# 3 NOISE

## 3.1 Introduction

### 3.1.1 Focus

The purpose of this assessment is to evaluate potential noise effects by describing the range and extent of noise from facility operations, including consideration of noise mitigation controls.

The following activities are potential noise sources:

- construction at the anchor fields, pipeline facilities, infrastructure sites, borrow sites and along the pipeline right-of-way
- anchor field and pipeline facilities operations
- transportation during construction and operations
- decommissioning activities

Operational controls and proper facility design can reduce the effects of noise from operations. Noise effects from construction of infrastructure sites and transportation are short term, and were not assessed in detail. Noise effects from drilling and well-test flaring, which will take place at the three anchor fields during construction, were assessed.

Potential effects on people in the area were assessed in detail. The assessment of effects of noise on wildlife is in Volume 5, Section 10, Wildlife.

### 3.1.2 Summary of Findings

#### 3.1.2.1 Noise During Operations

Sound levels from anchor field facilities range from 20 to 40 dBA at 1.5 km. Impact magnitude is expected to be low, and extent is local. Based on modelling results, the guideline limit of 40 dBA at 1.5 km will be met at all production area locations.

Drilling and well-test flaring are considered part of production area construction. Sounds from drilling are predicted to range from 30 to 42 dBA at 1.5 km (including noise from operations). Similarly, well-test flaring noise is predicted to range from 38 to 41 dBA at 1.5 km.

Modelled sound levels from the Inuvik area facility, the major facility of the gathering system, meet the 40 dBA at 1.5 km guideline limit. Magnitude of impact is expected to be low, and extent local.

Sound levels from pipeline facilities range from 23 to 38 dBA at 1.5 km from the facilities. Magnitude of impact is expected to be low and extent local.

The sound level from the NOVA Gas Transmission Ltd. (NGTL) interconnect facility (see Volume 2, Project Description) is predicted to be 27 dBA. As a result, magnitude of impact is expected to be low and extent is expected to be local.

### 3.1.3 Traditional Knowledge

Volume 1, Section 3, Traditional Knowledge, outlines the status of the traditional knowledge studies that communities near the project are undertaking. Because these studies are ongoing, the project proponents used existing published traditional knowledge in this EIS. There is no published traditional information on noise in the reference data.

## 3.2 Assessment Approach

Volume 1, Section 2, Assessment Method, provides information on the general assessment approach. The assessment approach for environmental noise levels included the following steps:

1. Identify project-related activities that might affect environmental noise levels, i.e., key issues.
2. Identify valued components (VCs), and key issues for measuring potential changes in VCs resulting from project activities.
3. Identify the potential effects, and illustrate the linkages between project activities and effects in the form of an effect pathway diagram.
4. Identify mitigation measures to reduce or prevent potential effects.
5. Evaluate the applicability of each pathway, after considering mitigation measures.
6. Predict changes in environmental noise levels for the applicable pathways.
7. Evaluate and classify the predicted effects based on weight of evidence, comparison with regulatory guidelines or site-specific benchmarks.
8. Identify a monitoring program to verify effect predictions and to comply with commitments described in Volume 7, Environmental Management

### 3.2.1 Key Issues

Key issues included in this assessment were identified through community input, including regional technical workshops and community-level meetings, review of other environmental assessments in the region and professional experience. The two key issues in the noise assessment involve characterizing:

- noise emissions from the project and determining what the effects of these emissions are on sound levels
- the effects of increased sound levels on people and wildlife

Potential impacts on people in the area are assessed in detail in this section of the EIS. Effects of noise on wildlife are assessed in Volume 5, Section 10, Wildlife.

### 3.2.2 Valued Components and Key Indicators

Noise is unwanted sound. It is the absence of noise that people value. The terms *noise* and *sound* are often incorrectly used interchangeably. All noises are a form

of sound, but not all sound is unwanted. Therefore, although the term noise is retained to identify the assessed discipline, the term sound will be used most often in reference to what is being assessed.

Table 3-1 shows the selection criteria for noise as a valued component. All selection criteria apply.

**Table 3-1: Selection Criteria for Valued Components**

| Valued Component | Regulatory Status | Stakeholder Concerns | Ecological Vulnerability | Importance to Local Communities | Precedence in Other Assessments |
|---|---|---|---|---|---|
| Environmental sound levels | ● | ● | ● | ● | ● |

NOTE:
● = indicates that selection criteria apply

Environmental sound levels vary continuously over time. To account for both daily and short-term variation in sound levels, several single-number 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 represented as a single number that accurately describes the environment and allows for further impact assessment.

The single-number descriptor 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 defined as the steady, continuous sound level over a given period that would have the same acoustic energy as the actual varying sound levels occurring over the same period in the measured environment. It is the standard predictor of human response to noise.

A-weighted sound levels are the frequencies of the measured sound heard by humans. The $L_{eq}$ value is a numerical measure of the sound loudness as heard by humans over the audible frequency range.

Key indicators for this assessment of noise are:

- $L_{eq}$ (24): a 24-hour, A-weighted energy-equivalent sound level
- $L_{eq}$ day, i.e., $L_{eq}$ (15): a 15-hour, A-weighted energy-equivalent sound level during the day, i.e., 07:00-22:00
- $L_{eq}$ night, i.e., $L_{eq}$ (9): a 9-hour, A-weighted energy-equivalent sound level during the night, i.e., 22:00-07:00
- $L_{eq}$ (1): a 1-hour, A-weighted energy equivalent sound level

Typical sound levels are shown graphically in Figure 3-1.

| Sound Level | dBA | Common Noise Sources |
|---|---|---|
| Deafening | **120** | Threshold of pain |
| | 115 | Maximum noise level at a hard-rock concert |
| | **110** | Accelerating motorcycle at 1 m |
| | 105 | Loud auto horn at 3 m |
| Very Loud | **100** | Dance club; Maximum human vocal output at 1 m |
| | 95 | Jackhammer at 15 m |
| | **90** | Inside a noisy factory |
| | 85 | Heavy truck pass-by at 15 m |
| Loud | **80** | School cafeteria; Noisy bar |
| | 75 | Near edge of major highway; Inside automobile travelling at 60 km/h |
| | **70** | Vacuum cleaner at 1.5 m |
| | 65 | Normal human speech, i.e., an unraised voice, at 1 m |
| Moderate | **60** | Typical background noise levels in a large department store; Hair dryer |
| | 55 | Running tap water |
| | **50** | Clothes dryer; Air conditioner |
| | 45 | Typical background noise level in an office caused by HVAC; Flowing stream |
| Faint | **40** | Typical background noise level in a library; EUB guideline for noise at 1.5 km |
| | 35 | Average whisper; Typical quiet outdoors |
| | **30** | Broadcast studio |
| | 25 | |
| Very Faint | **20** | Deep woods on a calm day |
| | 15 | |
| | **10** | |
| | 5 | Human breathing |
| | **0** | Threshold of hearing, i.e., quietest sound that can be heard |

NOTES:

EUB = Alberta Energy and Utilities Board
HVAC = Heating, ventilation and air conditioning

SOURCE: EUB 1999b

**Figure 3-1: Sound Levels Produced by Common Noise Sources**

### 3.2.3 Key Questions and Effect Pathway Diagrams

The key question for assessing the impacts of noise caused by the project is:

- How will the project affect environmental noise?

This question is assessed by:

- identifying potential links between project activities and environmental noise that people and wildlife are exposed to
- evaluating the validity of each pathway linking activities to potential effects on environmental sound levels
- monitoring limited ambient noise at representative sites to identify and confirm existing ambient sound levels
- characterizing the noise emissions from the project
- predicting, with computer noise modelling, sounds that might be created by the project facilities and infrastructure
- comparing sound levels predicted for the project with existing ambient sound levels and regulatory sound limits

Several project components have the potential to contribute to environmental sound levels and were included in the assessment. For example, construction and operation of the facilities will contribute to changes in environmental noise. Transportation will also contribute, but these effects would be local and transient.

An effect pathway diagram was developed to show various paths by which project activities could affect environmental noise. The effect pathway diagram is provided in Section 3.3, Effects on Noise.

### 3.2.4 Effect Descriptions

The environmental effects of a project, including noise effects, can be described by four attributes:

- direction
- magnitude
- extent
- duration

These attributes have been used to provide quantitative and qualitative estimates of the significance of impacts. Table 3-2 shows descriptions and definitions of the various effect attributes.

**Table 3-2: Definitions of Effect Attributes for Noise**

| Attribute | Effect Description | Definition |
|---|---|---|
| Direction | Adverse | The project is predicted to increase sound levels, i.e., facility noise at 1.5 km is greater than existing ambient noise levels |
| | Neutral | The project is predicted to have a negligible effect on sound levels, i.e., facility noise at 1.5 km is less than or equal to existing ambient noise levels |
| Magnitude | Low | Predicted sound levels at 1.5 km are below or equal to applicable acceptability criteria |
| | Moderate | Predicted sound levels at 1.5 km are below or equal to applicable acceptability criteria for normal operations + 5 dBA, i.e., will meet 45 dBA at 1.5 km when no guidelines exist. This rating applies only to intermittent sources |
| | High | Predicted sound levels at 1.5 km exceed applicable acceptability criteria |
| Geographic extent | Local | Effects are restricted to within 1.5 km of an activity or facility, i.e., the applicable acceptability criterion is met at 1.5 km |
| | Regional | Effects extend beyond 1.5 km |
| Duration | Short term | Effects on noise are limited to less than 1 year |
| | Medium term | Effects on noise occur from 1 to 4 years |
| | Long term | Effects on noise last more than 4 years but do not extend beyond 30 years after decommissioning |
| | Far future | Effects on noise last more than 10 years but do not extend beyond 30 years |

### 3.2.4.1 Direction

Direction describes the trend of the effect. For noise, an adverse effect is one that perceptibly increases average sound levels. The direction is neutral if the project has no perceptible effect on average sound levels.

### 3.2.4.2 Magnitude

Magnitude describes the severity or intensity of an effect. It is measured as a sound level or as a change in sound level. Following is a summary of applicable regulatory criteria for operations.

## Sound Level Limits for Operations Activities

### *Northwest Territories Air Quality Code of Practice*

The Government of the Northwest Territories (GNWT) has a consultation draft of an air quality Code of Practice (RWED 2002). The goals of the Code of Practice, as it pertains to noise emissions, are that:

- sound level increases be kept to an acceptable minimum
- quality of life for neighbours of energy facilities not be impaired
- wildlife not be adversely affected
- indoor sound levels not change perceptibly

The Code of Practice indicates that the GNWT regulatory authority endorses the Alberta Energy and Utilities Board (EUB) Directive ID 99-08 (EUB 1999a), with EUB Guide 38 as an Appendix (EUB 1999b). In the absence of a noise bylaw, the Code of Practice endorses the use of the EUB directive.

### *Alberta Energy and Utilities Board Noise Control Directive*

EUB Noise Control Directive ID 99-08 (EUB 1999a) and Guide 38 (EUB 1999b) provide specific direction for assessing environmental noise from energy sector facilities in Alberta.

A noise-sensitive receptor is defined as a permanent or seasonal dwelling that is occupied for at least six weeks a year. The proposed project facilities are more than 1.5 km away from any noise-sensitive receptors and are classified as remote.

According to EUB Noise Directive ID 99-08 and EUB Guide 38, excessive sound generation is not allowed for remote facilities, and new facilities planned for remote areas should be designed to meet a target sound level of 40 dBA $L_{eq}$ at 1.5 km. However, this target sound level is not a mandatory requirement of the guideline.

EUB Guide 38 applies to noise from operations only and excludes temporary activities, such as well-test flaring, drilling and construction noise, from impact assessments.

### *Guidelines for Normal Operations*

The project's production area and pipeline corridor facilities will be designed to meet a noise guideline limit of 40 dBA at 1.5 km, as suggested by EUB guidelines for remote areas. These guidelines specifically deal with energy-related noise sources. They have been used in Alberta to ensure that energy facilities are compatible with surrounding land uses. Land use in the Northwest Territories is different from that in most of Alberta, but similar to that in northern areas of the

province where the EUB guidelines are effective. The potential for noise impacts on transient noise-sensitive receptors, such as trappers' cabins or hunt camps, which might be occupied noncontinuously, is considered in the guidelines.

Predicted sound levels from normal (continuous) operations, which are equal to or less than the 40 dBA at 1.5 km guideline limit, are considered to have a low-magnitude noise impact. Noise levels from normal operations that exceed the 40 dBA at 1.5 km limit are considered to have a high-magnitude impact.

The 40 dBA limit would apply to noise caused by normal operations that provide continuous sources of noise. It would therefore not apply to intermittent activities such as infrastructure, site construction or drilling, and well-test flaring.

A limited noise baseline study (see Volume 3, Section 3, Noise) confirmed that the ambient sound levels near production area and pipeline corridor facilities are quiet with no audible industrial sources of noise.

In summary, the 40 dBA at 1.5 km noise limit in this assessment:

- is consistent with GNWT guidelines and with noise guidelines in other Canadian jurisdictions, i.e., Alberta
- is applicable to remote areas
- provides a noise level that is still audible at some times and locations, but that would be perceived as faint by people

### *Guidelines for Intermittent Sources*

EUB Guide 38 applies only to continuous noise during operations and excludes temporary activities such as drilling and well-test flaring. Although noise from these activities is exempt from the guideline limits, noise from these activities has been predicted as part of this assessment, to show the extent of noise effects.

Predicted sound levels from intermittent sources, i.e., drilling and well-test flaring, which are equal to or less than the 45 dBA at 1.5 km guideline limit, are considered to have a moderate-magnitude noise impact. If they are below or equal to 40 dBA at 1.5 km, they are considered to have low magnitude effect.

The 45 dBA guideline limit was derived from the 40 dBA at 1.5 km limit for continuous noise from operations + 5 dB. In terms of human perception, a 5-dB increase in sound level represents a barely noticeable increase in noise level (EUB 1999b).

### Sound Level Limits for Construction Activities

Construction noise is usually exempt from environmental noise impact assessments. Construction noise can be high magnitude, but it is often short duration. For this reason, construction noise is exempt from most noise impact assessment guidelines.

There are no acceptability criteria for construction activities in the Northwest Territories. Noise from temporary activities such as well-test and emergency flaring, drilling and site construction are exempt from EUB Guide 38 requirements (EUB 1999a).

Although well-test flaring and drilling are exempt from the guideline limits, noise from these activities has been predicted as part of this assessment to show the extent of effects.

#### 3.2.4.3 Geographic Extent

Geographic extent describes the area within which effects are likely to occur. The geographic extent is local if effects are restricted to within 1.5 km of an activity or facility, and regional if effects extend beyond 1.5 km.

#### 3.2.4.4 Duration

Duration refers to how long an effect occurs or how long a key indicator will need to recover from the effects of the project, where recovery is defined as a return to conditions that would have existed if the project had not occurred.

### 3.2.5 Study Areas

Two types of study area were defined to assess the geographic extent of project effects:

- local study area (LSA)
- regional study area (RSA)

#### 3.2.5.1 Local Study Areas

Impact assessments of noise during operations were done for several local study areas (LSAs), i.e., 1.5 km outside the facility fence line as defined by the EUB guidelines.

In the production area, the facilities in the three anchor fields were assessed, as was the Inuvik area facility. Along the pipeline corridor the four compressor stations at Little Chicago, Norman Wells, Blackwater River and Trail River were assessed. The Trail River heater station was also assessed. In northwestern Alberta along the pipeline corridor, the NGTL interconnect facility was assessed.

#### 3.2.5.2 Regional Study Area

The RSA is the area beyond the LSA where noise effects might still be predicted.

### 3.2.6 Analytical Approach

Potential noise impacts from project facilities were evaluated using a three-phased approach:

- determination of baseline conditions
- modelling
- comparison with guidelines

A limited baseline ambient monitoring survey was done to confirm that sound levels are low and that designation as a remote site according to EUB guidelines is appropriate.

Computer noise modelling was done for selected project facilities to predict noise effects caused by facility operations. Predicted sound levels include noise attenuation achieved with noise mitigation measures. Modelling for noise effects from operations includes terrain-screening effects, i.e., effect of hills, valleys and other terrain features on noise propagation. Meteorological conditions, including temperature and relative humidity, and ground conditions, such as the presence of snow, or types of vegetation, can affect the magnitude and extent of noise propagation by affecting atmospheric absorption and ground attenuation. To account for seasonal variation in these modelling parameters, noise impacts for both summer and winter operations were modelled.

Predicted levels were compared with operations noise guideline limits to identify the potential for adverse noise effects and to identify sources requiring additional noise mitigation measures.

#### 3.2.6.1 Field Survey

A limited baseline ambient monitoring survey (see Volume 3, Section 3, Noise) was done to confirm the applicability of the estimated 35-dBA ambient level in the EUB guidelines.

Summer and winter baseline sound levels were measured at representative receptors at Niglintgak for the anchor fields and at Inuvik and Norman Wells for the pipeline facilities. Table 3-3 summarizes the findings.

The measured sound levels are consistent with remote rural environments.

**Table 3-3: Ranges of Measured Baseline Ambient Sound Levels**

| Areas | Daytime Sound Level ($L_{eq}$ Day) (dBA) | Night-time Sound Level ($L_{eq}$ Night) (dBA) | Daily Sound Level ($L_{eq}$ [24]) (dBA) | Minimum Hourly Sound Level ($L_{eq}$ [1]) (dBA) | Maximum Hourly Sound Level ($L_{eq}$ [1]) (dBA) |
|---|---|---|---|---|---|
| Production area | 37–38 | 33–36 | 36–37 | 17–29 | 44 |
| Pipeline corridor | 21–33 | 19–32 | 20–32 | 18–28 | 24–38 |

### 3.2.6.2 Computer Modelling

Detailed computer noise modelling using Cadna/A was done for selected project facilities to predict noise impacts caused by facility operations. Cadna/A predicts environmental sound levels using the internationally recognized ISO 9613 environmental sound propagation algorithms (ISO 1993; ISO 1996). The ISO 9613 algorithms take into account the following factors:

- attenuation with distance
- atmospheric attenuation, i.e., absorption of sound by air
- ground absorption, i.e., absorption of sound as it travels over the terrain
- screening effects of on-site buildings and surrounding terrain
- source directivity because most sources do not radiate sound equally in all directions
- worst-case meteorological conditions, e.g., downwind propagation under a mild temperature inversion

The model uses three-dimensional digital terrain data and building data to describe and model noise impacts. Cadna/A produces predicted sound levels at given point receivers and isopleths of equal sound levels, i.e., noise contours.

Noise modelling was done for both summer and winter conditions because factors that affect sound propagation, e.g., ground cover, temperature and relative humidity, have large seasonal variations.

The type of ground cover in an area is important in estimating the corresponding ground absorption used in the noise model. Ground absorption values range from perfectly reflective to perfectly absorptive. Acoustically reflective ground types include water, ice, hard crusty snow, rock and pavement. Acoustically absorptive ground types include soft snow, grass, trees, shrubs and loose sand and gravel. The ground absorption coefficients used in the model vary by site and were estimated by reviewing site location notes for typical winter and summer terrain.

Temperature and relative humidity affect sound absorption by the atmosphere. Cold, dense air with high relative humidity transmits sound better than warm, dry air.

Noise mitigation measures that have been applied to similar facilities were included in the noise model.

The ISO 9613 propagation algorithms have a published accuracy of plus or minus 3 dBA over source–receiver distances between 100 and 1,000 m. A similar degree of accuracy would be expected at the 1.5 km limit. This is considered excellent agreement for an environmental noise model over such a large distance.

## 3.3 Effects on Noise

### 3.3.1 Effect Pathways

The effect pathway diagram in Figure 3-2 was developed to understand how the project could affect environmental noise. Noise from the project will be continuous or intermittent. Pathways are described in the discussion following.

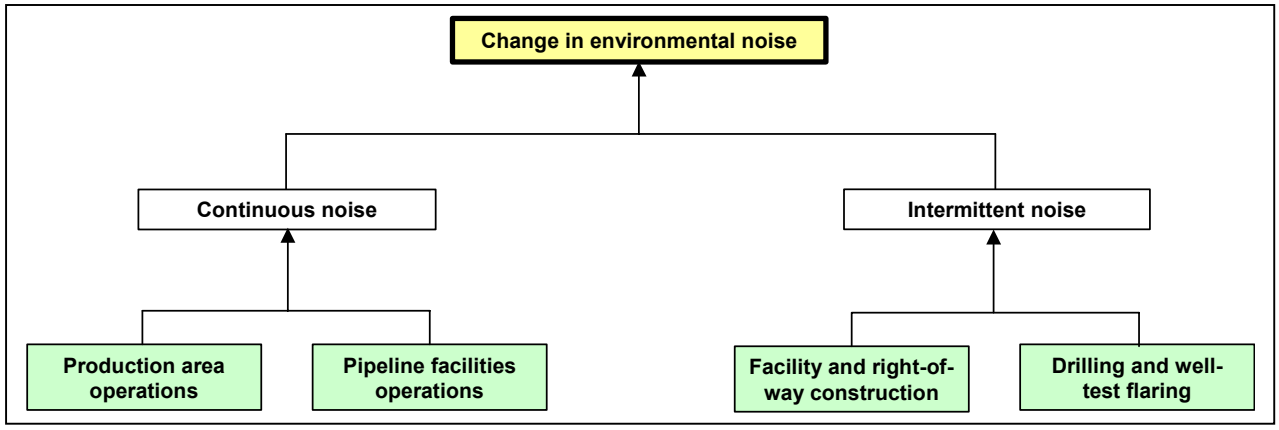


**Figure 3-2: Effect Pathways – Noise**

#### 3.3.1.1 Intermittent Noise

Intermittent noise will be generated by construction activity at the work sites in the production area and along the pipeline corridor. Noise sources will include portable generator sets, and earthmoving and other equipment that might be on site for extended periods, although likely less than three years, and seasonally.

Sound from site construction activities is exempt from noise guidelines, and was not assessed. Drilling and well-test flaring are construction activities that generally occur all year and extend into operations. Although not regulated by the EUB noise guidelines, these activities were included for environmental assessment purposes. The significance of impacts from drilling and well-test flaring is addressed in Section 10, Wildlife.

Intermittent noise could occur from flaring or venting at facility sites during upset conditions or maintenance activities. These activities will be infrequent and therefore are not considered in this assessment. Upset conditions are addressed in Volume 7, Section 5, Contingency Plans.

#### 3.3.1.2 Continuous Noise

Operations at the anchor fields and pipeline facilities could raise sound levels. Noise caused by operations is continuous sound, from constantly operating machinery. Models were used to predict sound levels at various distances up to 1.5 km from the facility fence line based on normal operations.

### 3.3.2 Overview of Project Design and Mitigation

Project design features are detailed in Volume 2, Project Description. Project mitigation measures are discussed in Volume 7, Environmental Management.

When modelling noise from operations, industry standard noise mitigation measures were assumed to be in place in all facilities. Table 3-4 outlines the general noise mitigation measures that will be used to reduce potential sound levels.

**Table 3-4: Mitigation Strategies for Noise**

| Effect Pathway | Primary Mitigation Strategies |
|---|---|
| Increase in continuous noise levels from facility operations | Design facility to meet EUB Guide 38 noise guideline levels for remote sites, i.e., 40 dBA at 1.5 km.<br>Implement engineering noise controls, as necessary, which might include silencers, pipe insulation and upgraded building shells.<br>In sensitive areas, schedule discretionary activities to avoid noise effects. |

### 3.3.3 Niglintgak

As described in Volume 2, Project Description, Niglintgak will have:

- three well pads – north, central and south
- six to 12 production wells
- a gas conditioning facility
- associated above-ground flow lines
- one disposal well, remote drilling sump and supporting infrastructure

Two options are being considered for the Niglintgak gas conditioning facility:

- on a barge in a side channel of Kumak Channel, which is the proposed option
- on land east of Kumak Channel, which is the alternate option

The facility is near sea level and the surrounding area is flat with no appreciable elevation changes.

#### 3.3.3.1 Baseline Conditions

A limited baseline ambient sound level survey (see Volume 3, Section 3, Noise) was done to characterize noise levels near the anchor fields. Measurements at Niglintgak in summer and winter are representative of existing ambient sound levels near the production area sites and are summarized in Table 3-5.

**Table 3-5: Measured Baseline Sound Levels – Niglintgak**

| Survey Period | Daytime Sound Level ($L_{eq}$ Day) (dBA) | Night-time Sound Level ($L_{eq}$ Night) (dBA) | Daily Sound Level ($L_{eq}$ [24]) (dBA) | Minimum Hourly Sound Level ($L_{eq}$ [1]) (dBA) | Maximum Hourly Sound Level ($L_{eq}$ [1]) (dBA) |
|---|---|---|---|---|---|
| Winter | 37 | 33 | 36 | 17 | 44 |
| Summer | 38 | 36 | 37 | 29 | 44 |

Baseline monitoring results verify that the baseline sound levels in the area are quiet, and in terms of human perception would be described as faint to moderate. The existing ambient environment is dominated by the sounds of nature, with negligible or no anthropogenic contribution. This is consistent with sound levels expected at remote sites as defined by EUB Guide 38.

### 3.3.3.2 Niglintgak Effects

Project-related pathways that could affect environmental noise during normal operations at Niglintgak are summarized in Table 3-6.

**Table 3-6: Effect Attributes for Operations – Niglintgak**

| Valued Component | Phase When Impact Occurs | Effects Attributes | | | |
|---|---|---|---|---|---|
| | | Direction | Magnitude | Geographic Extent | Duration |
| Environmental sound level | Construction – Drilling | Adverse | Moderate | Local | Short term |
| | Construction – Well test flaring | Adverse | Low | Local | Short term |
| | Operations | Adverse | Low | Local | Long term |

The effects are residual effects following implementation of mitigation measures. The direction of effects is adverse for both the land-based and barge-based options, and magnitude is low to moderate. The moderate rating would apply only during well-test flaring. At all other times magnitude would be low because noise levels at 1.5 km from the facility would not exceed 40 dBA. Geographic extent would be local because background noise levels would be reached at 1.5 km. Duration was classified as long term except for well-test flaring, because the effects will continue through project operations.

The effects relating to each of the applicable pathways are outlined by project phase in the following discussion.

## Construction

### *Well Drilling*

Drilling is a temporary, usually short-term activity, normally excluded from noise impact assessment under EUB Guide 38 noise guidelines. However, to provide a more complete assessment of potential noise impacts, noise caused by drilling was modelled. Two of the three locations were assumed to be operating, and well drilling was assumed to be occurring at the remaining well pad. All drilling will be done during the winter. Two drill rigs were assumed to be in operation.

Table 3-7 shows the predicted maximum noise levels caused by drilling.

**Table 3-7: Maximum Noise Levels at 1.5 km from Drilling – Niglintgak**

| Season | Predicted Maximum Noise Level (dBA) |
|---|---|
| Summer | N/A |
| Winter | 42 |

NOTES:
N/A = not applicable, no summer operations
Includes contribution of other noise sources from operations
Well drilling noise is continuous. Therefore, average maximum sound exposure values are the same, i.e., $L_{eq}$ (1), $L_{eq}$ day, $L_{eq}$ night and $L_{eq}$ (24).

### *Well-Test Flaring*

Flaring to test gas flows from the well will take place at the wellheads shortly after drilling is completed. Well-test flaring will be intermittent and generally restricted to short periods. This assessment assumes well-test flaring could occur for 24-hours. Conventional non-sonic flares will be used for testing. Well-test flaring gas volumes and other specifications can be found in Section 2, Air Quality.

Well-test flaring is excluded from impact assessments under EUB guidelines because it is a temporary activity. Flaring is considered part of wellhead construction. Potential off-site noise levels caused by flaring were modelled as part of this impact assessment. Table 3-8 shows the predicted maximum noise levels caused by flaring.

## Operations

Typical well locations at Niglintgak include a:

- pump building
- single flare stack

**Table 3-8: Maximum Noise Levels at 1.5 km from Well-Test Flaring – Niglintgak**

| Season | Predicted Maximum Noise Level (dBA) |
|---|---|
| Summer | 40 |
| Winter | 39 |
| NOTES:<br>Includes contribution of other noise sources from operations<br>Flaring noise is continuous. Therefore, average maximum sound exposure values are the same, i.e., $L_{eq}$ (1), $L_{eq}$ day, $L_{eq}$ night and $L_{eq}$ (24). | |

The gas conditioning facility includes:

- gas compressor building with associated equipment
- power generator building
- regenerator gas heater
- two heat medium heaters
- pad inlet gas heaters
- regenerator compressor building with associated equipment
- utility building, housing air compressors and pumps
- aftercooler fans
- propane condenser fans
- inlet separator building

The noise modelling included industry standard noise mitigation measures.

The facility will have a diesel-powered emergency electrical generator, which will only operate during upset conditions and for routine testing for one to four hours every two weeks. Noise from the emergency generators was not modelled.

While two options are being considered for the Niglintgak gas conditioning facility, only the noise modelling results for the land-based option have been presented in this assessment. These results, shown in Table 3-9, are considered representative of both options because comparable equipment would be used at either site and regulatory guidelines for noise will be met.

Summer and winter noise contours for the land-based option, i.e., isopleths of equal noise level, are shown in Figure 3-3 for summer and in Figure 3-4 for winter. Summer and winter noise contours for the barge-based option are shown in Figure 3-5 for summer and in Figure 3-6 for winter.

## Decommissioning

There will be no noise from operations during decommissioning. Therefore, noise will be intermittent and equal to or less than effects from construction.

**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.**

**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.**

**Figure 3.5 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.**

**Figure 3.6 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 3-9: Maximum Noise Levels at 1.5 km in Normal Operations – Niglintgak Land-Based Option**

| Season | Predicted Maximum Noise Level (dBA) | Noise Guideline Limit (dBA) | Excess Over the Guideline Limit (dBA) |
|---|---|---|---|
| Summer | 40 | 40 | N/A |
| Winter | 37 | 40 | N/A |

NOTES:
N/A = not applicable because guideline limit is met
Operations noise is continuous. Therefore, average maximum sound exposure values are the same, i.e., $L_{eq}$ (1), $L_{eq}$ day, $L_{eq}$ night and $L_{eq}$ (24).

### 3.3.4 Taglu

As described in Volume 2, Project Description, Taglu will have:

- a gas conditioning facility
- 10 to 15 production wells on a single well pad
- associated above-ground flow lines
- one or two disposal wells
- supporting infrastructure, including an airstrip

The Taglu site is near sea level and the surrounding area is flat with no appreciable elevation changes.

#### 3.3.4.1 Baseline Conditions

A limited baseline ambient sound level survey was done to characterize noise levels near production area sites. Measurements at Niglintgak in summer and winter (see Section 3.3.3.1, Baseline Conditions) are considered to apply to environmental conditions at Taglu. Sound levels are quiet with no or negligible anthropogenic contribution. Therefore, EUB guidelines for remote sites are appropriate for Taglu.

#### 3.3.4.2 Taglu Effects

Project-related pathways that could affect environmental noise during normal operations at Taglu are summarized in Table 3-10.

The effects are residual effects following implementation of mitigation measures. The direction of effects is adverse. Magnitude is low because sound levels 1.5 km from the facility will be 41 dBA or less, geographic extent is local because noise levels above 41 dBA do not extend beyond 1.5 km from the facilities and duration is long term because the effects will continue for the life of the project.

The effects relating to each of the applicable pathways are outlined by project phase in the following discussion.

**Table 3-10: Effect Attributes for Operations – Taglu**

| Valued Component | Phase When Impact Occurs | Effects Attributes | | | |
|---|---|---|---|---|---|
| | | Direction | Magnitude | Geographic Extent | Duration |
| Environmental sound level | Construction – Drilling | Adverse | Moderate | Local | Short term |
| | Construction – Well test flaring | Adverse | Moderate | Local | Short term |
| | Operations | Adverse | Low | Local | Long term |

## Construction

### *Well Drilling*

Drilling is a temporary, usually short-term activity, normally excluded from noise impact assessment under EUB Guide 38 noise guidelines. However, to provide a more complete assessment of potential noise impacts, noise caused by drilling was modelled. Twelve of the 13 well locations were assumed to be operating (a future condition, which might not occur until 10 years into operations).

Drilling is excluded from impact assessments under EUB guidelines because it is a temporary activity. Drilling is considered part of wellhead construction. Potential off-site noise levels caused by drilling were modelled as part of this impact assessment. Table 3-11 shows the predicted maximum noise levels caused by drilling.

**Table 3-11: Maximum Noise Levels at 1.5 km from Drilling – Taglu**

| Season | Predicted Maximum Noise Level (dBA) |
|---|---|
| Summer | 40 |
| Winter | 41 |
| NOTES:<br>Includes contribution of other noise sources from operations<br>Well drilling noise is continuous. Therefore, average maximum sound exposure values are the same, i.e., $L_{eq}$ (1), $L_{eq}$ day, $L_{eq}$ night and $L_{eq}$ (24). | |

### *Well-Test Flaring*

Well-test flaring is excluded from impact assessments under EUB guidelines because it is a temporary activity. Well-test flaring is considered part of wellhead construction. Potential off-site noise levels caused by flaring were modelled. Table 3-12 shows the predicted maximum noise levels caused by test flaring.

**Table 3-12: Maximum Noise Levels at 1.5 km from Well-Test Flaring – Taglu**

| Season | Predicted Maximum Noise Level (dBA) |
|---|---|
| Summer | 40 |
| Winter | 41 |
| NOTES:<br>Includes contribution of other noise sources from operations<br>Flaring noise is continuous. Therefore, average maximum sound exposure values are the same, i.e., $L_{eq}$ (1), $L_{eq}$ day, $L_{eq}$ night and $L_{eq}$ (24). | |

## Operations

Noise caused by production area operations was modelled. The facility at Taglu includes:

- regenerator compressor building with associated equipment
- inlet compressor building with associated equipment
- regenerator gas heater
- heat medium heater
- utility building with instrument air compressors
- power generator building
- refrigeration condenser fans
- regenerator gas cooler fans
- fuel gas conditioning cooler fans
- gas compressor air cooler fans

The noise modelling included industry standard noise mitigation measures. As with Niglintgak, noise from the emergency generators was not modelled.

Table 3-13 shows the predicted maximum levels of noise from operations. Figure 3-7 shows summer noise contours, i.e., isopleths of equal noise level, and Figure 3-8 shows winter noise contours.

**Table 3-13: Maximum Noise Levels at 1.5 km During Normal Operations – Taglu**

| Season | Predicted Maximum Noise Level (dBA) | Noise Guideline Limit (dBA) | Excess Over the Guideline Limit (dBA) |
|---|---|---|---|
| Summer | 40 | 40 | N/A |
| Winter | 40 | 40 | N/A |
| NOTES:<br>N/A = not applicable because guideline is met<br>Operations noise is continuous. Therefore, average maximum sound exposure values are the same, i.e., $L_{eq}$ (1), $L_{eq}$ day, $L_{eq}$ night and $L_{eq}$ (24). | | | |

**Figure 3.7 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.**

**Figure 3.8 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.**

### Decommissioning

There will be no noise from operations during decommissioning. Therefore, noise will be intermittent and equal to or less than effects from construction.

## 3.3.5 Parsons Lake

As described in Volume 2, Project Description, the Parsons Lake anchor field will have:

- a gas conditioning facility
- north and south well pads
- above-ground flow lines
- two disposal wells
- supporting infrastructure

The site will be developed in two stages. The north pad, comprising a single well pad with nine to 19 production wells, two wastewater disposal wells and gas conditioning facility, will be developed first. The south pad will follow development of the north pad, about five to 10 years later. The south pad will include a single well pad with three to seven wells. An above-ground flow line will transport product from the south pad to the north pad for processing.

The north pad is situated north of Parsons Lake, on very hilly terrain. The south pad is located south of Parsons Lake, and will be constructed during winter on an ice pad.

### 3.3.5.1 Baseline Conditions

A limited baseline ambient sound level survey was done to characterize noise levels near the anchor fields. Measurements at Niglintgak in summer and winter (see Section 3.3.3.1, Baseline Conditions) are considered to apply to environmental conditions at Parsons Lake. Both sites are remote and can be expected to have a similar noise environment. Sound levels are quiet with no or negligible anthropogenic contribution. Therefore, EUB guidelines for remote sites are appropriate for Parsons Lake.

### 3.3.5.2 Parsons Lake Effects

Project-related pathways that could affect environmental noise during normal operations at Parsons Lake are summarized in Table 3-14.

The effects are residual effects following implementation of mitigation measures. The direction of effects is adverse. Magnitude is low because sound levels 1.5 km from the facility will be 40 dBA or less, geographic extent is local because noise levels above 40 dBA do not extend beyond 1.5 km from the facilities, and duration is long term because the effects will continue for the life of the project.

**Table 3-14: Effect Attributes for Operations – Parsons Lake**

| Valued Component | Phase When Impact Occurs | Effects Attributes | | | |
|---|---|---|---|---|---|
| | | Direction | Magnitude | Geographic Extent | Duration |
| Environmental sound level | Construction – Drilling | Adverse | Moderate | Local | Short term |
| | Construction – Well test flaring | Adverse | Low | Local | Short term |
| | Operations | Adverse | Low | Local | Long term |

The effects relating to each of the applicable pathways are outlined by project phase in the following discussion.

## Construction

### *Well Drilling*

Drilling is a temporary, usually short-term activity, normally excluded from noise impact assessment under EUB Guide 38 noise guidelines. However, to provide a more complete assessment of potential noise impacts, noise caused by drilling was modelled. At the north pad, 10 of the 19 total well locations were assumed to be operating. The south pad will have four of the five total well locations operating.

Drilling is excluded from impact assessments under EUB guidelines because it is a temporary activity. Drilling is considered part of wellhead construction. Potential off-site noise levels caused by drilling were modelled as part of this impact assessment. Table 3-15 shows the predicted maximum noise levels caused by drilling.

**Table 3-15: Maximum Noise Levels at 1.5 km from Drilling – Parsons Lake**

| Season | Predicted Maximum Noise Level | |
|---|---|---|
| | North (dBA) | South (dBA) |
| Summer | 40 | 29 |
| Winter | 41 | 37 |

NOTES:
Includes contribution of other noise sources from operations
Well drilling noise is continuous. Therefore, average maximum sound exposure values are the same, i.e., $L_{eq}$ (1), $L_{eq}$ day, $L_{eq}$ night and $L_{eq}$ (24).

### *Well-Test Flaring*

Well-test flaring is excluded from impact assessments under EUB guidelines because it is a temporary activity. Flaring is considered part of wellhead construction. Potential off-site noise levels caused by flaring were modelled as part of this impact assessment. Table 3-16 shows the predicted maximum noise levels caused by test flaring.

**Table 3-16: Maximum Noise Levels at 1.5 km from Well-Test Flaring – Parsons Lake North and South Pads**

| Season | Predicted Maximum Noise Level | |
|---|---|---|
| | **North** (dBA) | **South** (dBA) |
| Summer | 40 | 23 |
| Winter | 38 | 29 |
| NOTES:<br>Includes contribution of other noise sources from operations<br>Well drilling noise is continuous. Therefore, average maximum sound exposure values are the same, i.e., $L_{eq}$ (1), $L_{eq}$ day, $L_{eq}$ night and $L_{eq}$ (24). | | |

## Operations

Noise from production area facilities during operations was modelled.

### *North Pad*

North pad facilities include:

- gas compressor building with associated equipment
- power generator building
- regenerator gas heater
- heat medium heater
- propane refrigeration building with associated equipment
- air cooler fans
- condenser fans
- inlet air cooler fans
- gas compressor after-coolers
- utility building containing pumps

### *South Pad*

South pad facilities include:

- a line heater
- utility and flare knock out drum buildings with associated equipment

The noise modelling included industry standard noise mitigation measures. As with Niglintgak, noise from the emergency generators was not modelled.

Table 3-17 shows predicted maximum levels of noise from operations. Figure 3-9 and Figure 3-10 show summer noise contours, i.e., isopleths of equal noise level, and Figure 3-11 and Figure 3-12 show winter noise contours.

**Table 3-17: Maximum Noise Levels at 1.5 km in Normal Operations – Parsons Lake**

| Season | Predicted Maximum Noise Level | | Noise Guideline Limit (dBA) | Excess Over the Guideline Limit | |
|---|---|---|---|---|---|
| | North (dBA) | South (dBA) | | North (dBA) | South (dBA) |
| Summer | 40 | 20 | 40 | N/A | N/A |
| Winter | 38 | 25 | 40 | N/A | N/A |

NOTES:
N/A = not applicable because guideline is met
Operations noise is continuous. Therefore, average maximum sound exposure values are the same, i.e., $L_{eq}$ (1), $L_{eq}$ day, $L_{eq}$ night and $L_{eq}$ (24).

### Decommissioning

There will be no noise from operations during decommissioning. Therefore, noise will be intermittent and equal to or less than effects from construction.

## 3.3.6 Gathering Pipelines and Associated Facilities

For this assessment, the gathering pipelines connect the three anchor fields to the Inuvik area facility (see Volume 2, Project Description). The gathering pipelines and associated facilities include:

- the Niglintgak lateral
- the Taglu lateral
- the Parsons Lake lateral
- the Storm Hills lateral
- the Inuvik area facility
- the Storm Hills pigging facility
- two intermediate block valves

The Inuvik area facility will be located about 20 km east of Inuvik. The terrain surrounding the facility is mainly flat with an elevation change of about 15 m. The purpose of the facility is to process and separate natural gas and NGLs from the gathering pipelines, to meet the specifications of the gas and NGL pipelines.

**Figure 3.9 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.**

**Figure 3.10 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.**

**Figure 3.11 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.**

**Figure 3.12 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.**

### 3.3.6.1 Baseline Conditions

A limited baseline ambient sound level survey was done to characterize noise levels near gathering system and pipeline corridor sites (see Volume 3, Section 3, Noise). Table 3-18 shows the results of summer and winter measurements near the proposed site of the Inuvik area facility.

**Table 3-18: Measured Baseline Sound Levels – Inuvik Area Facility**

| Survey Period | Daytime Sound Level ($L_{eq}$ Day) (dBA) | Night-time Sound Level ($L_{eq}$ Night) (dBA) | Daily Sound Level ($L_{eq}$ [24]) (dBA) | Minimum Hourly Sound Level ($L_{eq}$ [1]) (dBA) | Maximum Hourly Sound Level ($L_{eq}$ [1]) (dBA) |
|---|---|---|---|---|---|
| Winter | 21 | 19 | 20 | 17 | 24 |
| Summer | 33 | 25 | 31 | 21 | 39 |

Baseline monitoring results verify that the baseline sound levels in the area are quiet, and in terms of human perception would be described as faint to moderate. The existing ambient environment is dominated by the sounds of nature, with negligible or no anthropogenic contribution. This is consistent with sound levels expected in remote sites as defined by EUB Guide 38.

### 3.3.6.2 Inuvik Area Facility Effects

Project-related pathways that could affect environmental noise during normal operations at the Inuvik area facility are summarized in Table 3-19.

**Table 3-19: Effect Attributes for Operations – Inuvik Area Facility**

| Valued Components | Phase When Impact Occurs | Effect Attributes | | | |
|---|---|---|---|---|---|
| | | Direction | Magnitude | Geographic Extent | Duration |
| Environmental sound level | Operations | Adverse | Low | Local | Long term |

The effects are residual effects following implementation of mitigation measures. The direction of effects is adverse. Magnitude is low because sound levels 1.5 km from the facility will be 40 dBA or less, geographic extent is local because noise levels above 40 dBA do not extend beyond 1.5 km from the facility, and duration is long term because the effects will continue for the life of the project.

The effects relating to each of the applicable pathways are outlined by project phase in the following discussion.

## Operations

The Inuvik area facility includes:

- residue gas compressor buildings with associated equipment
- aerial cooler fans
- stabilizer overhead compressor building with associated equipment
- refrigerant compressor building with associated equipment
- pump building with associated equipment
- utility building with associated equipment
- power generator building
- refrigeration condenser fans
- stabilizer reboiler units

The noise modelling included industry standard noise mitigation measures. As with other facilities, i.e., production area sites, noise from the emergency generators was not modelled.

Table 3-20 shows the predicted maximum levels of noise from operations. Figure 3-13 shows summer noise contours, i.e., isopleths of equal noise level, and Figure 3-14 shows winter noise contours.

**Table 3-20: Maximum Noise Levels at 1.5 km, Normal Operations – Inuvik Area Facility**

| Season | Predicted Maximum Noise Level (dBA) | Noise Guideline Limit (dBA) | Excess Over the Guideline Limit (dBA) |
|---|---|---|---|
| Summer | 40 | 40 | N/A |
| Winter | 40 | 40 | N/A |
| NOTES:<br>N/A = not applicable because guideline is met<br>Operations noise is continuous. Therefore, average maximum sound exposure values are the same, i.e., $L_{eq}$ (1), $L_{eq}$ day, $L_{eq}$ night and $L_{eq}$ (24). | | | |

## Decommissioning

There will be no noise from operations during decommissioning. Therefore, noise will be intermittent and equal to or less than effects from construction.

**Figure 3.13 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.**

**Figure 3.14 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.**

### 3.3.7 Pipeline Corridor

For this assessment, and as described in Volume 2, Project Description, the pipeline corridor includes:

- the gas pipeline
- the NGL pipeline
- pipeline facilities including block valves, compressor stations and a heater station

The 1,220-km natural gas pipeline will transport sweet natural gas from the Inuvik area facility to the NGTL interconnect facility in northwestern Alberta. The gas pipeline and the NGL pipeline will share a common right-of-way, for about 475 km, from the Inuvik area facility to a point near Norman Wells.

The following facilities were assessed:

- Little Chicago compressor station
- Norman Wells compressor station
- Blackwater River compressor station
- Trout River heater station
- Trail River compressor station

The compressor stations will maintain natural gas pressures in the line, through gas compression. The Trout River heater station will help maintain natural gas pressures in the line through gas heating.

#### 3.3.7.1 Little Chicago Compressor Station – Baseline Conditions

A limited baseline ambient sound level survey was done to characterize noise levels near gathering system and pipeline corridor sites. Measurements near the Inuvik area facility site for summer and winter (see Section 3.3.6.1, Baseline Conditions) are considered to apply to environmental conditions near the Little Chicago site. Sound levels are quiet with no or negligible anthropogenic contribution. Therefore, EUB guidelines for remote sites are appropriate for the Little Chicago compressor station.

The station is located in rolling terrain that slopes upward to the west. The total grade change throughout the LSA is about 170 m.

#### 3.3.7.2 Little Chicago Compressor Station – Effects

Project-related pathways that could affect environmental noise during normal operations at the Little Chicago facility are summarized in Table 3-21.

**Table 3-21: Effect Attributes for Operations – Little Chicago Compressor Station**

| Valued Component | Phase When Impact Occurs | Effect Attributes | | | |
|---|---|---|---|---|---|
| | | Direction | Magnitude | Geographic Extent | Duration |
| Environmental sound level | Operations | Adverse | Low | Local | Long term |

The effects are residual effects following implementation of mitigation measures.

The direction of effects is adverse, magnitude low, geographic extent local and duration long term. Magnitude is low because sound levels 1.5 km from the facility will be 40 dBA or less, geographic extent is local because noise levels above 40 dBA do not extend beyond 1.5 km from the facility, and duration is long term because the effects will continue for the life of the project.

The effects relating to each of the applicable pathways are outlined by project phase in the following discussion.

## Operations

The Little Chicago facility includes:

- pipeline compressor buildings with associated equipment
- compressor suction and discharge pipes
- compressor discharge aerial cooler fans
- a utility building with associated equipment
- a power generator building

Based on the information provided by the design team, it was assumed that only one power generator would operate at any one time in the facility. The noise modelling included industry standard noise mitigation measures. As with other facilities, i.e., production area sites, noise from the emergency generators was not modelled.

Table 3-22 shows the predicted maximum levels of noise from operations. Figure 3-15 shows summer noise contours, i.e., isopleths of equal noise level, and Figure 3-16 shows winter noise contours.

## Decommissioning

There will be no noise from operations during decommissioning. Therefore, noise will be intermittent and equal to or less than effects from construction.

**Figure 3.15 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.**

**Figure 3.16 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 3-22: Maximum Noise Levels at 1.5 km, Normal Operations – Little Chicago Compressor Station**

| Season | Predicted Maximum Noise Level (dBA) | Noise Guideline Limit (dBA) | Excess Over the Guideline Limit (dBA) |
|---|---|---|---|
| Summer | 38 | 40 | N/A |
| Winter | 37 | 40 | N/A |

NOTES:
N/A = not applicable because guideline is met
Operations noise is continuous. Therefore, average maximum sound exposure values are the same, i.e., $L_{eq}$ (1), $L_{eq}$ day, $L_{eq}$ night and $L_{eq}$ (24).

### 3.3.7.3 Norman Wells Compressor Station – Baseline Conditions

A limited baseline ambient sound level survey was done to characterize noise levels near gathering system and pipeline corridor area sites. Measurements near the Inuvik area facility site for summer and winter (see Section 3.3.6.1, Baseline Conditions) are considered characteristic of environmental conditions near the Norman Wells site. Both sites are remote and can be expected to have a similar noise environment.

The station is situated near the north shore of the Mackenzie River so terrain in the LSA is mainly flat.

Because the Norman Wells facility is near an existing energy-related facility and other anthropogenic sources of noise, additional summer measurements were taken, to further validate specific local conditions. Locations of the summer baseline sound survey were:

- 1 km west of the proposed compressor station site
- 1.5 km west of the Imperial Oil plant on the north side of Norman Wells
- about 5 km west of the Norman Wells airport

Helicopters and fixed-wing aircraft, taking off or landing, were occasionally heard during the survey. Table 3-23 summarizes the results.

**Table 3-23: Long-term Sound Levels – Norman Wells Site, Summer**

| Survey Period | Daytime Sound Level ($L_{eq}$ Day) (dBA) | Night-time Sound Level ($L_{eq}$ Night) (dBA) | Daily Sound Level ($L_{eq}$ [24]) (dBA) | Minimum Hourly Sound Level ($L_{eq}$ [1]) (dBA) | Maximum Hourly Sound Level ($L_{eq}$ [1]) (dBA) |
|---|---|---|---|---|---|
| Summer | 32 | 32 | 32 | 28 | 38 |

NOTE:
All sound levels are after validation

Baseline monitoring results verify that the baseline sound levels in the area are quiet and in terms of human perception would be described as faint to moderate. The existing ambient environment is dominated by the sounds of nature with negligible or no anthropogenic contribution. This is consistent with sound levels expected at remote sites as defined by EUB Guide 38.

### 3.3.7.4 Norman Wells Compressor Station – Effects

Project-related pathways that could affect environmental noise during normal operations at the Norman Wells facility are summarized in Table 3-24.

**Table 3-24: Effect Attributes for Operations – Norman Wells Compressor Station**

| Valued Component | Phase When Impact Occurs | Effect Attributes | | | |
|---|---|---|---|---|---|
| | | Direction | Magnitude | Geographic Extent | Duration |
| Environmental sound level | Operations | Adverse | Low | Local | Long term |

The effects are residual effects following implementation of mitigation measures. The direction of effects is adverse. Magnitude is low because sound levels 1.5 km from the facility will be 40 dBA or less, geographic extent is local because noise levels above 40 dBA do not extend beyond 1.5 km from the facility, and duration is long term because the effects will continue for the life of the project.

The effects relating to each of the applicable pathways are outlined by project phase in the following discussion.

#### Operations

The Norman Wells facility includes:

- pipeline compressor buildings with associated equipment
- compressor suction and discharge pipes
- compressor discharge aerial cooler fans
- a utility building with associated equipment
- a power generator building

It was assumed that only one power generator would operate at any one time in the facility. The noise modelling included industry standard noise mitigation measures. As with other facilities, i.e., production area sites, noise from the emergency generators was not modelled.

Table 3-25 shows the predicted maximum levels of noise from operations. Figure 3-17 shows summer noise contours, i.e., isopleths of equal noise level, and Figure 3-18 shows winter noise contours.

**Figure 3.17 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.**

**Figure 3.18 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 3-25: Maximum Noise Levels at 1.5 km, Normal Operations – Norman Wells Compressor Station**

| Season | Predicted Maximum Noise Level (dBA) | Noise Guideline Limit (dBA) | Excess Over the Guideline Limit (dBA) |
|---|---|---|---|
| Summer | 38 | 40 | N/A |
| Winter | 38 | 40 | N/A |
| NOTES:<br>N/A = not applicable because guideline is met<br>Operations noise is continuous. Therefore, average maximum sound exposure values are the same, i.e., $L_{eq}$ (1), $L_{eq}$ day, $L_{eq}$ night and $L_{eq}$ (24). | | | |

### Decommissioning

There will be no noise from operations during decommissioning. Therefore, noise will be intermittent and equal to or less than effects from construction.

## 3.3.7.5 Blackwater River Compressor Station – Baseline Conditions

A limited baseline ambient sound level survey was done to characterize noise levels near gathering system and pipeline corridor area sites. Measurements near the Inuvik area facility site for summer and winter (see Section 3.3.6.1, Baseline Conditions) are considered applicable to environmental conditions near the Blackwater River site. Sound levels are quiet with no or negligible anthropogenic contribution. Therefore, EUB guidelines for remote sites are appropriate for the Blackwater River facility.

Although the terrain throughout the LSA is slightly rolling and sloping upward to the west, the station is situated in a relatively flat location.

## 3.3.7.6 Blackwater River Compressor Station – Effects

Project-related pathways that could affect environmental noise during normal operations at the Blackwater River facility are summarized in Table 3-26.

**Table 3-26: Effect Attributes for Operations – Blackwater River Compressor Station**

| Valued Component | Phase When Impact Occurs | Effect Attributes | | | |
|---|---|---|---|---|---|
| | | Direction | Magnitude | Geographic Extent | Duration |
| Environmental sound level | Operations | Adverse | Low | Local | Long term |

The effects are residual effects following implementation of mitigation measures. The direction of effects is adverse. Magnitude is low because sound levels 1.5 km from the facility will be 40 dBA or less, geographic extent is local because noise levels above 40 dBA do not extend beyond 1.5 km from the facility and duration is long term because the effects will continue for the life of the project.

The effects relating to each of the applicable pathways are outlined by project phase in the following discussion.

## Operations

The Blackwater River facility includes:

- pipeline compressor buildings with associated equipment
- compressor suction and discharge pipes
- compressor discharge aerial cooler fans
- utility building with associated equipment
- power generator building

It was assumed that only one power generator would operate at any one time in the facility. The noise modelling included industry standard noise mitigation measures. As with other facilities, i.e., production area sites, noise from the emergency generators was not modelled.

Table 3-27 shows the predicted maximum levels of noise from operations. Figure 3-19 shows summer noise contours, i.e., isopleths of equal noise level, and Figure 3-20 shows winter noise contours.

**Table 3-27: Maximum Noise Levels at 1.5 km, Normal Operations – Blackwater River Compressor Station**

| Season | Predicted Maximum Noise Level (dBA) | Noise Guideline Limit (dBA) | Excess Over the Guideline Limit (dBA) |
|---|---|---|---|
| Summer | 38 | 40 | N/A |
| Winter | 38 | 40 | N/A |

NOTES:
N/A = not applicable because guideline is met
Operations noise is continuous. Therefore, average maximum sound exposure values are the same, i.e., $L_{eq}$ (1), $L_{eq}$ day, $L_{eq}$ night and $L_{eq}$ (24).

## Decommissioning

There will be no noise from operations during decommissioning. Therefore, noise will be intermittent and equal to or less than effects from construction.

**Figure 3.19 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.**

**Figure 3.20 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.**

### 3.3.7.7 Trout River Heater Station – Baseline Conditions

A limited baseline ambient sound level survey was done to characterize noise levels near gathering system and pipeline corridor area sites. Measurements near the Inuvik area facility site for summer and winter (see Section 3.3.6.1, Baseline Conditions) are considered applicable to environmental conditions near the Trout River site. Sound levels are quiet with no or negligible anthropogenic contribution. Therefore, EUB guidelines for remote sites are appropriate for the Trout River facility.

The terrain in the LSA is mainly flat with no appreciable elevation changes.

### 3.3.7.8 Trout River Heater Station – Effects

Project-related pathways that could affect environmental noise during normal operations at the Trout River facility are summarized in Table 3-28.

**Table 3-28: Effect Attributes for Operations – Trout River Heater Station**

| Valued Component | Phase When Impact Occurs | Effect Attributes | | | |
|---|---|---|---|---|---|
| | | Direction | Magnitude | Geographic Extent | Duration |
| Environmental sound level | Operations | Adverse | Low | Local | Long term |

The effects are residual effects following implementation of mitigation measures. The direction of effects is adverse. The magnitude is low because sound levels 1.5 km from the facility will be 40 dBA or less, geographic extent is local because noise levels above 40 dBA do not extend beyond 1.5 km from the facility and duration is long term because the effects will continue for the life of the project.

The effects relating to each of the applicable pathways are outlined by project phase in the following discussion.

#### Operations

The Trout River Heater Station facility includes:

- above-ground piping
- fuel gas equipment
- line heaters
- power generator building

Based on the information provided by the design team, it was assumed that only one power generator would operate at any one time in the facility. The noise modelling included industry standard noise mitigation measures. As with other facilities, i.e., production area sites, noise from the emergency generators was not modelled.

Table 3-29 shows the predicted maximum levels of noise from operations. Figure 3-21 shows summer noise contours, i.e., isopleths of equal noise level, and Figure 3-22 shows winter noise contours.

**Table 3-29: Maximum Noise Levels at 1.5 km, Normal Operations – Trout River Heater Station**

| Season | Predicted Maximum Noise Level (dBA) | Noise Guideline Limit (dBA) | Excess Over the Guideline Limit (dBA) |
|---|---|---|---|
| Summer | 23 | 40 | N/A |
| Winter | 25 | 40 | N/A |
| NOTES:<br>N/A = not applicable because guideline is met<br>Operations noise is continuous. Therefore, average maximum sound exposure values are the same, i.e., $L_{eq}$ (1), $L_{eq}$ day, $L_{eq}$ night and $L_{eq}$ (24). | | | |

### Decommissioning

There will be no noise from operations during decommissioning. Therefore, noise will be intermittent and equal to or less than effects from construction.

## 3.3.7.9 Trail River Compressor Station – Baseline Conditions

A limited baseline ambient sound level survey was done to characterize noise levels near gathering system and pipeline corridor area sites. Measurements near the Inuvik area facility site for summer and winter (see Section 3.3.6.1, Baseline Conditions) are considered applicable to environmental conditions near the Trail River site. Sound levels are quiet with no or negligible anthropogenic contribution. Therefore, EUB guidelines for remote sites are appropriate for the Trail River facility.

The terrain in the LSA is mainly flat with no appreciable elevation changes.

## 3.3.7.10 Trail River Compressor Station – Effects

Project-related pathways that could affect environmental noise during normal operations at the Trail River facility are summarized in Table 3-30.

**Table 3-30: Effect Attributes for Operations – Trail River Compressor Station**

| Valued Component | Phase When Impact Occurs | Effect Attributes | | | |
|---|---|---|---|---|---|
| | | Direction | Magnitude | Geographic Extent | Duration |
| Environmental sound level | Operations | Adverse | Low | Local | Long term |

**Figure 3.21 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.**

**Figure 3.22 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 effects are residual effects following implementation of mitigation measures. The direction of effects is adverse. Magnitude is low because sound levels 1.5 km from the facility will be 40 dBA or less, geographic extent is local because noise levels above 40 dBA do not extend beyond 1.5 km from the facility and duration is long term because the effects will continue for the life of the project.

The effects relating to each of the applicable pathways are outlined by project phase in the following discussion.

## Operations

The Trail River facility includes:

- pipeline compressor buildings with associated equipment
- compressor suction and discharge pipes
- compressor discharge aerial cooler fans
- utility building with associated equipment
- power generator building

Based on the information provided by the design team, it was assumed that only one power generator would operate at any one time in the facility. The noise modelling included industry standard noise mitigation measures. As with other facilities, i.e., production area sites, noise from the emergency generators was not modelled.

Table 3-31 shows the predicted maximum levels of noise from operations. Figure 3-23 shows summer noise contours, i.e., isopleths of equal noise level, and Figure 3-24 shows winter noise contours.

**Table 3-31: Maximum Noise Levels at 1.5 km, Normal Operations – Trail River Compressor Station**

| Season | Predicted Maximum Noise Level (dBA) | Noise Guideline Limit (dBA) | Excess Over the Guideline Limit (dBA) |
|---|---|---|---|
| Summer | 38 | 40 | N/A |
| Winter | 38 | 40 | N/A |

NOTES:
N/A = not applicable because guideline is met
Operations noise is continuous. Therefore, average maximum sound exposure values are the same, i.e., $L_{eq}$ (1), $L_{eq}$ day, $L_{eq}$ night and $L_{eq}$ (24).

## Decommissioning

There will be no noise from operations during decommissioning. Therefore, noise will be intermittent and equal to or less than effects from construction.

**Figure 3.23 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.**

**Figure 3.24 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.**

### 3.3.8 Northwestern Alberta

The proposed pipeline crosses the boundary into northwestern Alberta where it ties into the NGTL Northwest Mainline (Dickins Lake Section) at the interconnect facility. The NGTL pipeline extends from this tie-in point to about 65 km south of the Alberta and Northwest Territories boundary.

#### 3.3.8.1 NGTL Interconnect Facility Baseline Conditions

A limited baseline ambient sound level survey was done to characterize noise levels near gathering system and pipeline corridor area sites. Measurements near the Inuvik area facility site for both summer and winter (see Section 3.3.6.1, Baseline Conditions) are considered applicable to environmental conditions near the NGTL site. Sound levels are quiet with no or negligible anthropogenic contribution. Therefore, EUB guidelines for remote sites are appropriate for the NGTL site.

The terrain in the LSA is mainly flat with no appreciable elevation changes.

#### 3.3.8.2 NGTL Interconnect Facility Effects

The NGTL interconnect facility is a custody transfer meter station just south of the Northwest Territories-Alberta boundary. This station will have pigging facilities and will meter the gas before it enters the existing NGTL pipeline system. The major fuel source for the facility, natural gas from the pipeline, will be used to operate the primary generator. The standby generator will be diesel-fired.

Table 3-32 summarizes the project-related pathway that could affect environmental noise during normal operations at the NGTL interconnect facility.

**Table 3-32: Effect Attributes for Operations – NGTL Interconnect Facility**

| Valued Component | Phase When Impact Occurs | Effect Attributes | | | |
|---|---|---|---|---|---|
| | | Direction | Magnitude | Geographic Extent | Duration |
| Environmental sound level | Operations | Adverse | Low | Local | Long term |

The effects are residual effects following implementation of mitigation measures. The direction of effects is adverse. Magnitude is low because sound levels 1.5 km from the facility will be 40 dBA or less, geographic extent is local because noise levels above 40 dBA do not extend beyond 1.5 km from the facility and duration is long term because the effects will continue for the life of the project.

The effects relating to each of the applicable pathways are outlined by project phase in the following discussion.

### Operations

The NGTL interconnect facility includes:

- a power generator building
- a meter building with associated equipment
- line heaters

The noise modelling included noise mitigation measures for this type of facility. As with other facilities, i.e., production area sites, noise from the emergency generator was not modelled.

Table 3-33 shows the predicted maximum levels of noise from operations. Figure 3-25 shows summer noise contours, i.e., isopleths of equal noise level, and Figure 3-26 shows winter noise contours.

**Table 3-33: Maximum Noise Levels at 1.5 km, Normal Operations – NGTL Interconnect Facility**

| Season | Predicted Maximum Noise Level (dBA) | Noise Guideline Limit (dBA) | Excess Over the Guideline Limit (dBA) |
|---|---|---|---|
| Summer | 27 | 40 | N/A |
| Winter | 27 | 40 | N/A |
| NOTES:<br>N/A = not applicable because guideline is met<br>Operations noise is continuous. Therefore, average maximum sound exposure values are the same, i.e., $L_{eq}$ (1), $L_{eq}$ day, $L_{eq}$ night and $L_{eq}$ (24). | | | |

### Decommissioning

There will be no noise from operations during decommissioning. Therefore, noise will be intermittent and equal to or less than effects from construction.

## 3.3.9 Infrastructure

Noise caused by infrastructure would be from the following project-related sources:

- road traffic, barge landings and traffic, air traffic, airstrips and helipads
- borrow sites
- construction camps, stockpile sites, communication centres and fuel storage sites

**Figure 3.25 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.**

**Figure 3.26 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.**

Infrastructure noise might be continuous, e.g., noise from an active construction camp, or it might be intermittent, involving extended periods of quiet followed by short-term, loud noise levels, e.g., an airplane overflight or landing. However, infrastructure noise will occur only during construction and in many cases seasonally. Infrastructure noise is low magnitude and short duration, and was not assessed in detail.

Construction noise will be centred at the main facilities, which are remote. Pipeline construction will be intermittent and transient, as construction progresses, and therefore will only affect a given area for a short period. Transportation noise impacts from, for example, aircraft overflights, winter road traffic and barge landings will be relatively intermittent (see Volume 2, Section 8, Logistics).

### 3.3.10 Significance of Effects

In the previous section, the characteristics of the residual effects of the project were described in terms of effects direction, magnitude, extent and duration. These characteristics are used to determine the significance of the effects on environmental noise.

Volume 1, Section 2, Assessment Method, discusses the rationale for determining significance. An adverse residual effect is considered significant if the effect is either:

- moderate or high magnitude and extends into the far future, i.e., more than 30 years after project decommissioning
- high magnitude and occurs outside the LSA at any time

This section discusses the significance of effects for the production area and the pipeline corridor.

Table 3-34 shows the results of the effects assessment and indicates if the effect is significant.

Effects in noise are predicted to be low except for moderate magnitude effects from well test flaring and drilling in the production area.

#### 3.3.10.1 Production Area

Noise effects caused by normal operations at the anchor fields will not be significant. The 40 dBA at 1.5 km criterion will be met.

**Table 3-34: Significance of Environmental Noise Effects**

| Component | Phase When Impact Occurs | Direction | Magnitude | Geographic Extent | Duration | Significant |
|---|---|---|---|---|---|---|
| Production area | Construction – Drilling | Adverse | Moderate | Local | Short term | No |
| Production area | Construction – Well test flaring | Adverse | Low-moderate[1] | Local | Short term | No |
| Production area | Operations | Adverse | Low | Local | Long term | No |
| Gathering system | Operations | Adverse | Low | Local | Long term | No |
| Pipeline corridor | Operations | Adverse | Low | Local | Long term | No |
| NGTL interconnect facility | Operations | Adverse | Low | Local | Long term | No |

NOTE:
1 Moderate effects are related to well test flaring at Taglu with a predicted sound level of 41 dB at 1.5 km

Well drilling and well-test flaring, both temporary noise sources, were assessed and considered to be of low to moderate magnitude, local and of short duration. Noise effects caused by these temporary activities are not significant.

### 3.3.10.2 Gathering System – Inuvik Area Facility

Noise effects caused by normal operations at the Inuvik area facility will not be significant. Predicted maximum noise levels meet the 40 dBA at 1.5 km criterion.

### 3.3.10.3 Pipeline Corridor Areas – Compressor Stations and Heater Station

Noise effects caused by normal operations of pipeline corridor compressor facilities and the Trout River heater station facility are not significant. The 40 dBA at 1.5 km criterion is met at all locations.

### 3.3.10.4 Pipeline Corridor Areas – Interconnect Facility

Noise effects caused by normal operations of the NGTL interconnect facility are not significant. The 40 dBA at 1.5 km criterion is met at this location.

### 3.3.10.5 Prediction Confidence

Available information and understanding of noise are used to predict effects of the project on noise levels. As with all predictions of future conditions, the predictions in the impact assessment have a level of uncertainty.

The conservative computer noise prediction models used in the analysis attempt to account for meteorological conditions, including downwind propagation and the effects of a mild temperature inversion, which contribute to worst-case noise propagation. These conditions would not occur often. The models have a

published accuracy of ±3 dBA over the source–receiver distances in question, which is considered excellent accuracy for an environmental noise model over such a large distance.

The models depend on the accuracy of sound level data used in the analysis. Standard sound emission data was used wherever possible. Conservative estimates were applied when specific data was not available.

Because of the conservative approach used to predict sound levels, there is a high degree of confidence in the assessment of effect significance.

## 3.4 Monitoring

Volume 7, Section 6, Environmental Compliance and Effects Monitoring Plan, provides an overview of the intent and purpose of the environmental monitoring program to be implemented for the project.

Two types of programs will be developed:

- compliance monitoring
- effects monitoring

### 3.4.1 Compliance Monitoring

Noise level monitoring requirements during construction and operations vary by jurisdiction. There is currently no construction noise monitoring requirements in the Northwest Territories. Under Alberta EUB guidelines, construction noise monitoring is not required, whereas postconstruction noise from operations monitoring is not required unless noise complaints are received (EUB 1999b).

### 3.4.2 Effects Monitoring

There are currently no plans to monitor environmental effects for noise.

## References

Alberta Energy and Utilities Board (EUB). 1999a. *Noise Control Directive*. Interim Directive ID 99-08. Calgary, Alberta.

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Environmental Protection Service, Department of Resources, Wildlife and Economic Development, Government of Northwest Territories (RWED). 2002. *Air Quality Code of Practice, Upstream Oil and Gas Industry, Consultation Draft*. Yellowknife, Northwest Territories.

International Organization for Standardization (ISO). 1993. International Standard ISO 9613-1, *Acoustics – Attenuation of Sound During Propagation Outdoors – Part 1: Calculation of Absorption of Sound by the Atmosphere*. Geneva, Switzerland.

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