3 NOISE

3.1 Introduction

The noise baseline section presents a summary of baseline information compiled from literature and field studies. It describes information from the noise study areas, focusing on concerns that are assessed in Volume 5, Biophysical Impact Assessment.

The project areas are expected to be quiet, with no or negligible anthropogenic sources of noise. The acoustic environments of the sites are dominated by the sounds of nature, e.g., wind rustling through foliage and animal noises. Existing ambient sound levels are expected to be low, in the range of 35 dBA.

A comprehensive noise field study is not required for the project under applicable noise guidelines because of the remote nature of the facilities and the lack of noise-sensitive receptors within 1.5 km of facility sites. This study, therefore, will use a noise guideline limit of 40 dBA at 1.5 km, according to the requirements outlined in Alberta Energy and Utilities Board (EUB) *Guide 38: Noise Control Directive User Guide* (Guide 38) (EUB 1999a). This limit is based on a remote rural ambient sound level of 35 dBA, with a 5-dB increase above this level for industrial presence in an area. The use of Guide 38 is referenced in the Government of the Northwest Territories draft *Air Quality Code of Practice, Upstream Oil and Gas Industry, Consultation Draft* (RWED 2002). Volume 5, Section 3, Noise, describes the assessment guidelines in detail.

3.1.1 Baseline Study Objectives

The objective of the baseline sound monitoring surveys is to characterize the existing sound environment near proposed project components.

Guide 38 (EUB 1999a) provides direction for assessing environmental noise and explains the need for establishing baseline conditions. The Northwest Territories regulatory authority for the upstream oil and gas industry endorses use of *Interim Directive 99-08: Noise Control Directive* (ID 99-08) (EUB 1999b). The National Energy Board has no specific criteria regarding environmental noise, and often uses applicable provincial guidelines.

The noise component of an environmental impact study typically compares future predicted sound levels with preconstruction existing sound levels. The areas that might be affected by operations, transportation and construction noise are remote, with no permanent or seasonal dwellings within 1.5 km of the sites, and are well-removed from existing industrial noise sources.

Although a comprehensive noise survey is not required, monitoring has been done at selected locations to confirm suspected ambient sound levels and verify assumptions.

3.2 Methods

3.2.1 Study Area

This baseline study used a methodological approach consistent with Guide 38 (EUB 1999a). Figure 3-1 shows the methods for conducting the noise baseline study.

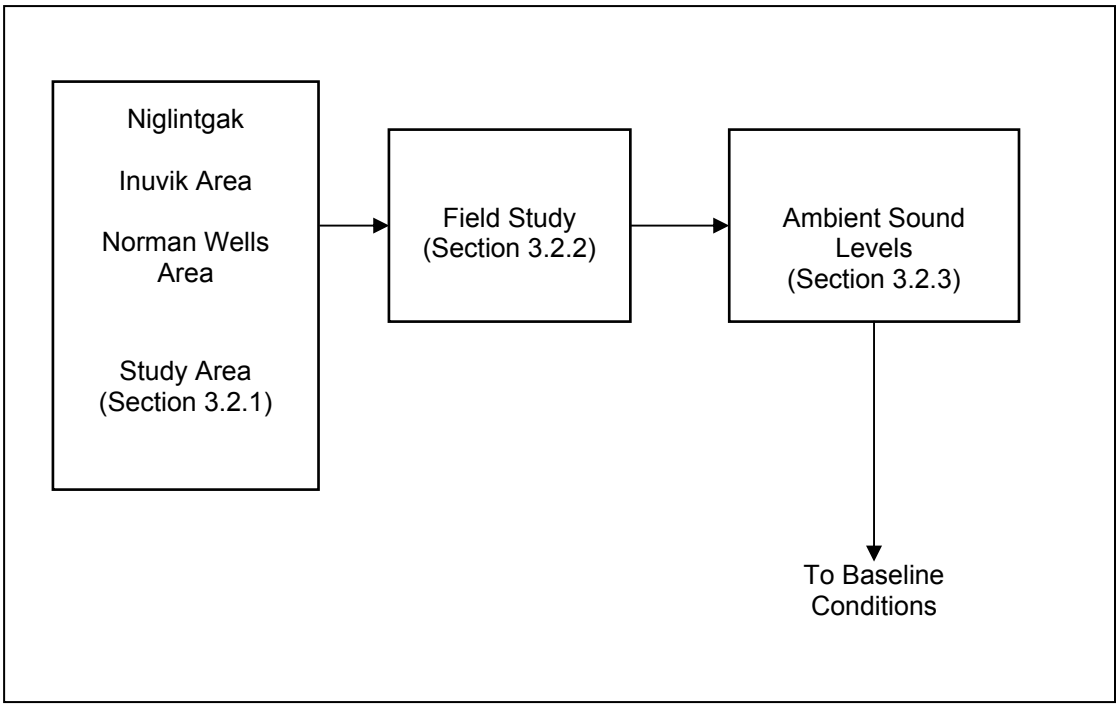

Figure 3-1: Method for Noise Baseline Study

A limited ambient noise study was done at the following sites in the production area and pipeline corridor to confirm existing conditions and the applicability of the 35 dBA ambient sound level:

- production area – summer and winter sound levels were measured near the proposed site at Niglintgak. Based on professional experience, sound levels at Niglintgak are representative of ambient sound levels at all field sites.
- pipeline corridor – noise was measured at two locations:
  - near the proposed site of the Inuvik area facility. Based on professional experience, summer and winter sound levels measured at the Inuvik area facility are representative of ambient sound levels along most of the pipeline corridor.

- at the proposed Norman Wells compressor site, near an existing Imperial Oil operation and the Norman Wells airport. The cabin lies outside the 1.5-km local study area (LSA).

Table 3-1 summarizes the locations and seasonal timing of the ambient sound monitoring studies.

Table 3-1: Monitoring Locations and Seasons

Project Area	Location	Winter Ambient Noise Monitoring	Summer Ambient Noise Monitoring
Production area	Niglintgak	Nov. 30–Dec. 1, 2002	July 6–7, 2003
Pipeline corridor	Inuvik area facility	Dec. 3–4, 2002	July 5–6, 2003
	Norman Wells compressor station	–	July 10–11, 2003

NOTE:
– = not monitored

3.2.2 Field Study

The following field measurements and observations were made:

- 24-hour A-weighted energy equivalent sound level (L_{eq})
- weather conditions, including:
  - temperature
  - wind speed and direction
  - humidity
- local ground conditions and topography

Equipment used in the sound surveys included:

- a microphone
- a sound level meter
- an audio recording device

The sound level meter calculates and digitally logs the numerical sound level measured by the microphone during the survey. These sound levels are mathematically processed to yield average sound values. At the same time, the audio recorder makes a digital audio recording of the sound the microphone is detecting, for later playback and analysis.

3.2.3 Ambient Sound Levels

Sound levels measured in the field were processed to provide ambient sound level values suitable for assessment.

3.2.3.1 Equivalent Sound Levels

Environmental sound levels vary continuously over time. To account for both daily and short-term variations in sound levels, several single numerical descriptors have been developed based on large-scale psycho-acoustic studies of annoyance with environmental noise. These allow sound monitoring of a constantly varying sound environment over an extended period, with the results described as a single number that accurately describes the environment.

The single number descriptor commonly used in most international standards for environmental sound measurements is the energy equivalent sound level (L_{eq}). The L_{eq} value, expressed in dBA, is the energy-averaged, A-weighted sound level for the complete measurement interval. It is the steady, continuous sound level over a given period that has the same acoustic energy as the actual varying sound levels occurring over the same period in the measured environment. It is one of the most common and useful predictors of human response to noise, and it is also the noise descriptor that is applicable to environmental noise criteria specified in Guide 38 (EUB 1999a). The A-weighting accounts for the frequency content of the measured sound based on a frequency response similar to that heard by the human ear. The descriptors specific to this study are the:

- 24-hour A-weighted energy equivalent sound level, $L_{eq}(24)$, referred to as the daily sound level
- 15-hour A-weighted energy equivalent sound level, L_{eq} Day or $L_{eq}(15)$, referred to as the daytime sound level
- 9-hour A-weighted energy equivalent sound level, L_{eq} Night or $L_{eq}(9)$, referred to as the nighttime sound level
- 1-hour A-weighted energy equivalent sound level, $L_{eq}(1)$, referred to as the hourly sound level

3.2.3.2 Data Validation and Abnormal Data

When the measured sound levels contain invalid or abnormal sounds, the measured values are not truly representative of the typical sound environment. In such cases, a validation technique or isolation analysis can be used to remove the invalid periods or abnormal events from the measured data, to improve the quality of the measurements.

Examples of natural conditions that could lead to nonrepresentative, abnormal sound levels include:

- wind noise causing overloading on the microphone
- rain and snow causing increased noise levels

Specialized wind screens are used to reduce the effects of such meteorological conditions on noise measurements.

Additional nonrepresentative sounds include anthropogenic noises, such as:

- helicopter overflights and landings
- aircraft overflights
- snowmobiles approaching the sound monitoring station

Field staff working with the sound equipment while the survey is being conducted can also cause abnormal data. A time record of equipment inspections is kept to ensure that normal environmental sound data is not confused with this type of abnormal data. Validation and isolation analysis was done on field data.

3.2.3.3 Weather

As mentioned previously, excessive wind can invalidate the measurements of a microphone. Wind speeds less than 15 km/h are usually required for a meaningful sound monitoring survey. Guide 38 (EUB 1999a) provides direction on the maximum wind speed under which sound monitoring should be conducted and sets the maximum acceptable hourly average wind speed for sound monitoring at 15 km/h.

Measurements can also be affected by:

- high or low temperatures
- periods of high relative humidity
- periods of precipitation

The following parameters were recorded during measurements:

- wind direction
- wind speed
- temperature
- relative humidity
- rainfall, not including snowfall

Only valid field measurements are reported in this study.

3.3 Baseline Conditions

3.3.1 Niglintgak

3.3.1.1 Winter Sound Levels

Ambient sound was measured near the proposed Niglintgak production facility from 16:00 on November 30, 2002 until 14:00 on December 1, 2002. Sound monitoring equipment was located at 69° 19′ 15″ N and 135° 17′ 32″ W (E 488488, N 7690158 UTM coordinates) (see Figure 3-2). The site is about 2 km west of the summer sound monitoring survey site at Niglintgak.

Table 3-2 summarizes the measurement results. There is little human or wildlife activity in the area during late November and early December. There is currently no industrial presence within audible distance of the monitoring site. The daily sound level after validation was determined to be 36 dBA.

Table 3-2: Winter Sound Levels at Niglintgak

Survey Period	Sound Level (dBA)				
	Daytime L_{eq} Day	**Nighttime L_{eq} Night**	**Daily L_{eq} (24)**	**Minimum Hourly L_{eq} (1)**	**Maximum Hourly L_{eq} (1)**
Nov. 30–Dec. 1, 2002	37	33	36	17	44
NOTE: Sound levels are validated values					

3.3.1.2 Summer Sound Levels

Ambient sound was also measured near the proposed Niglintgak production facility from 12:00 on July 6, 2003 until 12:00 on July 7, 2003. Sound monitoring equipment was located at 69° 19′ 5″ N and 135° 14′ 41″ W (E 490379, N 7689837 UTM coordinates) (see Figure 3-2, cited previously). The site is about 2 km east of the winter sound monitoring survey site at Niglintgak.

Table 3-3 summarizes the measurement results. The main sources of environmental sound at Niglintgak during the summer were:

- wind
- birds
- insects

The daily sound level after validation was determined to be 37 dBA.

Figure 3.2 has been removed for the purposes of reducing file size and can be viewed as a graphic separately. This document can be accessed through the link in the Table of Contents reference web page.

Table 3-3: Summer Sound Levels at Niglintgak

Survey Period	Sound Level (dBA)				
	Daytime L_{eq} Day	Nighttime L_{eq} Night	Daily L_{eq} (24)	Minimum Hourly L_{eq} (1)	Maximum Hourly L_{eq} (1)
July 6–7, 2003	38	36	37	29	44
NOTE: Sound levels are validated values					

When wind speeds were less than 10 km/h, sound levels were typically between 20 and 30 dBA. During periods when wind speed was between 10 and 15 km/h, sound levels averaged between 30 and 40 dBA.

3.3.2 Inuvik Area Facility

3.3.2.1 Winter Sound Levels

Ambient sound was measured near the proposed Inuvik area facility site from 16:00 on December 3, 2002 until 11:00 on December 4, 2002. Sound monitoring equipment was located at 68° 24′ 37″ N and 133° 14′ 42″ W (E 572066, N 7589625 UTM coordinates) (see Figure 3-3). The site is about 3.2 km south-southeast of the summer sound monitoring survey site near the proposed Inuvik area facility, as defined at the time of the sound survey.

Table 3-4 summarizes the measurement results. Sound levels at the survey site were often below 20 dBA. During periods when winds were light, the sound of the wind dominated and raised sound levels to between 20 and 27 dBA. There is currently no industrial presence within audible distance of the monitoring site. The only audible sounds were from wind and occasional air traffic at the Inuvik Airport. The daily sound level after validation was determined to be 20 dBA.

Table 3-4: Winter Sound Levels at the Inuvik Area Facility

Survey Period	Sound Level (dBA)				
	Daytime L_{eq} Day	Nighttime L_{eq} Night	Daily L_{eq} (24)	Minimum Hourly L_{eq} (1)	Maximum Hourly L_{eq} (1)
Dec. 3–4, 2002	21	19	20	17	24
NOTE: Sound levels are validated values					

Figure 3.3 has been removed for the purposes of reducing file size and can be viewed as a graphic separately. This document can be accessed through the link in the Table of Contents reference web page.

3.3.2.2 Summer Sound Levels

Ambient sound was measured near the proposed Inuvik area facility from 13:00 on July 5, 2003 until 13:00 on July 6, 2003. Sound monitoring equipment was located at 68° 26′ 4″ N and 133° 17′ 1″ W (E 570383, N 7592305 UTM coordinates) (see Figure 3-3, shown previously). The site is about 3.2 km north-northwest of the winter sound monitoring survey site near the proposed Inuvik area facility.

Table 3-5 summarizes the results. Sound levels at the survey site were low. When the winds were light, the sound level was primarily between 20 and 30 dBA. Short periods of wind and rain caused the sound level to rise to between 30 and 40 dBA. Occasionally the sound of distant air traffic at the Inuvik Airport caused sound levels of around 50 dBA. The daily sound level after validation was determined to be 31 dBA L_{eq}.

Table 3-5: Summer Sound Levels at the Inuvik Area Facility

Survey Period	Sound Level (dBA)				
	Daytime L_{eq} Day	**Nighttime L_{eq} Night**	**Daily L_{eq} (24)**	**Minimum Hourly L_{eq} (1)**	**Maximum Hourly L_{eq} (1)**
July 5-6, 2003	33	25	31	21	39
NOTE: Sound levels are validated values					

3.3.3 Norman Wells

3.3.3.1 Summer Sound Levels

Ambient sound was measured near the proposed Norman Wells compressor station from 16:00 on July 10, 2003 until 16:00 on July 11, 2003. Sound monitoring equipment was located 65° 17′ 37″ N and 126° 54′ 50″ W (E 597269, N 7242789 UTM coordinates) (see Figure 3-4). Winter sound levels were not measured at this location, because summer sound levels were consistent with those measured at Inuvik.

Figure 3.4 has been removed for the purposes of reducing file size and can be viewed as a graphic separately. This document can be accessed through the link in the Table of Contents reference web page.

The summer baseline sound survey site was 1 km from the proposed compressor station site and about 1.5 km west of an existing Imperial Oil facility north of Norman Wells. The monitoring location was about 5 km from the Norman Wells airport. The sound of helicopters and fixed-wing aircraft taking off and landing was occasionally heard during the survey. Major audible sounds were from:

- the Imperial Oil facility
- wind
- birds
- rain
- fixed-wing aircraft
- helicopters
- thunder
- insects

A low-frequency rumble was audible most of the night from 22:00 to 05:00, which probably originated at the Imperial Oil facility. Aircraft taking off and landing at the airport caused 1-minute L_{eq} sound levels between 50 and 70 dBA for short periods. Eleven occurrences of aircraft noise were recorded during the survey. Thunder caused one spike in the sound record, giving a 1-minute L_{eq} value of 58 dBA. Table 3-6 summarizes the results. The lowest hourly L_{eq} measured after data validation was 28 dBA.

Table 3-6: Summer Sound Levels at the Norman Wells Compressor Station

Survey Period	Sound Level (dBA)				
	Daytime L_{eq} Day	**Nighttime L_{eq} Night**	**Daily L_{eq} (24)**	**Minimum Hourly L_{eq} (1)**	**Maximum Hourly L_{eq} (1)**
July 10–11, 2003	32	32	32	28	38
NOTE: Sound levels are validated values					

References

Alberta Energy and Utilities Board (EUB). 1999a. *Noise Control Directive User Guide – 4th Edition. Guide 38*. Calgary, Alberta.

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