SECTION C: IMPACT ASSESSMENT

CHAPTER C3: NOISE AND VIBRATION

Contents

Figures

Tables

3 NOISE AND VIBRATION

3.1 INTRODUCTION

This Chapter of the ESIA assesses the potential impacts of the Project on ambient noise and the potential to cause vibration impacts. The Chapter summarises potential sources of noise and vibration and identifies receptors including those which may be classified as 'sensitive' to noise impacts. Where adverse impacts are identified, the chapter sets out suitable mitigation measures to eliminate or reduce impacts to an acceptable level.

For identified noise and vibration impacts, a comparison is made with national Mongolian standards and IFC guidelines, which are described *in Chapter B4: Noise and Vibration*. Oyu Tolgoi is committed to undertaking acoustic monitoring to determine high noise hazard areas within the ore processing facility and other fixed and potentially noise infrastructure. Impacts to sensitive fauna are discussed in *Chapter C6: Biological Resources and Ecosystem Services.*

3.2 SCOPE OF THE ASSESSMENT

3.2.1 Spatial Scope

The noise and vibration assessment covers the areas of influence of the Oyu Tolgoi Project Mine Licence Area mining and processing operations, the Gunii Hooloi borefield and water supply pipeline, the Temporary Domestic Airport, the Permanent Airport and the transport infrastructure and power line corridor from site to the Mongolia-china border at Gashuun Sukhait. Other transport routes may be employed by the Project, such as from Ulaanbaatar, however in a relative context noise impacts from their use will be minor and not discussed further.

3.2.2 Technical Scope

The scope of activities considered within the noise and vibration assessment include:

- All project activities within the Mine Licence Area;
- Installation of the borefield and interconnecting pipeline;
- Operation of the existing and future airstrip;
- Ground transport associated with the Oyu Tolgoi to Gashuun Sukhait road; and
- Vibration and overpressure from blasting operations.

3.2.3 Temporal Scope

The temporal scope covers the construction, operational and closure phases of the Project, although with regards noise and vibration no post-mine legacy is anticipated. That is, following mine closure, noise impacts from vehicle, processing plant, and vibration associated the blasting will effectively cease.

3.2.4 Receptors to Project Noise and Vibration

Those receptors considered applicable to Project noise include:

- Worker accommodation located within the Mine Licence Area, which will operate during the construction, operational and decommissioning phases of the Project;
- Established and permanent winter herder camps, although these are further than 10 km from the Mine Licence Area (see *Chapter D14 Stakeholder Engagement Plan*). The herder winter camp resettlement programme completed in 2004 was undertaken to move herders away from the construction activities associated with the Project. Oyu Tolgoi has since developed new winter camp locations and wells for relocated herder families with previously established nomadic camps within 10 km of the Project;
- Temporary summer camps, which although transient, could in theory exist as close as 2km from mining activities (immediately adjacent to the Mine Licence Area boundary fence); and

- Local population in the vicinity of Project activities outside the Mine Licence Area, including the infrastructure corridor to the south, the airports, and the construction of the borefield and its associated infrastructure (borefield operation is not expected to be a significant source of noise).

Khanbogd is the nearest *soum* centre and is located 35 km to the northeast of the Mine Licence Area, and is therefore not expected to be impacted by noise during either Project construction or operations. Should this position change with, for example, future developments that are connected to the Project, all necessary studies and approvals under the Project standards will take place.

3.3 IMPACT ASSESSMENT

3.3.1 Summary of Impacts

Through a review of the Project design basis, construction schedule, scoping and baseline assessment, the noise and vibration key issues considered to be associated with the Project include:

- Noise impacts to herders from the construction and operation of the Oyu Tolgoi to Gashuun Sukhait road;
- Noise impacts from the construction and use of the Temporary Domestic Airport and Permanent Airport on herders; and
- Noise impacts on workers within the Mine Licence Area.

Construction-Phase Activities and Impacts

The vast majority of noise-generating activities during construction will take place within the Mine Licence Area. The major sources of construction noise in the Mine Licence Area are:

- Cut and fill operations associated with land levelling;
- Materials haulage, including vehicles supplying the worksite with construction materials, equipment, fuel and pipe sections;
- Haulage associated with soil stripping and storage;
- Operation of construction vehicles (light and heavy);
- Use of stationary construction equipment (such as crushers, compressors, conveyors, excavators, concrete mixers);
- Generators for electrical power;
- Drilling and blasting activities; and
- Operation of water and fuel tankers.

Certain construction equipment will operate outside of the Mine Licence Area. This will include mobile sources of noise associated with construction within the infrastructure corridor to the Mongolia/China border, and the drilling of boreholes and installation of pipeline / electrical cable associated with the development of the Gunii Hooloi borefield. The source of noise in these areas will be focused on the active construction areas and the supporting camps set up in the area.

The Temporary Domestic Airport and the future Permanent Airport will, in general, only be a transient source of noise during each landing or takeoff.

Operations-Phase Activities and Impacts

During the operational phase the activities which are most likely to cause noise and vibration impacts to the receptors relate to the open pit mining and are likely to include:

- Drilling and blasting activities associated with the mining of the open pit;
- Materials haulage associated primarily with ore from pit, waste rock;
- General operation of vehicles (light and heavy) across mining licence; and
- Use of plant (crushers, compressors, conveyors).

Although the diesel generators associated with the power plant represent an additional source of noise, electrical power for operations would be provided by a permanent grid connection and the diesel power plant would be operated as an emergency back-up for critical systems only.

Outside the Mine Licence Area the key source of noise relates to traffic movements, including:

- Haulage of concentrate to Gashuun Sukhait;
- Import of materials from Gashuun Sukhait and other destinations in Mongolia with trucks and tankers;
- Maintenance of Gunii Hooloi borefield (mostly light vehicles);
- Bus transport of workers, mainly from Khanbogd and the Permanent Airport; and
- Aircraft using the Permanent Airport.

3.3.2 Infrastructure Construction Noise

Description of the Impact

The noisiest activities within the Mine Licence Area will be associated with the early construction works where there will be the excavation of foundations and erection of structures / equipment. Noise emissions are likely to be less significant as the construction programme progresses to a commissioning stage of the ore processing facility. Noise will be constant for the construction of the Gunii Hooloi and Oyu Tolgoi to Gashuun Sukhait infrastructure corridor where the construction phase noise will be focused on the immediate work area and will be transient in nature (days to weeks) at any one location.

A sample of the inventory of plant expected to be operating on site during peak construction is presented in *Table 3.1* along with the specified equipment sound pressure level at a reference distance of 10m.

Table 3.1: Noise from Peak Construction Equipment Operating Simultaneously

Plant Type	Leq 10 m dB(A)	No. of plant	Plant Type	Leq 10 m dB(A)	No. of plant
Dozer (D8)	92	5	Tanker truck 15t	81	5
Loader 966	84	2	100KVA gensets	82	20
Grader 140	84	10	Dump truck	82	15
Tandem Roller 14t	93	2	Grader	84	10
Crane 20t	88	20	Plate compactor	80	5
Excavator 214	68	10	Concrete mixer	76	5
Excavator 320	80	10	Concrete pump	81	5
Backhoe loader JCB 3X	76	5	Water pump	84	2
Auger 30 cm diam.	90	2	Mobile crane	81	10
Truck $10m^3$	82	20	Compressor	85	5

Source: Oyu Tolgoi Environment Department

Note: Leq 10m reflects reference sound pressure levels at a distance of 10 m. The above schedule does not include equipment used for overburden removal, which may take place during the construction phase.

In order to establish the potential for nuisance to the nearest sensitive receptors, which in this case are construction workers and herders, a screening assessment of construction activities has been undertaken based upon guidance presented within the British Standard BS 5228: 1997 "*Noise and Vibration Control on Construction and Open Sites*".

BS 5228 provides recommendations for basic methods of noise and vibration control relating to construction and open sites where work activities/operations generate significant noise and/or vibration levels. This standard provides guidance concerning methods of predicting and measuring noise and assessing its impact on those exposed to it.

Applying the BS 5228 screening assessment to estimate noise impacts from the closest point from the ore processing plant construction to the nearest winter herder location (assumed to be at a distance of

10 km) demonstrates noise levels of 28 dB, substantially less than the recorded baseline for the Project area.

Given the minimum 2 km separation between facility construction and the worker accommodation, construction noise at the camp is modelled to be 44.8dB. This is substantially less than the daytime guideline value of 60 dB(A) (MNS 4585:2007[1]) or 55 dB(A) (IFC[2]). The majority of heavy construction works would largely take place during day time periods, and therefore good sleeping conditions are expected to exist during night-time periods for construction workers. In the case that construction activities do progress at night time, the 45 dB(A) predicted for construction works would still afford reasonable sleeping conditions for workers (Mongolian and IFC night time noise guideline is 45 dB(A), and a typical temporary accommodation structure would attenuate up to 15 dB(A). The attenuation of noise by the worker accommodation structure, and the separation of the worker camp from construction activities is expected to afford reasonable sleeping conditions for night-shift workers, and this (and night time noise levels) will be measured through on-going noise monitoring. Workers will be encouraged to discuss disturbance to sleep from nuisance noise through the grievance mechanism.

Construction noise will be imperceptible in the nearest town (Khanbogd *soum* centre).

Mitigations and Management

Although there are no permanent receptors near to the Mine Licence Area, the Oyu Tolgoi Project will implement good practice measures to ensure that noise levels from construction activities are minimised. These measures will include best practice approaches including:

- Limiting the hours of operation for specific pieces of equipment or operations, especially mobile sources operating through community areas;
- Re-locating noise sources to less sensitive areas to take advantage of distance and shielding, although this is not anticipated to be necessary;
- Developing a mechanism to record and respond to complaints;
- Restriction on blasting activities to day-time only (should this take place during the construction phase);
- Control of vehicle speed limits, which will primarily be enforced for safety reasons but these would result in an improvement in noise emissions from road sources; and
- Regular inspection and maintenance of equipment and vehicles.

3.3.3 Aircraft Noise at the Temporary Domestic Airport

Description of the Impact

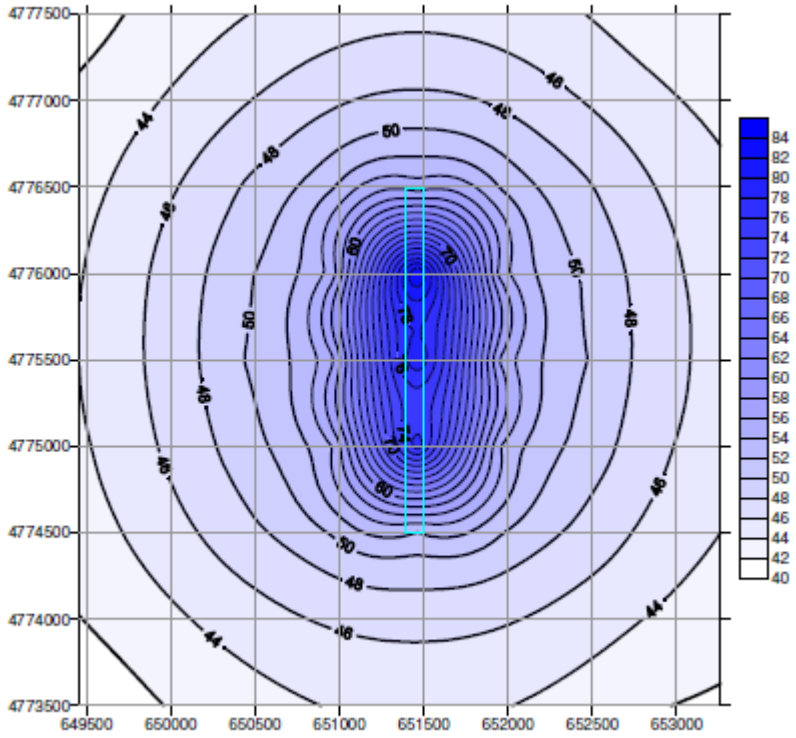
The Temporary Domestic Airport is located approximately 7 km north of the Oyu Tolgoi Mine Licence Area and is used for the transport of people and light / valuable goods to the site from Ulaanbaatar. The airport consists of basic infrastructure, such as runway (single gravel-surface strip), terminal building, control tower and other associated facilities. The frequency of flights during the construction phase averages between five and seven per week and may peak at up to three flights per day.

The operation of the airport has increased noise levels in this essentially rural area. The increased levels of noise have been generated predominately from aircraft landings and take-off.

As an aircraft lands or takes off, it creates a noise 'footprint' along the flight path rather than single point (see *Figure 3.1*). This results in cylindrical spreading rather than the spherical spreading of noise. This has the consequence of reducing the attenuation of the sound over distance compared to a point source, and a decrease in sound levels of 3 dB(A) per doubling of the distance (compared to 6 dB(A) for a point source).

Measurements collected within the vicinity of the Temporary Domestic Airport indicate noise levels of between 75 – 90 dB(A). Using noise levels collected by direct measurement, additional data points have been predicted (essentially an interpolation between measurement points) across a 4,000m x 3,500m area which has demonstrated that airport boundary noise is not expected to exceed 45 dB(A) (*Figure 3.1*).

Figure 3.1: Model of Spatial Distribution of the Noise Levels from the Temporary Domestic Airport



The Mongolian noise standard[1] stipulates that the maximum environmental noise exposure for nearby residents is 60 dB(A), and a rural guideline of 45 dB(A) is set out by IFC[2]. Average noise levels at the boundary are not expected to exceed 45 dB(A) on a time weighted basis. Take off and landing events, depending upon weather conditions, aircraft type / weight, and pilot operations, may cause the 45 dB(A) to be exceeded for short periods. This applies when noise sources will be relocated to less sensitive areas.

Whilst it is recognised that aircraft activities inevitably generate noise during take-off or landings, there are no winter herder camps located near to the airport area. Given the number of flights per week is very small (peaking up to 3 flights per day during construction), impacts from aircraft activity in terms of noise nuisance are considered to be minor.

The airport connecting road represents an additional source of noise in the form of road traffic. Screening conducted for the interconnecting 3 km access road from the Oyu Tolgoi-Khanbogd road and the terminal building indicates a noise exposure of 44 dB(A), suggesting that the road will not represent a source of significant nuisance to permanent receptors located near to the road during either day time or night time periods.

3.3.4 Blasting

Description of Blasting Impacts

Blasting during construction and operation will cause ground vibration, which will radiate away from the blast source. Typically, such vibration may be perceived by individuals and affect properties in close proximity to the blast area, depending on ground conditions and where the individual(s) are situated at the time of the blast. The vast majority of blasting will take place within the Mine Licence Area and will be used for the purposes of mining. Minor blasting may be required for some areas of road and other

[1] MNS 4585:2007 Air quality, Technical General Requirements.

[2] International Finance Corporation, 2007. Environmental, Health and Safety Guidelines. General EHS Guidelines, Washington, 2007.

construction if very hard rock is encountered, although this will be on a much smaller scale to that used for mining.

Given the instantaneous nature of blasting events and their perceived audible significance, they have been investigated separately from other Project noise sources.

The characteristic noise of a blast is a 'dull thump'. This is partly due to the detonating sequence and partly due to natural energy dissipation and reduction. Some of the noise perceived by a neighbouring community (e.g. a herder camp) would be directly from the blast itself.

Noise from the scattering and settling of blast material is of minor importance and is only perceptible over a distance of few hundred meters and is therefore not considered further as part of this assessment[3].

The level of ground vibration that would result from a mining blast was estimated using the following empirical formula, where *V* is peak particle velocity, D is the distance, Q is the maximum instantaneous charge, *k* and *a* are constants[4]:

$$V = k\left(\frac{D}{\sqrt{Q}}\right)^{a}$$

Applying the above formula to various blast sizes (or maximum instantaneous charge, MIC) provides an estimate of the extent of vibration that may arise at various distances. The nearest winter herder camp is assumed to be 10 km from the source of the blasting, and at this distance the maximum peak particle velocity is calculated to be less than 1 mm/s, substantially less than the international guideline of 5 mm/s[5] for 'sensitive sites'. Summer herders that may locate nearer to the Mine Licence Area (minimum distance of 2 km) may experience elevated ground vibration (4 mm/s), which is within the guideline.

These calculations are considered to be conservative, however as these are based on typical mining industry data[5, 5], and therefore monitoring of vibration will be undertaken by Oyu Tolgoi during and after blasting to confirm that this modelling data accurately reflects the predicted impacts. In summary blasting activities are unlikely to cause any significant impacts due to the lack of permanent receptors near to the Licence Area boundary.

The recommended guideline overpressure for noise associated with blasting is 115 dB, which can be exceeded on up to 5% of the blasts over a period of 12 months[5]. International guidance also notes that the level should not exceed 123 dB (Lin Peak) [5]. Overpressure calculated using industry data and inverse square law principles for propagation of noise indicates for the maximum charge of 800 kg the maximum noise level of 100 dB(A) may be experienced at permanent receptors over 10km from the blasting area. Higher noise will inevitably be perceived closer to the blasting location, however for the maximum charge size the industry limit of 123 dB(A) is not calculated to be exceeded outside of the Mine Licence Area.

Mitigation and Management Measures

Blasting will only take place, other than in exceptional circumstances (which have not been foreseen at the ESIA stage) between the hours of 09:00 and 17:00 in line with Mongolian and international industry regulations[1, 5].

Specific measures aimed at minimising vibration impacts that will be implemented during construction and operations are as follows:

- Splitting the explosives charge column into discrete charges fired on separate delays;
- Avoiding the use of exposed explosives;
- Adequate confinement of explosives;
- Blasting will be conducted during the daytime only;

[3] Research Centre of Astronomy and Geophysics (2010). Oyu Tolgoi Mine Site Ground Vibration Noise Assessment. November 2010. Mongolian Academy of Sciences

[4] US Bureau of Mines (Dowding 1996)

[5] Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration, Australian and New Zealand Environmental Council, September 1990

- Modern blasting techniques will be utilised;
- A blasting plan will be produced, using Good International Industry Practice (GIIP) in the blasting pattern design;
- Stakeholders will be consulted on the topic of blasting (refer to *Chapter D14: Stakeholder Engagement Plan*);
- Blasting will be monitored at sensitive areas, where necessary; and
- Design and practice of blasting will be improved in the light of monitoring results.

In keeping with good practice, blasting will be controlled using delayed sequences and will be previously simulated and tested in order to minimise complaints from nearby herders prior to and potentially during operations.

Monitoring will be by seismometer and locations will vary by charge size and location of blasting. The monitoring programme is required to be flexible given the location of greatest impact (although that is predicted to be small) could vary. Measurement will yield Peak Particle Velocity (PPV) for direct comparison to the Project Guidelines (Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration, Australian and New Zealand Environmental Council, September 1990), which we regard as internationally accepted. Monitoring data will be made available to interested and potentially affected parties.

3.3.5 Mining and Processing Activities

Description of the Impact

Operational noise will predominately arise from the operation of ore crushing / concentrate production, drilling equipment, large excavators and haulage trucks. Noisy items of equipment within the processing facility are likely to include crushers, grinders, cooling fans, pumps, compressors and plant motors. Blasting during operations will have the potential to create vibration as has been discussed in *Section 3.3.4*.

Mining and processing will take place continuously (other than scheduled plant shut-down or emergencies, such as power failure). As noted in *section 3.3.4* above, blasting will only take place during permitted daylight hours.

In order to assess the reasonable worst case impact of mining noise, this assessment has considered vehicles that (conservatively) are expected to operate simultaneously at the Oyu Tolgoi Mine Licence Area boundary are as follows.

Table 3.2: *Mining Equipment that May Simultaneously Operate at Oyu Tolgoi Licence Area Boundary*

Vehicle Type	Leq 10m dB(A)	No. of plant
Excavator 320	80	1
Truck 777-D	94	1
Drill rig	90	2
Water Bowser 15t	81	1
Generator	79	1
Water pump	84	1

Source: Oyu Tolgoi Environment Department

It is recognised that other mining equipment may operate within the licence area, with the greatest concentration of equipment expected to be around areas where ore extraction and transportation is taking place, and the waste rock dump. Mining operations in areas away from these main areas of activity will have a lower impact since these noise sources will be from smaller equipment typically operating individually.

To provide an initial assessment of the potential noise impacts on nomadic herder camps from the Project during the mining operations, a screening assessment has been undertaken. The screening approach

takes account of the fact that noise attenuates with distance from the source, and is based on the following formula:

$$Kd = (25\log_{10} R/10)$$

Where Kd is the attenuation of noise with distance over hard ground, and R is the distance in metres between source and receptor.

Based on the screening assessment, noise levels outside of the 10 km residential exclusion zone surrounding the Project at expected to be less than 20 dB(A), substantially less than the existing baseline. Mining noise at 2 km (the minimum distance at which summer herders may existing) is predicted to be 28 dB(A), again in general less than baseline and less than the corresponding Mongolian[1] and IFC guidelines[2]. The source receptor distance is sufficient to afford significant attenuation of offsite impacts.

Operational noise from the processing facility (which is largely housed in buildings) has been calculated at the licence area boundary and is estimated to be 19 dB(A), again substantially less than, baseline conditions.

A Permanent Worker Camp, accommodating 500-600 people, will be located in the northwest corner of the licence Area. This area is the furthest practicable distance from the processing plant.

The screening data indicate that impact (nuisance) to the construction camp and herders beyond the licence boundary is highly unlikely and project standards and guideline with respect to noise are unlikely to be breached[1,2].

3.3.6 Operation of the Oyu Tolgoi to Gashuun Sukhait Road

Description of the Impact

The sealed road from Oyu Tolgoi to Gashuun Sukhait will be used by Oyu Tolgoi to transport concentrate to the border where it will be taken by customers from the depot in the Chinese border town of Ganqimaodu.

Based on Oyu Tolgoi projections for production, it is estimated that roughly 80 trucks of 45 tonne payload will travel the road each day, equivalent to 80 return trips. There are few permanent settlements along the route, therefore noise impacts will be limited to a few herders who are or will be within 500 m of the road (existing herders have been offered relocation but have chosen to stay).

Mitigation Measures

No mitigation measures are anticipated to be introduced in addition to those described in *Chapter D11: Transport Management Plan*, which sets out minimum vehicle requirements with regard to vehicle noise control.

3.3.7 Oyu Tolgoi Gunii-Hooloi Borefield and Water Pipeline

Description of the Impact

Through the operational phase were will be a requirement for regular access to the water borefield for monitoring and maintenance. This access will be via a gravel service road from the Mine Licence Area, across the northern lease boundary and following the pipeline route to Gunii Hooloi. Traffic loading for the borefield road will be limited to light vehicles and occasional heavy equipment and trucks for routine inspections and maintenance. The impacts from the vehicle movements will be limited to the few herder camps in the area; and will be transitory and of short duration.

Mitigation Measures

No mitigation measures are anticipated to be introduced in addition to those described in *Chapter D11: Transport Management Plan*, which sets out minimum vehicle requirements with regard to vehicle noise control.

3.3.8 Aircraft Noise from the Permanent Airport

Description of the Impact

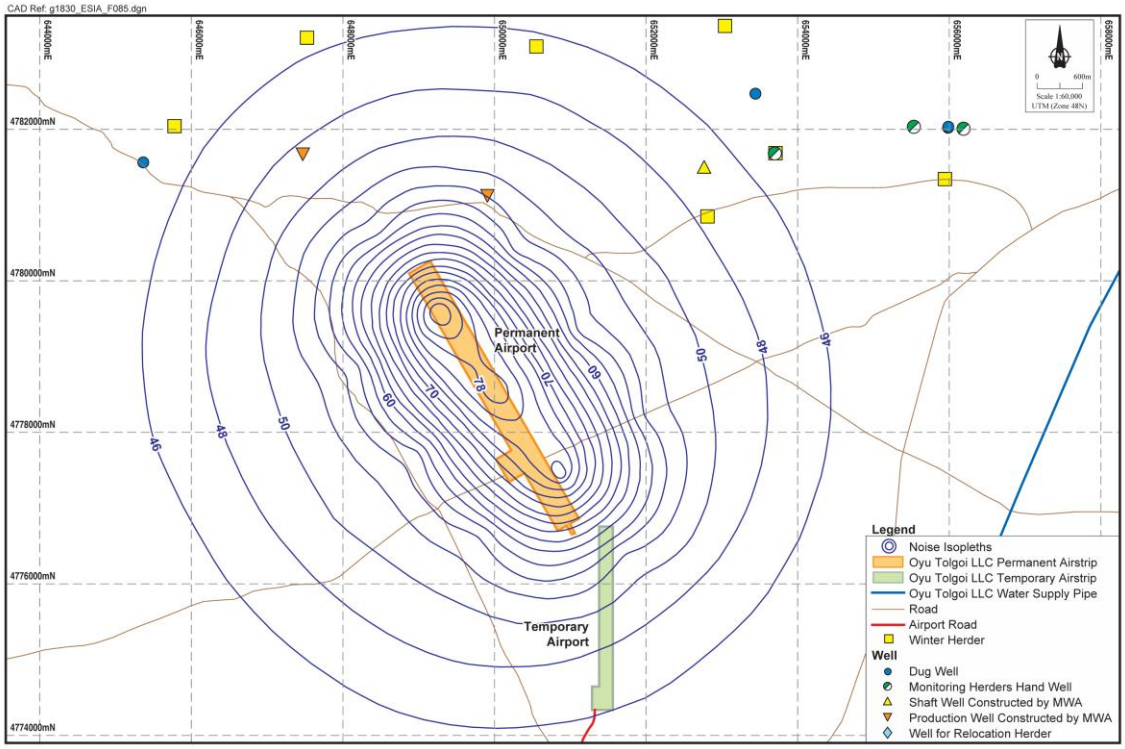
As noted earlier, the construction phase will be supported by the Temporary Domestic Airport, effectively an interim airstrip constructed to the south of the proposed location of a final and permanent airport. The

proposed location of the permanent airport and orientation of the runway supports more extensive use given the remoteness of the area. A definitive forecast of the extent of runway use / aircraft type after handover to the Government is not available, however it is anticipated a large proportion of flights will service the Oyu Tolgoi Project, and the total number of flights is expected to be 1-2 per day. Oyu Tolgoi can undertake additional monitoring of sensitive receptors near to the airport after handover; however responsibility for management of aircraft noise will rest with the Government, as the Government would handle runway operations (flight paths, restrictions on schedule, enforcement of international treaties affecting noise emissions (ICAO)).

The final international airport layout will be based on specifications derived from ICAO and will be suitable for aircraft as large as the Boeing 737-800 aircraft. This will require a 3,250 meter runway, taxiways, safety taxiway, safety end strips, parking apron, airstrip markings, runway lighting, power supply (to be provided by means of a diesel generator), electrical design, fencing, surface drainage, control tower above the passenger terminal and a car park. Once peak construction activities have been completed, and the Permanent Airport is constructed, although large aircraft will be used the average number of daily flights will be less than peak construction. The average is expected to be once per day.

Noise associated with the permanent airport has been investigated using an acoustic model the methodological approach for which is consistent with that undertaken for the Temporary Domestic Airport (*Figure 3.2*).

Figure 3.2: Predicted Noise Levels from the Permanent Airport



Source: Sustainability East Asia LLC (2010). Sustainability Noise Survey: Noise measurements made in the vicinity of the area surrounding the mine and the airport, Sustainability East Asia LLC, August 2010

Based on the findings of acoustic model, impacts for the future airport are expected to be consistent with those associated with the temporary airport. That is, whilst it is recognised that aircraft activities inevitably generate noise during take-off or landings, there are no winter herder camps located near to the permanent airport area. Given the number of flights per week is very small, impacts from aircraft activity in terms of noise nuisance are expected to be minor.

3.3.9 Decommissioning and Closure Impacts

Description of the Impacts

The detailed sequence of site closure activity is still subject to definition and, at this stage, only a conceptual closure and reclamation plan has been developed. The dismantling of the processing plant, removal of equipment and rehabilitation of the site is likely to generate short term noise impacts however there are no permanent residential receptors within 10 km of the site.

The activities associated with the rehabilitation of the mine site will use the same suite of mobile plant as used during operations, with the intensity of use diminishing steadily and minimal blasting (only potentially to make safe rock faces). Therefore the noise and vibrations impacts generated during site closure of the mine area are anticipated to be less than during operations.

The haulage of concentrate will cease as will the majority of imports from China. At this stage it is not clear whether the plant would be dismantled and sold to others in Mongolia or exported to China (if permitted). The overall truck movements on the road to Gashuun Sukhait and other access roads will be much reduced.

At the end of the construction period, it is anticipated that the permanent airport will be handed over to the Government of Mongolia and used as a regional airport for internal flights, and potentially expanded for international flights. If handed over to the authorities, all noise monitoring and mitigation measures will be passed over as well so that the noise impacts arising from the airport can continue to be managed effectively.

3.4 SUMMARY OF RESIDUAL IMPACTS

The screening assessments and acoustic modelling undertaken for the ESIA has demonstrated that, with appropriate mitigation, the noise and vibration impacts of the Project will be negligible. Construction in the infrastructure corridor between the Mine Licence Area and the Mongolia/Chinese border will be a potential source of noise impacts to the few herders who live within 500 m of the Oyu Tolgoi to Gashuun Sukhait road. Communication with the herders through the Oyu Tolgoi CSP Department will ensure that they are consulted and informed about further works and potential short-term noise impacts.

Aircraft noise will be noticeable for several kilometres from the Temporary Domestic Airport, and impacts will be similar for the permanent airport. Modelling (and monitoring for the Temporary Domestic Airport) has shown that this noise impacts are minor and will also be of short duration, and limited to daytime when a flight is landing or taking off.

Oyu Tolgoi has developed an overall noise management plan (*Chapter D3* of this ESIA), which incorporates good practice measures which will be implemented as follows:

- Providing notification to nearby residents of any exceptional mining activity planned which might create noise near to sensitive receptors;
- Operators will be required to use equipment that is in good working order and that meets current noise emission level standards;
- Driver practices when approaching and leaving the site will minimise noise emissions created through activities such as unnecessary acceleration and breaking squeal. Reversing of equipment will also be kept to a minimum to prevent nuisance caused by reversing alarms; and
- Site inductions will cover the importance of noise control and available noise reduction measures.

Table 3.3 below provides a summary of likely impacts related to noise and vibration.

Table 3.3: Summary of Noise Impacts and Mitigations

Impact	(1) Receptor	(2) Phase	(3) Impact Categorisation	(4) Potential Significance	Design Enhancement and Mitigation Measures	Management Plans, Policies and Procedures	Residual Significance
Noise impact resulting from construction equipment operation on Mine Licence Area	*Project worker accommodation area*, herders within 10 km of Mine Licence Area	**Construction**	**Duration:** Short-term **Extent:** Highly localised **Likelihood**: Certain	**Significance**: Negligible (Adverse)	▪ Attenuating distance between accommodation area / other receptors and construction equipment considered to be sufficient to mitigate impacts. ▪ Good practice noise mitigation measures described in equipment specifications. ▪ Noise monitoring shall be conducted at worker accommodation during both construction and operations to determine that good sleeping conditions are afforded to workers.	**Noise Management Plan**	**Negligible (Adverse)**
Noise impacts from Project vehicle traffic outside of the Mine Licence Area	*Temporary and permanent Herders camps*	**Construction**	**Duration:** Short-term **Extent:** Localised **Likelihood**: Certain	**Significance**: Minor (Adverse)	▪ Relatively small volume of traffic will be attributable to construction activities. ▪ Driving activities predominately and where practicable during daytime. ▪ Strict adherence to speed limits.	**Noise Management Plan** **Transport Management Plan**	**Negligible (Adverse)**
Noise impacts from construction activities outside of Mine Licence Area	*Temporary and permanent Herders camps*	**Construction**	**Duration:** Short-term **Extent:** Localised **Likelihood**: Certain	**Significance**: Negligible (Adverse)	▪ Equipment to be used and maintained in accordance with manufacturer guidelines. ▪ Noisy activities to take place, where practicable, during daytime.	**Noise Management Plan**	**Negligible (Adverse)**
Vibration impacts from blasting activities	*Temporary and permanent Herders camps*	**Construction Operations**	**Duration:** Short-term **Extent:** Localised **Likelihood**: Certain	**Significance**: Negligible (Adverse)	▪ Blast location / separation is expected to be sufficient for attenuation of blasting vibration. ▪ Measures to be implemented as described in the preceding section. ▪ Vibration monitoring to be undertaken during construction and operations.	**Noise Management Plan**	**Negligible (Adverse)**
Noise impacts from Temporary Domestic Airport	*Temporary and permanent Herders camps*	**Construction**	**Duration:** Short-term **Extent:** Localised	**Significance**: Negligible (Adverse)	▪ Conduct bi-annual noise monitoring to build on understanding of background and aircraft noise issues. ▪ Implementation of Noise Management Plan, including appraising flight times.	**Noise Management Plan**	**Negligible (Adverse)**

Impact	(1) Receptor	(2) Phase	(3) Impact Categorisation	(4) Potential Significance	Design Enhancement and Mitigation Measures	Management Plans, Policies and Procedures	Residual Significance
			Likelihood: Certain				
Noise impact resulting from onsite mining and ore processing equipment	*Accommodation area*, permanent herders within 10km	**Operations**	**Duration:** Long-term **Extent:** Localised to within licence area boundary utilised for process **Likelihood**: Certain	**Significance**: Negligible (Adverse)	▪ Attenuating distance between receptors and mining equipment / ore processing is considered to be sufficient to mitigate impact. ▪ Best practice noise mitigation measures described in preceding section. ▪ Implement workplace noise exposure assessments to enable proactive management of noise. ▪ Conduct bi-annual noise monitoring to ensure compliance with noise limits.	**Noise Management Plan**	**Negligible (Adverse)**
Noise impacts from vehicle traffic outside of the concession (including the Oyu Tolgoi/GS Road)	*Temporary and permanent Herders camps*	**Operations**	**Duration:** Short-term **Extent:** Localised **Likelihood**: Certain	**Significance**: Minor (Adverse)	▪ Small volume of traffic attributable to concentrate transport. ▪ Strict adherence to speed limits.	**Noise Management Plan** **Transport Management Plan**	**Negligible (Adverse)**
Noise impacts from Permanent International Airport	*Temporary and permanent Herders camps*	**Operations**	**Duration:** Short-term **Extent:** Localised **Likelihood**: Certain	**Significance**: Negligible (Adverse)	▪ Conduct bi-annual noise monitoring to build on understanding of background and aircraft noise issues. Should the airport be 'handed over' to the Mongolian Government, Oyu Tolgoi can undertake continued monitoring although responsibility for noise control will rest with the future operator. ▪ Implementation of Noise Management Plan, including appraising flight times.	**Noise Management Plan**	**Negligible (Adverse)**