nearest or most impacted permanently or seasonally occupied dwelling. The EUB would not automatically require detailed calculations to prove the validity of the predictions, but it does expect a reasonable technical basis for the values presented. Modelling and manufacturers' specifications, with an appropriate allowance for sound attenuation with distance from source, may be used as tools to predict CSLs. The design sound level should be compared to the calculated PSL to determine the possible impact of the facility.

For the purposes of this directive, a permanent facility is defined as any facility at a location longer than two months. However, drilling and servicing rigs fall into the temporary facility category even if they are expected to be at a location more than two months. Temporary activities generally do not require a noise impact assessment and are handled on a complaint basis. Nevertheless, when considering equipment such as rigs for these temporary activities, operators should be aware of the EUB's expectation of expeditious compliance if complaints occur.

Potentially impacted residents must be approached regarding the proposed facility and informed of any short-term and long-term noise impacts from construction and operation activities.

4.1 If both tonal and impulse/impact components are absent (see 4.0), adjustment A2 may be claimed. This adjustment is added to the other applicable A adjustments (see 3.0 and 5.0) and a maximum Class A adjustment of 10 dBA is permitted.

5.0 In some cases, the BSL given in Table 2 may be felt to be either too high or too low owing to special circumstances unique to the area under consideration. In such cases, it is permissible to perform a 24-hour ambient sound monitoring study to determine a more appropriate ASL in order to adjust Table 2 accordingly.

5.1 The opportunity to perform a 24-hour ambient sound monitoring study exists both prior to the approval of an application or once a facility is in place. Note that the intent of this sound study is to determine what the ASLs are, which does not include any energy-related industrial component. Therefore, for existing facilities, the sound survey must be conducted with all the facilities shut down so that the ASL is measured. See 9.1 below for an explanation of comprehensive sound surveys used for complaint cases.

The survey should be conducted 15 m from the nearest or most-impacted dwelling unit. For various reasons, such as topography or intervening barriers, the nearest dwelling unit may not be the most impacted unit. Even for remote facilities where there are no impacted dwellings, uncontrolled sound generation will not be allowed, particularly since retrofit may be required if a residence is built and the facility is no longer remote.

Although this is not a mandatory requirement, new facilities planned for remote areas should be designed to meet a target sound level of 40 dBA Leq at a distance of 1.5 km. (Note that using the rule of 6 dBA lost per doubling of distance from the source, the facility would generate a sound level of approximately 70 dBA at 50 m.) As a target, this does not establish the criterion for compliance should infringement occur.

The survey should be conducted during periods representative of typical days and nights for the area. What is typical depends upon the area being surveyed and should include such tests as

- What is the frequency of this type of activity?
- Do these types of activities normally occur in this area?

For example, the question might be whether to monitor at a location where fall harvesting (expected to run 24 hours a day for the next week) is taking place. The answer is no, because harvesting does not typically take place year round.

One of the first tests any sound survey is subjected to is whether it is representative for the area being measured. Consideration must be given to determining when an appropriate time to measure is so that the sound survey passes the test of "being representative."

The results of the 24-hour monitoring study should be reported in terms of a 15-hour daytime Leq and a 9-hour nighttime Leq. The results are known as the ambient sound level (ASL).

See Appendix 2 for instrumentation and measurement requirements.

Appropriate references, such as VHS recordings, DAT recordings, operational logs, or event logs, should be kept to verify any unusual noise levels or any noise events that may be deleted from the survey results. A log of vehicle pass-bys, for example, would be useful.

Figure 2 allows for an adjustment of between -10 and +10 dBA Leq. If the ASLs are more than 5 dBA lower than the BSLs, the adjustment factor will be negative, indicating that the BSLs in the directive are too high in this case and should be lowered by the factor A3. If A3 is negative, it is possible for the Class A adjustment to be negative as well.

Adjustment A3 is added to the remaining Class A adjustments if applicable (see 3.0 and 4.0), and a maximum permissible adjustment of 10 dBA Leq is permitted.

6.0 Adjustments A1, A2, and A3 (if claimed) are added together. Call the sum A.

6.1 If A is greater than 10 dBA, the maximum Class A adjustment is 10 dBA. If the sum of A is less than 10 dBA, the maximum Class A adjustment is equal to A.

7.0 If it is known that a noise will only be temporary, there may be some additional tolerance of it. However, in order to utilize this additional tolerance, it is important to fully inform the potentially impacted residents of the anticipated duration and character of the noise.

ID 99-8 provides for an increasing adjustment as the duration of the sound becomes shorter. The Class B adjustment is based on four increments of sound duration, namely, one day, one week, two months, and more than two months.

Permanent facilities (defined here as being in operation more than two months at a location) do not qualify for the Class B adjustment. The Class B adjustment is therefore set to zero. For temporary activities at permanent facilities, such as turnarounds or repairs, the EUB will consider the use of the temporary activity adjustment. For most of these types of activities, it is not expected an application would have to be made to the EUB, so this adjustment would apply only if a complaint were received.

7.1 The number of days of the full duration of the operation must be determined. This is the duration of the sound as heard by an observer, not necessarily the duration of sound at one location. For example, a service rig operating on a multi well drilling pad may spend only three days at each well, but it may spend well over a month in total at the pad. Each well operation took only three days, but to the observer the sound was present for over a month. The duration is calculated to the nearest day.

Based on the number of days calculated above, the appropriate Class B adjustment is selected from Table 4. Note that only one of B1, B2, B3, or B4 may be chosen. The adjustment selected is known as the Class B adjustment, or B.

8.0 The BSL obtained from Table 2 in note 2.0 above is added to the daytime adjustment and the Class A and Class B adjustments. If no adjustments are claimed, the BSL obtained from Table 2 is used. The total is known as the permissible sound level (PSL).

9.0 In certain situations when it is difficult for both sides to agree on an acceptable course of action, the EUB should be contacted to mediate and if necessary make recommendations or give specific direction. For permanent facilities, a comprehensive sound monitoring study based on representative conditions (see 9.1 for further clarification of representative conditions) is required to determine if a violation has occurred. For temporary facilities, the option of conducting comprehensive sound surveys may not be feasible. The EUB is required to outline a suitable course of action in this situation.

Should a successful resolution not be achieved through mediation, the facility owner or landowner continues to have the right to request a hearing before the EUB under the appropriate sections of the Energy Resources Conservation Act.

9.1 A comprehensive sound monitoring study is not the same as an ambient sound monitoring study. The comprehensive sound study incorporates all sounds in the area, including the contribution of the facility. An ambient sound study does not include the contribution of the facility. For more information on ambient sound surveys, see 5.1 above. Because of the difference, a facility requires a separate

sound survey from the comprehensive sound survey to claim adjustment A3. If a previous ambient monitoring survey has been conducted, that is acceptable to use to determine the ASLs.

The monitoring period may vary between 6 and 24 hours depending on the type, time, and duration of the noise. For example, if the sound is steady and not fluctuating, 6 hours of monitoring may be sufficient. On the other hand, if it varies and fluctuates and complaints are scattered in time, a longer term would be appropriate. The maximum survey time may exceed 24 hours where warranted. Exceptional circumstances should be discussed with the EUB before proceeding. If the complaint occurs very near to or straddles the day-night boundary, then a minimum of 3 hours must be performed during each of the day and night periods.

The comprehensive sound level (CSL) survey must encompass a representative portion of the times of day or night on typical days when the noise causing the complaints occurs. If a complainant has highlighted specific weather conditions, plant operating conditions, or seasons, the monitoring should take place under representative conditions. “Representative conditions” does not constitute absolute worst-case conditions or the exact conditions the complainant has highlighted if those conditions are not easily duplicated. In order to expedite complaint resolution, sound measurements may be conducted at the earliest opportunity when sound propagation towards the impacted dwelling is favourable. The local EUB field office can be consulted to help in establishing favourable conditions criteria.

The survey results are known as the CSL and are reported for the daytime and/or nighttime period involved. For example, if 6 hours of monitoring were carried out in the night, the results would be reported as a nighttime 6-hour Leq. For time periods less than the full 9 hours or 15 hours, it is assumed that the shorter time period is representative of the full time period unless results of the sound survey indicate otherwise.

The monitoring must be carried out at a point 15 m from the complainant’s dwelling towards the noise source. The 15-m requirement may be altered if it is physically impossible or acoustically illogical.

Instrumentation and measurement requirements are set out in Appendix 2.

A log or record of unusual noises such as vehicle passings, animal and bird sounds, and other non-industry-related sound, should be kept to verify any unusual short-term noise levels or any noise events that may be isolated from the survey results. The use of VHS recording, DAT recording, operational logs, event logs, etc., is acceptable to support any extraction of data from a CSL.

The daytime and/or nighttime CSLs are examined and a decision made as to whether they are to be used. If it is suspected that the facility is not the major contributor to the CSL or if it is thought that the facility's sound contribution is below the PSL, then facility isolation techniques may be applicable. These techniques may require the help of acoustical specialists.

Facility isolation techniques are used to determine the contribution of a single facility to the overall CSL at a particular location. These techniques could involve taking sound measurements near various sound sources to determine the equipment sound power levels and then determining the attenuation over the distance to the receiver. If possible, they may involve the selective shutting off of various facilities and determining the resulting decrease in CSL. These techniques are generally employed when several sources of sound are present and the contribution of each to the sound environment is being sought. Alternatively, it may be desired to demonstrate that the facility in question does not significantly contribute to the CSL or is below the PSL.

Where several facilities contribute to a CSL that exceeds the recommended levels, the EUB would favourably view the formation of a joint committee to solve the problem. Facilities not under EUB jurisdiction would have to be approached through the appropriate jurisdiction.

9.2 The PSL is obtained from flowchart 2. Any applicable adjustment factors may be claimed. If a noise assessment was completed for this facility, the PSL stated in that assessment must be used.

10.0 The PSL is the number that the CSL (or the isolated sound level) must be compared to.

10.1 Compliance with *ID 99-8* occurs when a valid comprehensive sound survey indicates the energy-related facility contribution is equal to or less than the PSL.

10.2 Corrective action to reduce the sound level of the facility at the complainant's dwelling is necessary. This may take the form of reducing the sound at the source, placing intervening barriers between the source and the receiver, or treating the receiver. In certain cases acoustical improvements to the receiver may be an economically attractive solution. The advice of a specialist in acoustics is recommended at this stage. When a facility is found to be noncompliant, the operator is allowed reasonable time to undertake corrective action. This time allows for any sound monitoring, analysis, evaluation, budgeting, equipment procurement, and installation on a schedule agreed upon by all parties. However, if in the opinion of the EUB, the operator is not working in the spirit of the directive to resolve the issue, the EUB will intervene. Consequences may include curtailing production to reduce sound generation and possible shutdown of the facility. Communication with the complainant through all phases of corrective action is required.

For temporary facilities such as rigs, the suggested solution that the facility will be moving on soon and will not be causing a problem anymore is generally not accepted. If the resident does accept that solution, then it is acceptable to the EUB.

Once corrective action has been taken, complainants should be approached to see if they are satisfied. If they are, the problem is resolved. If the complainants are not satisfied, another comprehensive sound survey should be done to determine if the facility is now complying with the directive. In special circumstances where both parties agree or the EUB dictates, an ambient sound survey may be conducted to determine the incremental impact of the facility. Based upon the results of this survey, a decision will be made by the EUB as to whether to recommend further action.

10.3 The facility satisfies the requirements of *ID 99-8.* The results of the comprehensive sound survey must be made available to the complainants, so that they understand why the facility is in compliance and no corrective action is required.

If a situation occurs where an operator is either unable or unwilling to meet a required reduction in noise level, it may apply to the EUB for a hearing under the appropriate section of the Energy Resources Conservation Act. A similar option is available to an impacted landowner.

10.4 In situations where a facility is in compliance, yet the complainant's concerns have not been resolved, the EUB should be contacted to mediate.

11.0 If you have any questions about *ID 99-8: Noise Control Directive* and how it relates to your particular situation, call the EUB's Regulatory Support Branch at (403) 297-3642.

6 Noise Complaint Investigations

The EUB expects operators to make every reasonable attempt to resolve any noise-related complaint brought to their attention in a timely manner. It is critical when investigating a noise complaint that operators first attempt to resolve the issue through direct contact with the complainant to understand their concerns and establish a dialogue. In doing so, the operator must carefully explain the requirements of this directive and clearly outline the process, including time lines they intend to follow in addressing the matter. If a comprehensive sound survey is to be performed, the operator or its consultant must determine the representative conditions that exist when noise would impact a residence for a survey to be technically valid.

A sample complaint investigation form that can be used by industry in responding to a noise concern follows on the next two pages.

On part 1 of the form the operator gathers necessary information about the quality and characterization of the noise from the resident(s) to help determine the source of the noise. This part also examines the weather and ground cover conditions that exist when the noise is most annoying to the residents. From this information the operator, or its representative, can establish the typical representative conditions that exist under which sound level monitoring should take place. Representative conditions do not necessarily constitute absolute worst-case conditions or the exact conditions the residents have described if those conditions are not easily duplicated.

Part 2 of the form, the event log, is designed for use by the residents concerned about the noise. They should enter details about the noise when it becomes annoying to them. The event log can then be used by the operator to further pinpoint the source of the noise or the representative conditions needed to conduct a sound level survey.

Sound level surveys should be conducted at the first available opportunity when the representative conditions can be reasonably met. Operators should provide a copy of the completed complaint investigation form to the residents in question and should consider including a copy in any sound level survey reports to demonstrate that the representative conditions were met.

NOISE COMPLAINT INVESTIGATION

PART 1

Date (D/M/Y):_____

Resident:_____ Respondent:_____

Legal location:_____ Company:_____

Address:_____ Address:_____

_____ _____

Telephone:_____ Telephone:_____

Noise Characterization

Identify the quality and characteristics of the noise.

Distance to source:_____ (m) When is noise a problem (day/night)?_____

Pitch (high/low): _____ Where is noise most annoying (inside/outside)?_____

Is there a noticeable tone? _____ Describe: _____

Is noise steady/intermittent/pulsing? _____ Describe: _____

What is noise comparable to? _____

Other comments: _____

Weather Conditions

Identify the weather conditions under which the noise is most noticeable.

Temperature: _____ Direction wind is coming from:_____

Wind speed (km/h): _____ Cloud cover:_____ Precipitation: _____

Ground cover between residence and facility (snow, water, grass, crop, trees, ice, etc.):

_____

Other comments: _____

Representative Conditions

From the above, identify the conditions that should exist as closely as possible during a comprehensive sound survey.

_____

_____

_____

_____

EVENT LOG

_____

PART 2

Resident: _____ Company contact: _____

Telephone: _____ Telephone: _____

List any details related to the sound from the industrial facility that is annoying you. Refer to the descriptions at the bottom for assistance in providing information.

Date (D/M/Y)	Time a.m./p.m.	Noise characteristics	Weather conditions	Ground cover	Receiver location

Noise characteristics: Describe the sound as a high or low tone, steady or pulsing. What would you compare the sound to?

Weather conditions: If possible, provide details on temperature, wind direction and speed, cloud conditions (clear or cloudy), and existence of precipitation when the sound is a problem.

Ground cover: Describe what is covering the ground between you and the facility; for example, is it snow, water, grass, crop, trees, ice?

Receiver location: Note where you were when the sound was annoying (outdoors, such as on the deck or in the yard or corrals, or indoors, such as in the bedroom or living room).

7 Noise Impact Assessments

A noise impact assessment (NIA) must be completed for any new permanent facilities or for modifications to existing permanent facilities where there is a reasonable expectation of a continuous noise source. Compressor stations, pumping stations, electric power plants, coal mines, industrial development permit facilities, gas processing plants, and batteries with compressors are examples of facilities where an NIA is required. The EUB may require an NIA for any facility it deems necessary.

While an NIA must be conducted for all facilities identified above, the assessment need not be included with the facility application if the analysis indicates compliance. In cases where the assessment indicates noncompliance, further attenuation measures must be considered. Where these are not practical, the assessment can be included with the application, along with the mitigative measures proposed to reduce the impacts. If the applicant is unsure of the requirements for an assessment, a knowledgeable consultant or the EUB should be contacted.

The intent of an NIA is to ensure that applicants consider possible noise impacts before a facility is constructed or operated, since the cost to retrofit may be significantly more than if noise mitigation measures are incorporated into the design of a facility. Best practical technology (accounting for cost versus benefit) should be considered to minimize the potential noise impacts to existing dwellings and future infringement. Operators should discuss noise matters with area residents during the design, construction, and operating phases of an energy facility. Should a valid complaint be registered after the facility is constructed and in operation, the operator must meet the permissible sound level (PSL) referenced in the NIA. It is in an operator's best interest to get as accurate a predicted sound level as possible, in order to avoid the expense and embarrassment of having a facility's operations affected or shut down because of noncompliance.

Operators planning facilities in an area where there is already an energy-industry presence are responsible for ensuring that their facility will not cause the overall sound levels to exceed the PSL or, where the existing noise levels are acceptable to residents even though they may be higher than the PSL, will not cause an increase in overall sound levels. The applicant may wish to discuss the proposed project with adjacent operators to examine potential sound attenuation measures that are both effective and economical. For example, it may be more cost effective to install silencers on existing equipment rather than design additional sound attenuation measures into the proposed facility.

No matter what sound level is predicted before a facility is built, if a valid complaint is received after the facility is operating and the measured CSL does not comply with *ID 99-8*, remedial action may be required. The EUB is less likely to grant operating concessions (i.e., higher sound emissions) to new facilities, since operators will have had the opportunity to identify and design proper noise control features into their facilities.

For operators proposing projects in an area with established energy facilities, a comprehensive sound survey or modelling using measurements from similar existing sound sources should be considered to determine the existing sound environment. For areas with no energy industry presence where noise may be an issue with local residents, operators may want to conduct an ambient sound survey to identify existing sound levels. However, a sound survey is not mandatory for conducting an assessment. In all cases, the NIA should address construction noise and any mitigation that may be required as a result.

As part of a facility application, the operator must indicate that the facility meets the requirements in *ID 99-8*. It must also keep corroborating information on hand. The EUB conducts audits of facilities that require proof that NIAs have been completed.

An acceptable NIA must do the following:

1. Identify what the PSL is at the nearest or most impacted dwelling. This includes all details on how the PSL was calculated and any adjustments claimed. Flowchart 2 in Section 5 can be used to calculate the PSL.

2. Identify major sources of noise from the facility and their associated sound power/pressure levels. Indicate whether the sound data are from vendors, field measurements, theoretical estimates, etc. Such items as cooler fans, exhaust noise, and pump noise are examples of major noise sources. When using manufacturer's data for expected performance, it may be necessary to modify the data to account for actual design conditions. Note that use of any theoretical data or extrapolation techniques can lead to inaccuracies and therefore is less reliable than actual field measurements made once the equipment is in place.

3. Identify what the predicted overall sound level at the nearest or most impacted residence will be. Normally only the nighttime sound level is necessary, as it will often not change from daytime to nighttime. But if there are differences between day and night operations, both levels must be calculated.

4. Identify how the predicted overall sound level at the nearest or most impacted residence was calculated. Models or hand calculations can be used to obtain the predicted sound levels. All inputs and assumptions (e.g., weather, ground conditions, wind speeds, wind direction) should be clearly stated within the assessment, so that if the EUB audits a facility and requests the NIA, the assessment can be understood.

5. Identify whether the assessment indicates the facility is in compliance with the requirements of *ID 99-8.*

6. Consider further attenuation measures in cases where the assessment indicates noncompliance. Where further attenuation measures are not practical, the assessment can be included with the application, along with the measures proposed to reduce the impacts.

7. Identify the person conducting the assessment.

A sample form has been developed to assist in conducting an NIA (see next page). It includes the major types of information that must be included in an assessment.

Direct questions regarding NIAs to the EUB's Regulatory Support Branch at (403) 297-3642.

NOISE IMPACT ASSESSMENT

Company: _____

Facility name:_____ Type: _____

Legal location: _____

Contact: _____ Telephone: _____

1. Permissible Sound Level (PSL) Determination

(Note that the PSL for a pre-1988 facility undergoing modifications may be the sound pressure level (SPL) that currently exists at the residence if no complaint exists.)

Distance to nearest or most impacted residence:_____ (m)

Basic sound level (nighttime): _____ (dBA) Class A adjustment:_____ (dBA)

Daytime adjustment: _____ (dBA) Class B adjustment: _____ (dBA)

Permissible sound level, nighttime: _____ (dBA) Daytime: _____ (dBA)

2. Sound Source Identification

Distance (far or free field) at which the SPL was calculated or measured: _____ (m)

List all new and existing equipment that are sound sources. For each, give its predicted sound pressure level (SPL) and the source of the SPL prediction data.

New equipment	**Predicted SPL**	**SPL prediction data source**

Existing equipment/facility	**Predicted SPL**	**SPL prediction data source**

3. Predicted Sound Level

Predicted sound level to the nearest or most impacted residence from new facility (including any existing facilities):_____ dBA (night/day) Permissible sound level: _____ dBA (night/day)

4. Predicted Sound Level Calculation

Name of computer model (if used): _____

Distance at which manufacturers' data was referred: _____(m)

Describe any considerations and assumptions used in conducting engineering estimates:_____

_____

_____

5. Compliance Determination

Is the predicted sound level less than the permissible sound level? Yes _____ No _____

If **YES**, the facility is expected to be in compliance with guidelines and the NIA is complete.

6. Attenuation Measures

If **NO** (the facility is not in compliance), what attenuation measures are planned to reduce noise impacts?

_____

_____

_____

_____

_____

Explain what measures have been taken to address construction noise. _____

_____

_____

_____

_____

7. Analyst's Name:_____

Title: _____

Telephone: _____ Date: _____

8 Compliance and Enforcement

A noise impact assessment must be conducted for any new permanent facilities or for modifications to existing permanent facilities where there is a reasonable expectation of a continuous noise source (see Section 7). However, you do not have to include the assessment with the facility application if the analysis indicates compliance (see EUB *Guide 56: Energy Development Application Guide*). In cases where the assessment indicates noncompliance, you must consider further attenuation measures. Where such measures are not practical, you can include the assessment with the application, along with reasons why the measures proposed to reduce the impacts are not practical.

The EUB conducts random comprehensive sound surveys and audits on facilities and facility applications and expects sound levels to be in compliance and NIAs to be complete and understandable. Upon audit, failure to have an appropriate or complete NIA is considered a noncompliance event. If you are unsure of the requirements for an NIA, contact an appropriate consultant or the EUB's Regulatory Support Branch (403-297-3642).

The EUB considers the following to be "major" noncompliance events:

- Submission of an NIA that is inappropriate, incomplete, and contains significant errors or omissions

- Failure of a new facility to meet the permissible sound levels at the nearest or most impacted residence as determined by a post-construction/start-up comprehensive survey

- Failure to respond expeditiously to a legitimate noise complaint regarding an existing facility

Noncompliance with other requirements of *ID 99-8* or *Guide 38* are considered "minor" events.

The EUB reserves the right to escalate noncompliance issue(s) to any level should conditions warrant.

If in the opinion of the EUB a noncompliance event causes noise levels greater than the permissible sound level or unacceptable impacts on nearby residents, it may suspend operations if the impacts cannot be resolved.

Where possible, the EUB intends to utilize existing audit and enforcement processes. For example, Field Surveillance Group enforcement ladders may be used to provide consistent consequences with other similar field facility noncompliance events. For more information on this, contact the appropriate EUB field centre office.

9 Example Problems

The example problems below, when used in combination with the flowcharts in Section 5, show a step-by-step process to determine compliance or noncompliance for any new or existing facility.

Example Problem 1

A new compressor station is proposed for the area shown below. What sound levels should the facility be designed for?

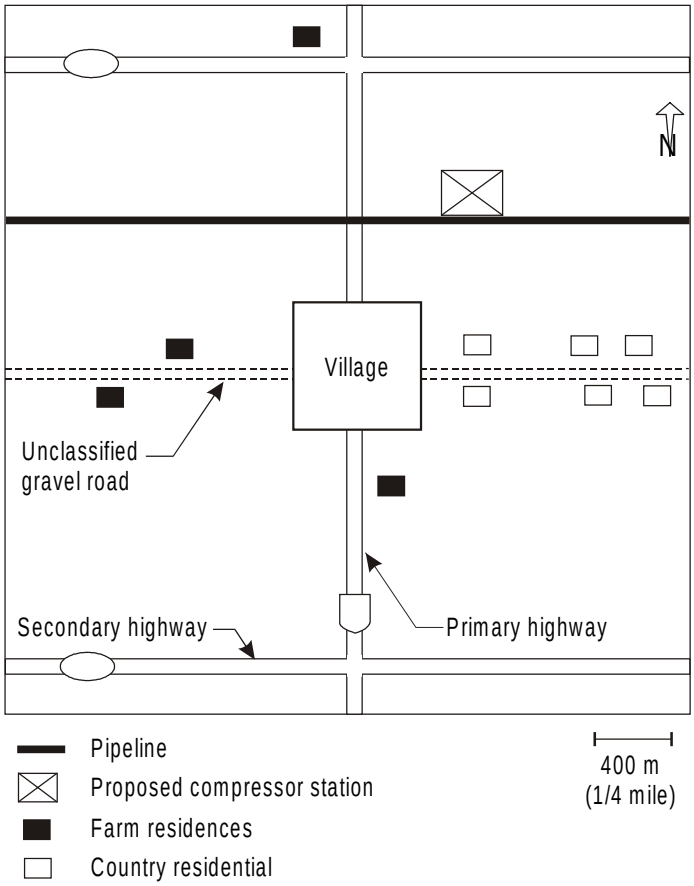


Figure 4. Area sketch for problem 1

Problem 1 - Solution

Using the flowcharts in Section 5, take the following steps in sequence to determine the appropriate PSL.

Step 1 Go to flowchart 1.
Designing new facility?
Yes. Use flowchart 2.

Step 2 Go to flowchart 2.
Read BSL from Table 2.

All three possible dwelling unit densities are represented in this area. The four 8.1-ha (20-acre) country residential dwellings factored over a quarter section fall into the 1-8 dwellings range, as do the farmhouses. The two country residential dwellings closest to the village and a portion of the village are in the 9-160 dwellings range, while the body of the village is in the greater than 160 dwellings range.

Regarding the transportation proximity category: the presence of the primary highway causes the adjacent farmhouses to fall into category 2, while the dwellings in the village fall into category 2 or 3, depending on the distance from the highway. Some of the country residences fall into category 2 (those closest to the highway), while others fall into category 1 (farther along the gravel road).The farmhouses on the gravel road are category 1.

It appears that the country residences to the south of the proposed facility are probably the most sensitive, being category 1 units. This gives a nighttime BSL of 40 dBA Leq, from Table 2.

Some preliminary calculation of expected sound levels and attenuation may be useful in determining the worst impacted residence. For instance, the nearest dwelling unit may be a category 2, while a more distant dwelling unit may be category 1. Some elementary calculations may be necessary to determine the worst case.

Step 3 Are daytime sound levels required?
No, as the lower sound level is the one that must be designed for and the nighttime level is usually lower.

Step 4 Seasonal operation?
No, because this facility will be running all year. Again, the lower level is the one that must be designed for, so including this adjustment in the design stage is not appropriate.

Step 5 Are tonal or impulse/impact components present?
This adjustment is applicable only to existing facilities and cannot be used in the design of new facilities. Therefore adjustment A2 is not applicable.

Step 6 Is the BSL appropriate for this area?
Assume no. The operators of this proposed facility have taken some spot measurements with a hand-held sound meter. The levels recorded ranged from 35 dBA at night to 55 dBA during the day.

Step 7 A 24-hour ambient sound monitoring study 15 m from the nearest acreage dwelling unit prior to construction of the facility must be conducted to claim adjustment A3. The results of the survey are

Daytime ASL: 53 dBA Leq
Nighttime ASL: 37 dBA Leq

Claim adjustment A3 from Figure 2. First, subtract the ASL measured in this step from the BSL in step 2.

Daytime BSL - daytime ASL = 50 - 53 = - 3
Nighttime BSL - nightime ASL = 40 - 37 = +3

For each in turn, locate this difference on the horizontal axis of Figure 2, read upward until the adjustment line is intersected, and read to the left to find the applicable adjustment A3.

Daytime adjustment: A3 = +8 dBA Leq
Nighttime adjustment: A3 = + 2 dBA Leq

Step 8 Sum of adjustments: A1 + A2 + A3 (call it A)
Daytime: 0 + 0 + 8 = 8 dBA Leq
Nighttime: 0 + 0 + 2 = 2 dBA Leq

Step 9 Is A greater than 10 dBA Leq?
In either case, no.
Class A adjustment = 8 dBA daytime
Class A adjustment = 2 dBA nighttime

Step 10 Is noise temporary in nature?
No; the facility will operate all year.
Class B adjustment: B = 0 dBA

Step 11 Determine the PSL.

Daytime					Nighttime				
PSL	=	BSL	+ Day	+ A	+ B	PSL	=	BSL	+ Day	+ A	+ B
PSL	=	40	+ 10	+ 8	+ 0	PSL	=	+ 40	+ 0	+ 2	+ 0
PSL1 = 58 dBA Leq						PSL = 42 dBA Leq					

Step 12 Daytime PSL = 58 dBA Leq
Nighttime PSL = 42 dBA Leq

as measured 15 m from the nearest acreage dwelling unit.

Using these PSLs, the designer must calculate the maximum sound output of the facility. In this case, for example, the dwelling unit is about 600 m from the facility. Assuming a theoretical 6 dBA drop in sound level per doubling of distance, the facility must have a sound level of no more than 60 dBA Leq measured 75 m from the facility in order to have a sound level of 42 dBA at 600 m. This can be seen from the following table:

Distance (m)	Sound Level (dBA)
600	42
300	48
150	54
75	60

This 6 dBA loss per doubling of distance is a very rough estimate, and more site-specific methods should be used if possible. A more accurate way to determine the sound attenuation with distance is to measure similar equipment at a topographically similar location. This is done by measuring the sound levels at specified distances away from the facility (for example, 100 m, 200 m, 400 m, etc.) to determine the actual attenuation with distance. It is not uncommon for this attenuation to vary between 5 and 10 dBA for each doubling of distance.

For a design situation, notice how it is the nighttime sound level that must be met. Most permanent facilities create the same amount of noise whether it is day or night, and so the most stringent criterion is the nighttime sound level.

The NIA developed from these findings would include the following:

Problem 1 - Noise Impact Assessment

Note that this NIA is slightly more detailed than some because of claiming adjustment A3. Other than that, it is typical of the type of information and level of detail required.

1. The major sources of noise in this facility include cooler fans, exhaust noise, and possibly noise. The manufacturer of this equipment has stated that the maximum sound level from all the equipment is 60 dBA measured at 50 m in front of the cooler fan.

2. The sound levels at the nearest residence have been predicted using only the theoretical 6 dBA loss per doubling of distance. No additional losses for air absorption, excess ground attenuation, or facing the cooler fan away from the dwelling have been calculated. The only input is the 60 dBA criterion at 50 m.

3. The distance to the most impacted residence is 600 m to the south. This also happens to be the closest residence. If we extrapolate the 60 dBA value out to 600 m, using the theoretical 6 dBA loss per doubling of distance:

$$L(R_2) = L(R_1) - 20 \log\left(\frac{R_2}{R_1}\right)$$

$$L(600\ m) = 60 - 20 \log\left(\frac{600}{50}\right)$$

$$L(600\ m) = 60 - 21.6$$

$$L(600\ m) = 38.4\ dBA$$

So the predicted sound level at the residence is 38.4 dBA.

As well, we have measurements at a similar facility with similar topography to the one being applied for. Those measurements indicate short-term sound levels of 55-60 dBA at a distance of 75 m. These measurements indicate that the 6 dBA loss per doubling of distance may be conservative. As another measure to ensure compliance of the facility, the cooler fan will be faced in a northeasterly direction, so that residences are not located in front of it.

4. The most impacted residence is along an unclassified gravel road, so it is a category 1 proximity to transportation. There are four residences along this road, each consisting of 81 ha (20 acres). When factored over the quarter section, these residences fall into the 1-8 dwellings range. Based upon these two factors, the BSL is 40 dBA at night, from Table 2.

The only adjustments to the BSL being claimed are the daytime adjustment and the ambient monitoring adjustment.

Some spot measurements with a hand-held sound meter have been taken. The levels recorded ranged from 35 dBA at night to 55 dBA during the day. As a result, a 24-hour ambient monitoring survey was conducted at the most impacted residence.

The results of the survey are 53 dBA Leq (15 h) during the daytime period and 37 dBa Leq (9 h) during the nighttime period. The report detailing the ambient monitoring survey is contained in an attachment to this NIA.

Claiming adjustment A3 from Figure 2, the ASL measured is subtracted from the BSL:

Daytime BSL - Daytime ASL = 50 - 53 = -3
Nighttime BSL - Nighttime ASL = 40 - 37 = +3

Using Figure 2, the applicable A3 adjustments are

Daytime adjustment A3 = +8 dBA Leq
Nighttime adjustment A3 = +2 dBA Leq

The PSLs are

Daytime						Nighttime					
PSL	=	BSL	+ Day	+ A	+ B	PSL	=	BSL	+ Day	+ A	+ B
PSL	=	40	+ 10	+ 8	+ 0	PSL	=	+ 40	+ 0	+ 2	+ 0
PSL = 58 dBA Leq						PSL = 42 dBA Leq					

5. The assessment indicates the predicted sound level is 38.4 dBA. This is less than the PSL of 42 dBA during the nighttime, calculated above. The assesssment indicates the facility will meet the noise directive. If the facility receives any complaints, they will be investigated promptly, and if the facility is not meeting the directive, remedial action will be undertaken to rectify the situation and bring the facility into compliance with the noise directive.

6. No further attenuation measures need to be considered at this time.

7. This NIA was conducted by A. Tech-Engineer, of XYZ Company.

Example Problem 2

A drilling rig is drilling a multiwell pad and averages one well every 1.5 days. Including rigging up and tearing down, the rig will be at the site for 25 days.

A residence exists 500 m south of the drill pad and is 50 m from a secondary highway. The company receives a complaint that noise during the early morning is unacceptable during typical drilling operations. The problem is not resolved by private negotiation.

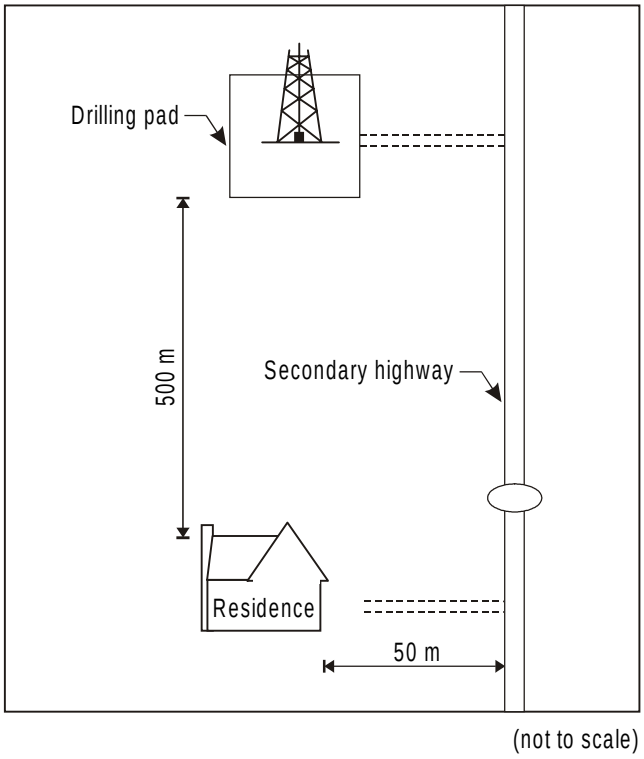


Figure 5. Area sketch for problem 2

Problem 2 - Solution

Step 1 Go to flowchart 1.
Complaint received?
Yes. Use flowchart 3.

Step 2 Go to flowchart 3.
Complainant willing to discuss problem?
Yes.

Step 3 Review details of complaint.
Normal drilling operations (tripping), 04:00, calm summer morning.

Step 4 Problem privately resolved?
No.
A comprehensive sound monitoring study is required. Because the rig will be at this location for 25 days, it is feasible to conduct a sound survey. The sound survey will be conducted as soon as possible in order to determine if a problem exists.

Step 5 The comprehensive sound survey must be performed under similar conditions to those during the complaint. The operator decides to monitor for the full nighttime period (22:00-07:00), while the rig is drilling ahead, instead of the minimum 6 hours required. The results of the comprehensive sound survey are

Comprehensive sound level (CSL) = 53 dBA Leq nighttime.

Since the drilling rig is the only source of sound apart from unrelated traffic, it is felt the CSL measured should be representative.

Step 6 Determine PSL.
Use flowchart 2.
The approach is similar to that taken in example problem 1.

Step 6A The BSL in this case is 45 dBA at night, because the dwelling is in the 1-8 dwellings per section and category 2 transportation proximity. The dwelling fits into category 2 because the residence is 50 m from a secondary highway.

Step 6B None of the Class A adjustments are applicable because
A1 - complaint not received during the winter season,
A2 - the adjustment for tonal or impulsive component absence applies only for permanent facilities,
A3 - we will assume the BSL is appropriate.
Therefore A is 0.

Step 6C The rig is in operation less than two months, so one of the Class B adjustments would be applicable. Each well is drilled in 1.5 days and drilling operations are expected to last 25 days. The duration of the activity is 25 days.

From Table 4, the class B adjustment = B3 = 5 dBA.

Step 6D The PSL is

PSL = BSL + Day + A + B
PSL = 45 + 0 + 0 + 5

PSL = 50 dBA Leq nighttime

Step 7 Compare CSL with PSL:

CSL = 53 dBA Leq nighttime
PSL = 50 dBA Leq nighttime

Step 8 CSL is not less than PSL.
Some sort of corrective action is required.

Step 9 The *ID 99-8* requirements are exceeded by 3 dBA Leq. The cause has not yet been identified. A simple solution may be to apply upgraded mufflers to the rig or reschedule some nighttime activities, such as tripping or unloading pipe, to daytime hours if possible.

The statement that "The rig is only going to be here for a few more days; let's just get the job done and then we won't be causing a problem anymore" will not generally be accepted as a solution. However, if the resident will accept that solution, it would be acceptable to the EUB.

Step 10 Once corrective action has been taken, the complainants should be approached to see if they are satisfied. If they are, the dispute has been resolved. If not, other simple solutions should be pursued. If nothing more can be accomplished, another comprehensive sound survey should be done to determine if the rig is now complying with the directive.

Based upon the results of this new survey, a decision will be made by the EUB whether to recommend further action. Should a successful resolution not be achieved through mediation, the facility owner or landowner continues to have the right to request a hearing before the EUB under the appropriate sections of the Energy Resources Conservation Act.

Appendix 1 Glossary

Some of the terms used in *ID 99-8* and *Guide 38* are defined for this particular context; these definitions are not necessarily the same as the generally accepted broader definitions of these terms. Explanations used in this section should not be used for other noise legislation, as the meanings for some terms may not be identical.

Abnormal noise events	Noises that are sufficiently infrequent as to be uncharacteristic of an area or that occur so close to the microphone as to dominate the measurements in an unrealistic manner. Consideration must be given to deleting occurrences of abnormal noise from the measurements to obtain a reasonably accurate representation of the sound environment. Examples of abnormal noises include a dog barking close to the microphone, a vehicle passing nearby, people talking in the vicinity of the microphone in a quiet environment, or a passing road grader.
Ambient noise	All noises that exist in an area and are not related to a facility covered by *ID 99-8.* Ambient noise includes sound from other industrial noise not subject to this directive, transportation sources, animals, and nature.
Ambient sound level (ASL)	The sound level that is a composite of different airborne sounds from many sources far away from and near the point of measurement. The ASL does not include any energy-related industrial component and must be measured without it. The ASL can be measured when the sound level in an area is not felt to be represented by the basic sound levels in Table 2. The ASL must be measured under representative conditions. As with comprehensive sound levels, representative conditions do not constitute absolute worst-case conditions (i.e., the most quiet day in this case) but conditions that portray typical conditions for the area. Also see entry for Representative conditions.
A-weighted sound level	The sound level as measured on a sound level meter using a setting that emphasizes the middle frequency components similar to the frequency response of the human ear.

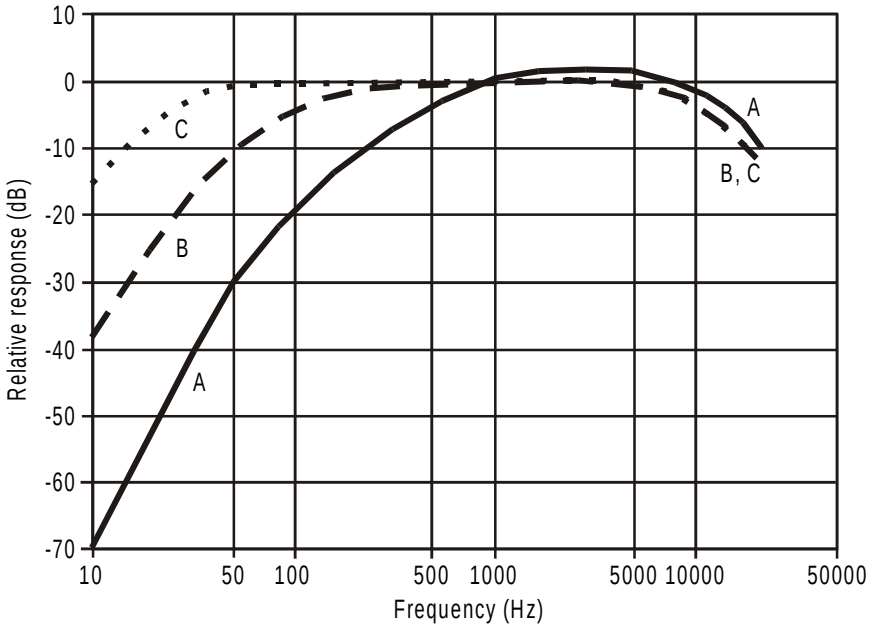


Figure 6. Weighting network curves

Bands (octave, ⅓ octave)

A series of electronic filters separate sound into discrete frequency bands, making it possible to know how sound energy is distributed as a function of frequency. The octave band has a centre frequency that is double the centre frequency of the octave band preceding it.

The ⅓ octave band analysis provides a finer breakdown of sound distribution as a function of frequency.

Basic sound level (BSL)

The A-weighted Leq sound level commonly observed to occur in the designated land-use categories with industrial presence. The BSL is assumed to be 5 dBA above the ASL and is set out in Table 2.

Calibration

The procedure used for the adjustment of a sound level meter using a reference source of a known sound pressure level and frequency. Calibration must take place before and after the sound level measurements.

Category

A classification of a dwelling unit in relation to transportation routes used to arrive at a BSL.

Category 1

Dwelling units more than 500 m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers.

Also see entry for Category.

Category 2	Dwelling units more than 30 m but less than 500 m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers. Also see entry for Category.
Category 3	Dwelling units less than 30 m from heavily travelled roads and/or rail lines and/or subject to frequent aircraft flyovers. Also see entry for Category.
Class A adjustment	Consists of the sum of adjustments that account for the adjustment seasonal nature of the noise source, absence of both tonal and impulse/impact components, and the actual ambient sound level in an area. It cannot exceed +10 dBA. The Class A adjustment is added to the BSL, the daytime adjustment, and the Class B adjustment to arrive at a permissible sound level.
Class B adjustment	An adjustment based on the duration of a noisy activity that recognizes that additional noise can be tolerated if it is known that the duration will be limited. An adjustment of B1, B2, B3, or B4 may be selected as applicable.
Comprehensive sound level (CSL)	The sound level that is a composite of different airborne sounds from many sources far away from and near the point of measurement. The CSL does include industrial components and must be measured with them, but it should exclude abnormal noise events. The CSL is used to determine whether a facility is complying with *ID 99-8.* Also see entry for Representative conditions.
Daytime	Defined as the hours from 07:00 to 22:00.
Daytime adjustment	An adjustment that allows a 10 dBA increase because daytime sound levels are generally about 10 dBA higher than nighttime values.
Density per quarter section	Refers to a quarter section with the affected dwelling at the centre (a quarter-mile/400-m radius). For quarter sections with various land uses or with mixed densities, the density chosen must be factored for the area under consideration.

dB (decibel)

A unit of measure of sound pressure that compresses a large range of numbers into a more meaningful scale. Hearing tests indicate that the lowest audible pressure is approximately 2×10^{-5} Pa (0 dB), while the sensation of pain is approximately $2 \times \mathbf{10^2}$ Pa (140 dB). Generally, an increase of 10 dB is perceived as twice as loud.

$$\text{Sound pressure level (dB)} = 10 \log \left(\frac{p^2}{p_o^2} \right)$$

$$= 20 \log \left(\frac{p}{p_o} \right)$$

p = root-mean-square sound pressure (Pa)

p_o = reference root-mean-square-sound pressure, generally 2×10^{-5} Pa

dBA

The decibel (dB) sound pressure level filtered through the A filtering network to approximate human hearing response at low frequencies.

Also see entries for dB and A-weighted sound level.

Dwelling unit

Any permanently or seasonally occupied residence with the exception of an employee or worker residence, dormitory, or construction camp located within an industrial plant boundary. Trailer parks and campgrounds may qualify as a dwelling unit if it can be demonstrated that they are in regular and consistent use during the applicable season.

Dwelling unit (most impacted)

The nearest dwelling unit may not necessarily be the one most adversely affected because of factors such as topography or man-made features. For example, the nearest dwelling unit to a facility may be located behind an intervening ridge, while a more distant dwelling unit may be in direct line of sight with the facility. Care must be taken in determining the most impacted dwelling unit.

Also see entry for Dwelling unit.

Emergency	An unplanned event requiring immediate action to prevent loss of life or property. Events occurring more than four times a year are not considered unplanned.
Energy equivalent sound level (Leq)	The Leq is the average A-weighted sound level over a specified period of time. It is a single-number representation of the cumulative acoustical energy measured over a time interval. The time interval used should be specified in brackets following the Leq (e.g., Leq (9) is a 9-hour Leq). If a sound level is constant over the measurement period, the Leq will equal the constant sound level where f_i is the fraction of time the constant level $L_{i,}$ is present. $$Leq = 10 \log\left(\sum_{i=1}^{n} f_i \times 10^{L_i/10} \right)$$ See Section 3 for more detail on the Leq concept.
Facility	A facility is any operation used in exploration, processing, development, and transportation of energy resources. A new facility is one that was not in operation prior to the effective date of *ID 99-8.* An existing facility is one that was in operation prior to the effective date of this directive.
Far field	The far field may consist of two parts, the free part and the reverberant part. In the free part, the sound pressure level obeys the inverse-square law (6 dBA loss per doubling of distance). See Section 3.5 for examples. The reverberant part exists for enclosed situations where there are many reflected sound waves from all directions. An example of a reverberant field is the case of industrial equipment enclosed in a room.
Fast response	Fast response has a time constant of 125 milliseconds on a sound level meter. Also see entry for Slow response.
Filter	A device separating the components of an incoming signal by its frequencies.

Frequent aircraft flyovers	Used in the assessment of categories as part of a site-specific analysis for dwellings that lie within a contour area with a noise exposure forecast (NEF) 25 or greater, as designated by Transport Canada. In the absence of any NEF contours for a local airport, Transport Canada will be referenced for current air traffic statistics. In this case, to qualify for the BSL adjustment, a dwelling must be within 5 km of an airport that has a minimum of nine aircraft takeoffs or landings over the nighttime period. Also see entry for Noise exposure forecast.
Heavy industrial area	Usually an area zoned by the appropriate municipality containing or meant to contain a concentration of large industrial complexes, thereby helping operators avoid multiplicity of industrial effects on surrounding residents. A buffer zone is generally established between the industrial facilities and where people live so that there are no residences situated among industrial facilities.
Heavy truck	Any truck having a gross vehicle weight of 12 000 kg or more and having three or more axles.
Heavily travelled road	Generally includes primary and secondary highways and any other road where the average traffic count is at least 10 vehicles/hour over the nighttime period. It is acknowledged that primary and secondary highways are sometimes lightly travelled during the nighttime period, which is usually the period of greatest concern. The EUB will use the 10 vehicles/hour criterion to determine whether primary and secondary highways qualify as heavily travelled during the nighttime period.
Industrial development permit facility	Typically a large industrial facility such as a chemical production plant or oil refinery that uses large amounts of energy and has received an approval to operate from the EUB.
Impulse/impact component	A sound that quickly rises to a peak value and falls off over a short period of time. The absence of impulse/impact components is determined when the difference between the A-weighted impulse response setting sound level measurement and the A-weighted slow-response setting sound level measurement is 10 dBA or less. Some examples of an impulse/impact sound are a hammer striking a nail, the firing of a gun, pipe-on-pipe impacts due to unloading pipe at a well site, and pile driving.

Infringement	Defined as when a residence is newly located within the existing noise footprint (boundary) of a facility, such that the facility could be seen as being in contravention of *ID 99-8*.
Isolation analysis techniques	Various sound measurements and analytical skills used to separate out various sound sources and obtain the sound level from the source of interest alone.
Leq	See Energy equivalent sound level.
Near field	The region close to the source where the inverse-square law (6 dBA loss per doubling of distance) does not apply. Usually this region is located within a few wavelengths of the source and is also controlled by the dimensions of the source.
Nighttime	Defined as the hours from 22:00 to 07:00.
Noise	Generally associated with the unwanted portion of sound.
Noise exposure forecast (NEF)	The NEF contours are site specific to each airport and take into account such factors as traffic levels, proximity to runways, flight paths, and aircraft type and size. NEF contours are available from Transport Canada.
Noise impact assessment (NIA)	An NIA identifies the expected sound level emanating from a facility as measured 15 m from the nearest or most impacted permanently or seasonally occupied dwelling. It also identifies what the permissible sound level is and how it was calculated. Also see Section 6: Noise Complaint Investigations.
Pass-by	The movement of a vehicle past the point of measurement and observed as an increase in sound level to a peak, followed by a decrease as the vehicle moves away from the microphone.
Permanent facility	Any existing or proposed facility that will be at a location longer than two months.
Permanently occupied dwelling	A fixed residence occupied on a full-time basis.

Permissible sound level (PSL)	The maximum sound level that a facility should not exceed at a point 15 m from the nearest or most impacted dwelling unit. The PSL is the sum of the BSL, daytime adjustment, Class A adjustment, and Class B adjustment.
Pristine area	A pure, natural area that might have a residence but no industrial presence, including energy, agricultural, forestry, manufacturing, recreational, or other industries that could make noise generation a consideration.
Rail lines	Includes any rail line where there is a minimum of one 25-car train passage during every nighttime period.
Representative conditions	Those conditions typical for an area and/or the nature of a complaint. For ASLs, these are conditions that portray the typical activities for the area, not the quietest time. For CSLs, these do not constitute absolute worst-case conditions or the exact conditions the complainant has highlighted if those conditions are not easily duplicated. Sound levels must be taken only when representative conditions exist; this may necessitate a survey of extensive duration (two or more consecutive nights).
Seasonally occupied dwelling	A fixed residence that, while not being occupied on a full-time basis, is occupied on a regular basis. A regular basis does not imply a scheduled occupancy but implies use of six weeks per year or more. The residence must not be mobile and should have some sort of foundation or features of permanence (e.g., electrical power, domestic water supply, septic system) associated with it. Summer cottages or mobile homes are examples of seasonally occupied dwellings, while a holiday trailer simply pulled onto a site is not.
Slow response	A standardized detector response on a sound level meter that dampens the movement of displays so that rapidly fluctuating sound levels may be read. Slow response has a time constant of 1 second, which helps average out the display fluctuations. Fast response has a time constant of 125 milliseconds.

Sound level meter	An instrument designed and calibrated to respond to sound and to give objective, reproducible measurements of sound pressure level. It normally has several features that would enable its frequency response and averaging times to be changed to make it suitable to simulate the response of the human ear.
Sound monitoring survey	The measurement and recording of sound levels and pertinent related information over a given time period. *Guide 38* sets out two types of monitoring surveys. The first helps determine the PSL and consists of a 24-hour continuous sound monitoring survey conducted 15 m from the nearest or most impacted dwelling unit without any energy-related industrial presence. This type of sound survey can be used to determine an ASL. Also see entry for Ambient sound level. The second sound monitoring survey is required to determine a facility's compliance with *ID 99-8*. The CSL is determined by conducting a continuous sound monitoring survey over a minimum 6-hour period to a maximum 24-hour period. The need for extended sound monitoring surveys (greater than 24 hours) may exist and should be discussed with the EUB prior to proceeding. Also see entry for Comprehensive sound level.
Spectrum	A wide range or sequence of frequencies.
Temporary facility	Any facility that will be at a location less than two months.
Tonal components	This adjustment is applicable only to existing facilities and cannot be used in design of new facilities. Most energy industry facilities typically exhibit either a tonal or impulse/impact component. Examples of tonal components are transformer hum, sirens, and piping noise. *ID 99-8* specifies that the absence of a tonal component may be demonstrated by performing a ⅓ octave band analysis. The test for the presence of tonal components consists of two parts. The first must demonstrate that the sound pressure level of any one of the slow-response, A-weighted, ⅓ octave bands between 20 and 16 000 Hz is 10 dBA or more than the sound pressure level of at least one of the adjacent bands within two ⅓ octave bandwidths. In addition, there must be a minimum of a 5 dBA drop from the band containing the tone within 2 bandwidths on the opposite side.

	The second part is that the tonal component must be a pronounced peak clearly obvious within the spectrum. An example of tonal component determination is shown in Section 5.1, note 4.0**.**
Windscreen	A specialized piece of porous sponge that fits over the microphone in order to reduce the noise generated by the wind blowing around the microphone. Useful in moderately low wind speeds. Generally, outdoor measurements are not recommended when wind speeds exceed 15 km/h, as the wind-induced noise on the microphone becomes of the same magnitude as the levels of noise being measured.

Appendix 2 Measurement Instrumentation and Techniques

Measurement Instrumentation

Instrumentation used to conduct sound monitoring surveys must be able to measure the A-weighted (dBA) continuous energy equivalent sound level (Leq) of steady, intermittent, and fluctuating sounds. It must be able to accumulate the data and calculate the Leqs over the time periods required herein and must meet the minimum technical specifications in International Electrotechnical Commission (IEC) publication 804 for Type II sound level meters.

Sound Level Meter Calibration Requirements

It is important that the sound level meters used for noise surveys be properly calibrated and functioning. The sound level meters used for noise measurements made under this directive must

1) meet the requirements as indicated in American National Standards Institute (ANSI) S1.4-1983 and S1.4A-1985 or latest revision;

2) be calibrated immediately prior to the measurement with a sound calibrator meeting the requirements of ANSI S1.40-1984 or latest revision;

3) have their calibration confirmed immediately after the measurement using the same calibrator; a record of calibration results must be included in the report;

4) be calibrated by the instrument manufacturer, by an authorized instrument calibration facility, or by another agency acceptable to the EUB within a two-year period immediately preceding the measurements; records of calibration and the procedures used in the reciprocal calibration must be maintained, although formal calibration certificates are not necessary.

Calibrator Certification Requirements

Calibrators must be recertified in accordance with ANSI publication SI.40-1984, which requires that a calibrator be recalibrated at least once a year.

The sound measurement instrumentation necessary to conduct the ⅓ octave band sound pressure level measurements to characterize the presence of tonal components must meet the minimum technical specification in IEC publication 225-1966 or ANSI publication S1.11-1966 for Class II filter sets used in conjunction with conventional sound level meters that meet the minimum technical specifications in IEC publication 651-1979 or ANSI publication S1.4-1983 for Type II sound level meters.

The sound measurement instrumentation necessary to conduct the impulse sound level measurements to characterize the presence of impulse/impact components must meet the minimum technical specifications in IEC publication 651-1979 or ANSI publication S1.4-1983 for Type II sound level meters.

Better-quality instrumentation may meet many or all of the specifications mentioned herein.

Measurement Techniques

The sound measurement techniques employed must be carefully chosen and controlled to obtain valid and consistent results. Factors to take into account include the effects of meteorological factors, activities in the vicinity of the sound meter, suitability of the monitoring location, and topographical features.

General guidelines for sound measurement techniques are found in the following publications: *A Method for Conducting and Reporting Noise Surveys at Industrial Plants*, March 1978, Alberta Environment; *Model Municipal Noise Control By-Law*, 1978, Ontario Ministry of the Environment; *Methods for the Measurement of Sound Pressure Levels*, ANSI publication S1.13-1971; and *Assessment of Noise with Respect to Community Response*, International Organization for Standardization (ISO) publication 1996.

Users must also ensure that the instrumentation is working within manufacturers' recommended specifications and limitations.

The major considerations requiring attention include the following:

- Calibration—acoustic calibration must be performed before and after each survey.

- Microphone position and orientation—the microphone must be a minimum of 1.2 m above the ground. Use of a tripod is recommended. The microphone must be a minimum of 3 m away from significant sound-reflecting surfaces and oriented as per instrumentation manufacturer's instructions. Use of a windscreen recommended by the manufacturer is required.

- Steady precipitation—invalid for monitoring.

- Wind effects—invalid noise data may occur with wind speeds greater than those shown in Table 1 below. This table shows that wind gradients can greatly affect the sound levels measured. The table is less applicable in situations where hills exist between the facility and the measurement location. Appropriate judgement must be used in determining the applicability of the table. Short-term wind gusts less than five minutes in duration and up to 20 km/h may be acceptable.

- Abnormal noise events, including excessive winds, are potentially invalid for monitoring; however, the use of an appropriate isolation analysis technique may correct for any such events.

Table 1. Suggested wind speed limits for obtaining reasonable data

	Distance from noise source to measurement location		
	< 500 m	**500-1000 m**	**> 1000 m**
Upwind*	10 km/h	5 km/h	<5 km/h
Crosswind	15 km/h	10 km/h	5 km/h
Downwind	15 km/h	10 km/h	5 km/h

* The wind is blowing from the measurement location towards the noise source.

Note that the limits for wind speed and precipitation apply at the measurement position, not at some remote sensing position many kilometres away. While data from a location nearby (within 10 km) may serve as an indicator, that does not guarantee the same conditions at the measurement position.

In cases where a discrepancy occurs between measurement techniques mentioned herein and those presented in the cited references, *ID 99-8* prevails. The EUB reserves the right to pass judgement regarding the suitability of any sound measurement techniques employed.

Appendix 3 Sound Levels of Familiar Noise Sources

Source[1]	Sound Level (dBA)
Bedroom of a country home	30
Soft whisper at 1.5 m	30
Quiet office or living room	40
Moderate rainfall	50
Inside average urban home	50
Quiet street	50
Normal conversation at 1 m	60
Noisy office	60
Noisy restaurant	70
Highway traffic at 15 m	75
Loud singing at 1 m	75
Tractor at 15 m	78-95
Busy traffic intersection	80
Electric typewriter	80
Bus or heavy truck at 15 m	88-94
Jackhammer	88-98
Loud shout	90
Freight train at 15 m	95
Modified motorcycle	95
Jet taking off at 600 m	100
Amplified rock music	110
Jet taking off at 60 m	120
Air-raid siren	130

[1]Cottrell, Tom, 1980, *Noise in Alberta*, Table 1, p.8, ECA80 - 16/1B4 (Edmonton: Environment Council of Alberta).

Sound Levels Generated by Common Appliances

Source[2]	Sound level at 3 feet (dBA)
Freezer	38-45
Refrigerator	34-53
Electric heater	47
Hair clipper	50
Electric toothbrush	48-57
Humidifier	41-54
Clothes dryer	51-65
Air conditioner	50-67
Electric shaver	47-68
Water faucet	62
Hair dryer	58-64
Clothes washer	48-73
Dishwasher	59-71
Electric can opener	60-70
Food mixer	59-75
Electric knife	65-75
Electric knife sharpener	72
Sewing machine	70-74
Vacuum cleaner	65-80
Food blender	65-85
Coffee mill	75-79
Food waste disposer	69-90
Edger and trimmer	81
Home shop tools	64-95
Hedge clippers	85
Electric lawn mower	80-90

[2]Reif, Z. F., and Vermeulen, P. J., 1979, "Noise from domestic appliances, construction, and industry," Table 1, p.166, in Jones, H. W., ed., *Noise in the Human Environment*, vol. 2, ECA79-SP/1 (Edmonton: Environment Council of Alberta).

Appendix 4 *ID 99-8: Noise Control Directive*

1 November 1999

TO: All Energy Industry and Industrial Development Permit Facility Operators and Drilling and Servicing Rig Contractors

NOISE CONTROL DIRECTIVE

Introduction

This directive supersedes *Interim Directive (ID) 94-4.* It is effective immediately and will be reviewed after a two-year period, in November 2001, or as required.

With the continued widespread growth of energy operations throughout the province, additional sources of energy industry-related sound are appearing. While residents, particularly in rural areas, would generally prefer no increase in sound levels resulting from energy-related developments, it is sometimes not possible to completely eliminate these increases. However, if proper sound control features are incorporated into facility design in the planning stages, increases in sound levels can be kept to acceptable minimums.

This directive views noise from a receptor viewpoint, rather than considering sound levels at the property line. Criteria based on property line measurements were considered to be too restrictive in rural settings, since a natural buffer often exists between operating facilities and any occupied dwellings.

This directive applies to all facilities under the EUB's jurisdiction or where the EUB has issued a permit to operate. Facilities approved prior to April 1988 will be dealt with on a case-by-case basis, while new facilities will be designed to meet this directive. Although the directive is comprehensive, it is expected some cases will need to be dealt with on a site-specific, issues-oriented basis. For example, while the directive is not applicable to construction activity, these activities must be conducted with some consideration for noise. Any related complaints must be dealt with by the facility operator. For details about construction noise, see *Guide 38: Noise Control Directive User Guide*, Section 5.1, note 1.0.

This directive takes into consideration the existing ambient sound level, character of the sound, temporary or permanent nature of the source, and seasonal sensitivity to sound in order to establish reasonable sound levels. It was developed by a committee composed of members from the acoustical consulting community, industry, universities, rural landowners, governmental agencies, and EUB staff.

The directive attempts to take a balanced viewpoint by considering the interests of both the nearby residents and the facility owner/operator. The directive does not guarantee that a resident will not hear sounds from a facility even if it is in compliance; rather it aims for a situation where sound level increases will be kept to acceptable minimums and overall quality of life and indoor sound levels for neighbours to a facility will not be adversely affected. For example, the attenuation of sound through the walls of a dwelling should decrease indoor sound levels to a point where normal sleep patterns are not disturbed.

Guide 38

Guide 38: Noise Control Directive User Guide has been revised to help you better understand this directive. It presents the rationale for the directive, provides background information, and outlines an approach to dealing with noise problems. Those not familiar with noise and related terminology used in this directive are encouraged to review Section 3: The Leq Concept and Appendix 1: Glossary in *Guide 38.*

What's New in *Guide 38*: This 1999 edition of *Guide 38,* which replaces earlier editions, integrates the section formerly identified as "Supplement to the Interim Directive" into the guide itself.

Although the technical requirements in this edition of the directive and *Guide 38* have not changed, many enhancements have been made to help users better understand the complexities of this policy. Some of the more significant areas of interest are as follows:

- Construction Noise (Section 5.1)—Industrial operators must consider construction noise. This guide provides a number of suggestions that operators can implement to help minimize the noise impact on nearby residents.

- Complaint Investigation Process (Section 6)—The directive and guide now provide tools to assist operators and their neighbours in determining the conditions when industrial noise is a problem so that noise surveys can be performed under similar representative conditions.

- Noise Impact Assessments (Section 7)—The improved section on noise impact assessments enables operators to better understand EUB expectations and carry out assessments as part of their facility applications.

- Measurement Instrumentation and Techniques (Appendix 2)—Calibration requirements have been added for sound level meters in accordance with the appropriate American Noise Standards Institute requirements.

Complaint Investigation

The EUB expects operators to deal expeditiously with any noise-related complaint brought to their attention. When attempting to resolve a noise complaint, it is critical that operators first establish direct contact with the complainant to understand their concerns and create a dialogue. At this point, the operator should explain the requirements of this directive and clearly outline the process, including time lines, it intends to follow in addressing the matter. If a comprehensive

sound survey is to be performed, to be technically valid the operator or its consultant must determine the representative conditions that exist when noise would impact a residence. For more information on complaint investigation, see *Guide 38,* Sections 2 and 6. Section 6 includes a sample Complaint Investigation and Event Log form to assist in resolving the concern.

Noise Impact Assessment

Intent and Objective: The intent of a noise impact assessment (NIA) is to ensure that applicants consider possible noise impacts before a facility is constructed or operated, since the cost to retrofit may be significantly more than if noise mitigation measures are incorporated into the design of a facility. The objective of an NIA is to predict what the expected design sound level from the facility is at the nearest or most impacted permanently or seasonally occupied dwelling. Best practical technology (accounting for cost versus benefit) should be considered to minimize the potential noise impacts to existing dwellings and future infringement. Operators should discuss noise matters with area residents during the design, construction, and operating phases of a facility. Should a valid complaint be registered after the facility is constructed and in operation, the operator must meet the permissible sound level (PSL) referenced in the NIA.

Eligible Facilities: An NIA must be completed as part of the facility application process for any new permanent facilities or for modifications to existing permanent facilities where there is a reasonable expectation of a continuous or intermittent noise source. For the purposes of this directive, a permanent facility is defined as any facility that will be at a location longer than two months. Compressor stations, pumping stations, electric power plants, coal mines, gas processing plants, industrial development permit facilities, and batteries with compressors are examples of facilities where an NIA is required.

Drilling and servicing rigs fall into the temporary facility category even if they are expected to be at a location more than two months. Temporary activities will generally not require an NIA and will be handled on a complaint basis. Nevertheless, when selecting equipment, such as rigs, for these temporary activities, operators should bear in mind the EUB's expectation of expeditious compliance if complaints occur. The EUB may require an NIA for any facility it deems necessary.

Compliance and Enforcement: An NIA must be conducted for any new permanent facilities or for modifications to existing permanent facilities where there is a reasonable expectation of a continuous noise source (see Section 7 in *Guide 38*). However, you do not have to include the assessment with the facility application if the analysis indicates compliance (see EUB *Guide 56: Energy Development Application Guide*). In cases where the assessment indicates noncompliance, you must consider further attenuation measures. Where such measures are not practical, you can include the assessment with the application, along with reasons why the measures proposed to reduce the impacts are not practical.

The EUB conducts random comprehensive sound surveys and audits on facilities and facility applications and expects sound levels to be in compliance and NIAs to be complete and understandable. Upon audit, failure to have an appropriate or complete NIA is considered a noncompliance event. If you are unsure of the requirements for an NIA, contact an appropriate consultant or the EUB's Regulatory Support Branch (403-297-3642).

The EUB considers the following to be "major" noncompliance events:

- Submission of an NIA that is inappropriate, incomplete, and contains significant errors or omissions
- Failure of a new facility to meet the permissible sound levels at the nearest or most impacted residence as determined by a post-construction/start-up comprehensive survey
- Failure to respond expeditiously to a legitimate noise complaint regarding an existing facility

Noncompliance with other requirements of *ID 99-8* or *Guide 38* are considered "minor" events.

The EUB reserves the right to escalate noncompliance issue(s) to any level should conditions warrant.

If in the opinion of the EUB a noncompliance event causes noise levels greater than the permissible sound level or unacceptable impacts on nearby residents, it may suspend operations if the impacts cannot be resolved.

Where possible, the EUB intends to utilize existing audit and enforcement processes. For example, Field Surveillance Group enforcement ladders may be used to provide consistent consequences with other similar field facility noncompliance events. For more information on this, contact the appropriate EUB Field Centre office.

Technical Methodology: The EUB does not automatically require detailed calculations to prove the validity of the predictions, but it does expect a reasonable technical basis for the values presented in the NIA. Computer modelling, field measurements of similar equipment, accepted acoustical engineering examples from literature, or calculations may be used as tools to predict comprehensive sound levels (CSL).

Legitimate manufacturers' specifications rated for the type of service expected are also acceptable, but applicants are cautioned to use only manufacturers' data that indicate sound levels in the acoustic far or free fields. Manufacturers' data are often provided as the sound pressure level in the near or reverberant field (e.g., sound pressure levels measured at 1 m from the source), which are not indicative of those expected in the far or free field. Using near or reverberant sound pressure levels results in inaccurate noise impact assessment predictions. A sound pressure level value measured at 1 m is not applicable for inverse square law calculations and therefore does not qualify for the 6 dB reduction in sound level for each doubling of distance from the source. Once the predicted CSL has been established, it should be compared to the calculated PSL to determine the possible impact of the facility on any permanent or seasonal residents.

Special Considerations: Operators planning facilities in an area where there is already an energy industry presence are responsible for ensuring that their facility either will not cause the overall sound levels to exceed the PSL or, in situations where the existing noise levels are acceptable to residents even though they may be higher than the PSL, will not cause an increase in overall sound levels. In the latter case, the existing sound levels become the new PSL. Applicants may wish to discuss their proposed projects with adjacent operators to examine potential sound attenuation measures that are both effective and economical. For example, it may be more cost effective to install silencers on existing equipment, rather than design additional sound attenuation measures into the proposed facility.

For operators proposing projects in an area with established energy facilities, a comprehensive sound survey or modelling using measurements from similar existing sources should be considered to determine the sound environment. For areas with no energy industry presence where noise may be an issue with local residents, operators may want to conduct an ambient sound survey to identify existing sound levels. However, neither sound survey is required to conduct an NIA.

For more information on the requirements of an NIA, refer to *Guide 38*, Section 7, which includes a worksheet form to assist in completing an assessment.

Grandfathering

It is the EUB's view that noise impacts are either acceptable or unacceptable, irrespective of the age of the facility, and that a separate formula based on facility age would be inappropriate. However, the EUB remains willing to address individual cases on their own merits, since a vast number of variables may affect the level of noise impacts and an operator's ability to respond effectively. The EUB is also aware that each decision by an operator with regard to noise attenuation may affect its ability to provide overall net public benefits in other areas (e.g., facility consolidation). The EUB is willing to consider noise as one component of an overall public benefit/cost assessment for a facility and to consider a range of options in assessing project acceptability. Further information regarding this interim directive may be obtained from the EUB's Regulatory Support Branch (403-297-3642) or from the appropriate Field Centre.

Brad McManus, QC
Board Member