SECTION C: IMPACT ASSESSMENT

CHAPTER C2: CLIMATE AND AIR QUALITY

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2 CLIMATE AND AIR QUALITY

2.1 INTRODUCTION

The Oyu Tolgoi Project has the potential to generate both particulate and gaseous emissions during all phases of the Project lifecycle. This Chapter provides an assessment of Project emissions on ambient air quality and provides an assessment of the greenhouse gases (GHGs) generated by the Project. This Chapter also presents the proposed measures aimed at avoiding and mitigating anticipated impacts to ambient air quality, as well as a reference to the management plans that shall ensure that such mitigation measures are appropriately and effectively implemented.

Baseline ambient air quality is discussed in *Chapter B3: Air Quality*. The Standards applicable to the Project are described in detail in *Chapter B3* and are also summarised below. The impact assessment has been developed using a combination of quantitative assessment, professional judgement and review of industry good practice. In terms of quantitative assessment, this Chapter includes a summary of an air dispersion modelling assessment. This assessment has quantified potential impacts to ambient air quality from the operation of major stationary combustion equipment including diesel power generators, coal-fired boilers and a hazardous waste incinerator. Greenhouse Gas (GHG) emissions for construction and operational phases of the Project have also been quantified and assessed. Mobile emissions sources and dust generation are also addressed.

2.1.1 Objectives

The specific objectives of this air quality impact assessment are to:

- Identify the main sources of potential impact to air quality arising from construction, operational and closure phases of the Project;
- Determine, quantitatively and qualitatively, whether air emissions could potentially impact sensitive receptors in the vicinity of Project activities;
- Assess and define mitigation measures for addressing air quality impacts arising from the various phases of the Project; and
- Identify long-term management and monitoring measures related to air quality.

2.1.2 Overview of Key Issues and Emission Sources

The key issues, in terms of potential impact to air quality, comprise:

- Dust emissions together with their impact on human health and their potential to cause nuisance to those exposed;
- Emissions of potentially polluting gases: sulphur dioxide (SO_2), oxides of nitrogen (NO_x) and carbon monoxide (CO), and their potential impact on human health;
- Emissions of other potentially hazardous species, including hydrochloric acid (HCl), dioxins and furans, cadmium (Cd), lead (Pb), mercury (Hg), hydrogen fluoride (HF) and their potential impact on human health; and
- Emissions of GHGs (principally CO_2).

Chapter A4: Project Description provides maps of the site layout and the location of key Project features discussed in this chapter.

2.2 SCOPE OF THE ASSESSMENT

2.2.1 Spatial Scope

The assessment considers both construction and operational impacts within and outside of the Mine Licence Area and within the broader Project Area of Influence:

- Oyu Tolgoi Mine Licence Area (including mining and ore processing operations, the Tailings Storage Facility (TSF) Waste Rock Dump (WRD) and temporary power generation, heating and waste disposal facilities;
- Transport infrastructure and power line corridor from Oyu Tolgoi to Gashuun Sukhait; and
- Water pipeline and associated road and power line to the Gunii Hooloi borefield.

The assessment has not been extended into China; there will be no Oyu Tolgoi operations that will lead to direct and significant air emissions outside the national boundary of Mongolia. The copper concentrate will be sold to customers at the Chinese / Mongolian border and this point of sale denotes the effective boundary of the Project and this assessment. Whilst indirect emissions will be associated with further processing of ore concentrate outside of Mongolia, these are activities over which the Oyu Tolgoi Project has little or no control and which have not been established solely as a result of the Oyu Tolgoi Project.

2.2.2 Temporal Scope

The temporal scope of this assessment covers the full life of the Project. Impacts are discussed for the construction, operational and closure phases of the Project, although with regards to air quality no post-mine legacy is anticipated. That is, following mine closure, air quality impacts from vehicles, processing plant, and coal-fired heating plant will effectively cease.

2.2.3 Limitations

This Chapter and associated emission inventories and assessments are based upon the Project description set out in *Chapter A4: Project Description*. Oyu Tolgoi is committed to reviewing material design changes through the updating of quantitative impact assessments for the Project in line with international good practice.

2.3 AIR QUALITY STANDARDS AND GUIDELINES

The Mongolian National Air Quality Standard (MNS 4585:2007) is intended for urban areas, rather than remote rural areas. Specifically, MNS 4585:2007 states:

> *"This standard applies to reconnaissance, assessment and monitoring of the quality of indoor and outdoor air during planning and utilisation of town and settlements, residential housing, offices, entertainment and public service facilities and civil constructions".*

As MNS 4585 is oriented to urban areas, where populations are subject to additional environmental stresses, the numerical values of the standards are set at a very low value. For example, the permissible level for SO_2, the 24-hour average is 20 µg/m^3. This is numerically equivalent to the World Health Organisation (WHO) standard for the same averaging period. The WHO publication setting out this guideline recognises that the level is difficult to achieve, and has suggested interim guidelines of 50 and 125µg/m^3[1]. Similarly for NO_2, MNS 4585 sets out a 20-minute average of 85µg/m^3 and a 1-hour average of 68µg/m^3. This compares to a WHO 1-hour standard of 200µg/m^3.

As a result, MNS 4585:2007 is not considered directly applicable to a remote mining facility due to it being developed for urban environments and compliance with this Standard has not been required for previous DEIAs prepared for the Oyu Tolgoi Project. IFC General EHS Guidelines (2007)[2] state that in the absence of applicable national ambient air quality standards (and in this case, national standards are considered to apply to urban areas), internationally recognised standards will be applied. EU ambient air quality standards[3] are cited in the IFC General EHS Guidance as recognised international standards and have been adopted for the purposes of this assessment (*Table 2.1*).

[1] World Health Organisation (2006). Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulphur Dioxide. Global Update 2005. Summary of Risk Assessment. WHO/SDE/PHE/OEH/06.02.

[2] International Finance Corporation, (2007), Environmental, Health and Safety Guidelines. General EHS Guidelines, Washington, 2007, pp4.

[3] EU air quality requirements from Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe

Table 2.1: EU Ambient Air Quality Standards

Parameter	Averaging Period	EU Ambient Air Quality Standard [(3)] ($\mu g/m^3$)	Permitted Number of Exceedences per Year
Sulphur dioxide (SO_2)	1 hour 24 hours	350 125	24 3
Carbon monoxide (CO)	8 hours	10,000	N/A
Nitrogen dioxide (NO_2)	1 hour Annual	200 40	18 N/A
Ozone (O_3)	8 hours	120	25
PM_{10}[1]	24 hours Annual	50 40	35 N/A
$PM_{2.5}$[2]	Annual	25	N/A
Lead	Annual	0.5	N/A
Benzo a pyrene	Annual	0.001	N/A

Notes:
1: PM_{10} denotes particulate matter of less than 10 microns in diameter
2: $PM_{2.5}$ denotes particulate matter of less than 2.5 microns in diameter
3: EU air quality requirements from Directive 2008/50/EC on ambient air quality

2.4 IMPACT ASSESSMENT

2.4.1 Summary of Potential Impacts

Potential impacts to air quality during the construction phase of the Project are as follows:

- Exhaust emissions from plant operated during the construction phase, which include diesel power generating units, small-scale coal-fired boilers and a small-scale waste incinerator;
- Exhaust emissions from construction vehicles;
- Dust generation from land preparation, topsoil stripping, earth / overburden movement and dust generation during movement of vehicles over unpaved surfaces; and
- Dust and exhaust emissions from the construction (and operation) of the Temporary Airport and construction of the Permanent Airport.

Potential impacts to air quality during the operational phase of the Project will be similar to the construction phase and are as follows:

- Exhaust emissions from stationary equipment: Diesel Power Station (DPS) for emergency backup only, a coal-fired heating plant (CHP), and a waste incinerator[4];
- Exhaust emissions from mining and other vehicles;
- Dust generation within the Mine Licence Area associated with open pit mining activities and the TSF; and
- Emissions associated with aircraft operating at the Permanent Airport.

The Project requires significant electrical power for the processing of ore into concentrate. The Oyu Tolgoi power supply strategy provides three options for Project power supply:

- Diesel-generated power, on site for construction;
- Purchase of power from the Inner Mongolia Autonomous Region of China, supplied to the Mine Licence Area via an Oyu Tolgoi-owned 220 kV power transmission line from the Mongolia/China border for project commissioning and early operations; and

[4] Note that the proposed coal-fired power plant is excluded from this assessment and will be assessed in a supplemental report.

- Generation of power from an on-site coal-fired Power Plant for long-term power supply as set out in the Investment Agreement[4].

For additional details of the coal fired power station, refer to *Chapter A4 Project Description*.

2.4.2 Description of Emission Sources during Construction

Temporary Diesel Power Generation

During construction, electrical power is provided to the construction camp area by ten 2 MW output diesel generators (Sunfall type). The generators are located within a dedicated DPS within the Mine Licence Area. It is anticipated that at the end of the construction phase, or during early operations, the power station will be expanded with an additional ten 2 MW output diesel generators (Cummins type). During operations, the DPS will support the Project during emergency shutdown (e.g. during a power failure) or facility start-up only.

Fuel for the diesel generators will be sourced regionally and is expected to have a maximum sulphur content of 0.5%. The Project is committed to using low sulphur diesel fuel where this is commercially available and not excessively expensive.

Emissions from the DPS comprise NO_x, CO, PM_{10} / $PM_{2.5}$ and SO_2.

While there are no Mongolian emission limits/standards, the existing (Sunfall) generators produce emission concentrations in excess of international good practice as defined by IFC General EHS Guidelines. The newer (Cummins) generators will meet international good practice standards (with the exception of particulates) as set out below. Given that the generators are operated on an individual basis, with individual exhausts, the EU Large Combustion Plant Directive 2001/80/EC is not considered to be applicable[5].

Table 2.2: Diesel Generator Emission Estimates (mg/Nm^3)

Regulated Emission	Sunfall Emission Estimate [1]	Sunfall Emission Estimate [2]	Cummins Data Sheets [3]	IFC General EHS Guidelines 2007	Mongolian / Chinese
NO_x	7,984	7,946	1,701	1,850 [6]	N/A
SO_2	1,252 [4]	501 [5]	455	3,755 [7]	N/A
PM	275	275	100	50-100	N/A

[1] Calculated using ENVIRON Air Dispersion Modelling Report (Oyu Tolgoi Gold Mine, ENVIRON Australia Pty Ltd, 3 November, 2010, Project Number: AS110499)

[2] Calculated using Air Dispersion Modelling Report for Diesel Generators, Environmental Studies and Information Centre, "OS Mt" Co., ltd, 2007

[3] Based on data presented in documents 2660DQLB-QSK78G6-eds-1009 and QSK78-G9-FR6676_EPA_QSK78-G9

[4] Corresponds to a maximum sulphur content of 0.5% by mass which is more than that reported in the Environ Report (Environ ADM based on 0.0875% by mass)

[5] Corresponds to a maximum sulphur content of 0.2% by mass

[6] Assumes a bore size diameter [mm] > or = 400. Bore size less than 400mm, NOx limit of 1,460 mg/Nm^3 or up to 1,600 mg/Nm^3 applies

[7] Based on the IFC limit of 1.5% sulphur in fuel by mass

Construction Phase Waste Incineration

Currently, an incinerator is used to dispose of relatively minor quantities of waste oil filters, combustible hazardous waste and medical (non-sharps) waste arising from construction activities (see *Figure 2.1*). The incinerator is located adjacent to the construction phase truck shop. This incinerator has a combustion room temperature of 1,200^{o}C, with a burning capacity of 10-30 kg/hour. No monitoring of the incinerator emissions have been undertaken due to the difficulties in importing calibration gases into Mongolia.

The incinerator operates for approximately three hours per day, ten days per month, and will be decommissioned and replaced by an incinerator designed to international standards to support operations. Due to the infrequent nature of operations and the small size of the unit, the impact of the

[5] Refer to Article 2 (7) of Directive 2001/80/EC for further guidance on this matter.

existing incinerator to air quality is expected to be minor and is not considered further within this assessment.

Currently about 95% of all incinerated waste is composed of oil filters or oily rags. Infectious wastes generated from the Oyu Tolgoi medical centre is being burned in the incinerator under the supervision of the clinic staff, whilst the non-combustible medical wastes (sharps etc.) are sealed and sent to Ulaanbaatar for appropriate disposal.

Small-Scale Coal-Fired Boilers

Nine small-scale coal-fired boilers are currently used for the provision of heating within the worker accommodation areas and remote site facilities. The boilers are used on the basis of the seasonal heating requirements, and will be decommissioned following the commissioning of the CHP.

The move to the use of the central CHP and closure of the small scale coal boilers will enable Oyu Tolgoi better to control and improve air quality across the site through more efficient heat production, emissions abatement and use of a single common stack with greater elevation and dispersion.

As the existing coal-fired units are relatively small and given that they are scheduled for decommissioning during early operations, the coal fired boilers are not expected to constitute a significant or long-term impact to air quality and are not discussed further.

Figure 2.1: Existing Waste Incinerator

Exhaust Emissions from Construction Equipment

During the construction phase, emissions will arise from the operation of mobile diesel-powered plant (such as trucks, excavators, graders and backhoes) and stationary equipment (such as small mobile generators and cranes). Similarly, vehicles transporting construction materials, workers and other equipment to and around the site will contribute to emissions from vehicle exhausts.

Dust Emissions

Dust will be generated during:

- earthworks activities, including topsoil clearance, overburden stripping, rock blasting, cut and fill operations and stockpiling;
- open pit mining activities, including rock blasting, excavation and stockpiling; and

- vehicle movements on unpaved surfaces.

Within the Mine Licence Area, the following locations and activity periods have been identified as main dust emitting sources:

- Open Pit and WRD – during mining activities;
- Concentrator – during earthworks activities;
- TSF – during earthworks activities;
- Site Roads – during earthworks activities and vehicular use; and
- Infrastructure Facilities – during earthworks activities.

Outside the Mine Licence Area, the following locations and activity periods have been identified as main dust emitting sources:

- Gunii Hooloi Pipeline – during earthworks activities;
- Off-Site Facility Access Roads (including access road along the Gunii Hooloi Pipeline and access road to the temporary and permanent airports) – during earthworks activities and vehicular use;
- National Highway from Oyu Tolgoi to Gashuun Sukhait road – during earthworks activities;
- Transmission Lines (including 220 kV transmission line from the Chinese border to the Mine Licence Area and along the Gunii Hooloi pipeline) – during earthworks activities; and
- Temporary and Permanent Airport – during earthworks activities and aircraft use (temporary airport only).

Aircraft Emissions

The Project is currently supported with a temporary domestic airport which will be replaced with a permanent airport at or around the start of the operational phase of the Project. The key function of the temporary airport is to support construction activities, peaking at up to three flights per day for small aircraft. Given the infrequent number of flights and small size of the aircraft, emissions from the temporary domestic airport are expected to be negligible and are not discussed further.

2.4.3 Sensitive Receptors

The Project Area is remote and population density within 10 km of the Mine Licence Area is extremely low. Sensitive receptors to emissions considered to exist near to the Project include:

- The worker accommodation areas within the Mine Licence Area;
- Locations beyond the Mine Licence Area (demarcated by the boundary fence line), including in the vicinity of the Airport and the Gunii Hooloi pipeline alignment, where herders could establish summer shelters and where herders can potentially roam and be exposed (over short-term periods) to Project-associated emissions;
- Winter herder shelters located at a minimum of 10km from the Project; and
- A small number of herder winter shelters located within 500 m of the Gunii Hooloi pipeline and Oyu Tolgoi to Gashuun Sukhait road.

There are currently no permanent residences within 10 km of the mine site.

2.4.4 Assessment of Construction Impacts to Air Quality

Diesel Power Station

In order to determine the impact of the DPS to ambient air quality, a dispersion modelling assessment has been conducted using the Commonwealth Scientific Research Organisation (CSIRO) developed model known as TAPM (Version 4.03).

TAPM is a prognostic meteorological model that is integrated with an air dispersion model. The prognostic meteorological model predicts the meteorological conditions across the model domain based on large scale meteorology (obtained from global weather forecasting models that use current

observation data), local topography and land surface characteristics (i.e. soil type, vegetation cover). The predicted meteorology, together with information on the characteristics of each emission source, is used within the air pollution dispersion component of the model to predict the ground level concentrations for each hour of the year at specified grid points across the modelled domain.

Modelling has been conducted for the full build-out (from 10x2 MW to 20x2 MW) of the DPS (the case expected to generate the greatest emissions and assuming high sulphur content fuel).

Although surface meteorological monitoring data were available for the surrounding area, the data was not incorporated into the modelling as there was no upper atmospheric data available. Therefore, the prognostic meteorological component of TAPM was used to predict the meteorology within the region.

The modelling assessment has considered the two environmental receptors to emissions from the DPS during construction:

- Receptor 1: The highest ground level concentration predicted outside of the Mine Licence Area (representing the potential worst-case exposure scenarios to herders, assuming that they established a temporary camp site immediately adjacent to the site boundary); and
- Receptor 2: Construction worker accommodation within the Mine Licence Area.

Dispersion Modelling Results

Predicted ground level concentrations of criteria pollutants at receptors near to the DPS are presented in *Table 2.3*.

Table 2.3: Dispersion Modelling Results for the Diesel Power Station

Parameter	Averaging Period	EU Ambient Air Quality Standard (µg/m^3)	Permitted Number of Exceedences per Year	Modelled Result(1) Receptor	
				1	2
Sulphur dioxide (SO_2)	1 hour 24 hours	350 125	24 3	461 165	521 172
Carbon monoxide (CO)	8 hours	10,000	N/A	2,507	2,094
Nitrogen dioxide (NO_2) (2)	1 hour Annual	200 40	18 N/A	161 5	179 5
PM_{10}	24 hours Annual	50 40	35 N/A	7 2	4 2
$PM_{2.5}$	Annual	25	N/A	2	2

(1) Incorporates permitted number of exceedences per year (from Directive 2008/50/EC)

(2) Assumes 10ppb ozone concentration for the purposes of nitric oxide conversion to NO_2

Modelled data indicates that the assessment criteria are not expected to be exceeded outside of the Mine Licence Area and at the worker camp (the only environmental receptor within the Mine Licence Area) for all criteria pollutants excluding sulphur dioxide. Exceedences predicted for SO_2 both within and outside of the Mine Licence Area are a direct result of the sulphur content of the fuel in Mongolia, which may be as high as 0.5%.

Mitigation Measures for the Diesel Power Station

Modelled data has indicated that the Project NO_2 ambient standard is expected to be met during operation of the DPS, although Oyu Tolgoi is considering a number of measures to reduce NO_2 impacts further. Specifically, measures that may be considered will include the retrofitting of catalytic converters to one or multiple exhausts, or the prioritisation of the use of the Cummins engines[6] over the Sunfall engines (the Cummins engines release less NO_x than the Sunfall engines).

With regards to reducing the impact of SO_2 emissions on ambient air quality, the Project is fully committed to using low sulphur diesel where this is commercially available and not excessively expensive. Modelling indicates that the EU ambient standards are expected to be met where diesel fuel of ≤0.3% sulphur is used.

[6] See www.cummins.com

These options will be explored by means of cost-benefit analysis during the final stages of the construction programme, and the proposed methods of reducing impact will be evaluated in terms of air quality impacts using a dispersion model to confirm the most effective approach to controlling ground-level concentrations of key pollutants.

Assessment of Construction Dust

The South Gobi region is naturally a dusty environment as described in the environmental baseline assessment *Chapter B2: Climate and Climate Change* and *Chapter B3: Air Quality*.

Dust generated during construction of the Project will result from earthworks and open pit mine activities and vehicular movements on unpaved roads.

Where working in uncontaminated soils, dust normally represents a nuisance rather than a significant health or environmental hazard to those exposed.

Airborne soil dust is typically coarse and therefore remains airborne only for short periods. United States Environmental Protection Agency (US EPA) research shows that in excess of 90% of total airborne dust returns to the earth's surface within 100 m of the emission source and over 98% within 250 m[7]. However, under strong wind conditions, these effects could extend further. As the closest approach of activities within the Mine Licence Area to permanent receptors is 10 km and temporary receptors is 2km (the distance from the edge of the open pit to the Mine Licence Area boundary), dust nuisance to herders and other local residents is highly unlikely to occur from activities within the Mine Licence Area.

Outside of the Mine Licence Area, the Oyu Tolgoi to Gashuun Sukhait road, Gunii Hooloi water pipeline and power transmission line construction have the potential to cause dust disturbance to surrounding receptors, although the key human receptors (herder camps) in close proximity to these construction activities are located along the Gunii Hooloi pipeline and Oyu Tolgoi to Gashuun Sukhait road.

Mitigation Measures and other Project Commitments

Dust suppression shall be considered when construction of the road and pipeline is in close proximity to the herder camps. Dust suppression may not be necessary if the camps are not inhabited at the time of nearby construction activities. Similarly, dust suppression within the Mine Licence Area will only be utilised if it is visibly being seen to impact upon accommodation areas.

To minimise impacts from dust, a number of measures will be applied where visual observation confirms the possibility of causing nuisance to nearby sensitive receptors:

- Borrow pit locations are and will continue to be consulted upon with communities and any borrow pits seen to cause community concern are not used. Restricting vehicle speeds on all unsealed roads to a maximum of <80km/h and as low as 10km/h at sensitive receptor locations (e.g. camp areas);
- Provision of dust masks for use by any workers undertaking a dust generating activity;
- Controlled loading and unloading of haulage vehicles;
- Sealing the Oyu Tolgoi to Gashuun Sukhait road during operation of the Oyu Tolgoi Project in accordance with Government of Mongolia requirements;
- Sealing the permanent airport runway;
- Restricting off-road travel, including monitoring via GPS vehicle management system of any unauthorised off-road travel;
- Undertaking formal rehabilitation of all decommissioned borrow pits, quarries and roads, including re-planting of local vegetation species;
- Placement of stockpiled topsoil on completed earthworks surfaces (e.g. road verges) including formal planting of local vegetation species on completed earthworks surfaces (e.g. road verges). Provision of wet dust suppression or dust palliatives of unsealed roads in sensitive receptor locations; and

[7] United States Environmental Protection Agent (USEPA) AP-42

- Cessation of outdoor construction activities during periods of intense natural dust storms.

It should be recognised that a Project goal is to minimise water consumption, and therefore wet suppression of dust will be applied on an 'as needed' basis at sensitive receptor locations. Where possible, and as part of project water conservation initiatives, wet dust suppression use will be undertaken using wastewater that has been comprehensively treated to the Mongolian Standard for disposal to soil (for further information, see *Chapter C4: Topography, Geology and Soils Impact Assessment*).

2.4.5 Assessment of Vehicle and Equipment Emissions

During the construction phase exhaust emissions will result from the use of diesel-powered vehicles (such as trucks, graders and backhoes) and stationary equipment (such as mobile generators and cranes), as well as vehicles transporting construction materials, personnel and equipment to the site.

The operation of vehicles and equipment will result in emissions of CO, SO_2, NO_x and PM_{10}. These emissions will arise from vehicles and equipment over a relatively large area during the construction period, and therefore any deterioration in air quality is expected to be minor and relatively transient.

Mitigation Measures and other Project Commitments

Although no specific mitigation measures are proposed for vehicle emissions, all vehicles and equipment owned and operated by Oyu Tolgoi:

- Will undergo regular maintenance;
- Will be operated to manufacturers' guidelines;
- Will be replaced when vehicle condition and/or performance deteriorates to an unacceptable level; and
- Where appropriate, idling of engines will be avoided.

Where significant black smoke is observed from an exhaust, the equipment will be safely shut down and maintenance measures taken. With the application of appropriate mitigation measures, vehicle and equipment construction activities are expected to have a negligible impact on local air quality given the extent of the area over which emissions will arise.

Where possible, all vehicles purchased will be international-specification vehicles sourced from reputable international suppliers (e.g. Toyota, Komatsu, Volvo, Caterpillar).

2.4.6 Description of Emission Sources during Operations

Central Heating Plant

During project operations, a coal-fired Central Heating Plant (CHP) will be installed which will comprise two 7 MW and two 29 MW Circulating Fluidised Bed (CFB) coal-fired boilers. The CHP will generate steam required for building and underground heating on a seasonal basis. Emissions from the four boilers will be discharged from a dedicated stack, and will include NO_x, CO, PM, SO_2, in addition to metals contained in fly ash.

While there are no Mongolian emission limits/standards, the Central Heating Plant is forecast to produce emission concentrations in excess of international good practice as defined by IFC General EHS Guidelines. Given that individual boilers are operated through a common exhaust stack the EU Large Combustion Plant Directive 2001/80/EC is considered to be applicable[8].

[8] Refer to Article 2 (7) of Directive 2001/80/EC for further guidance on this matter.

Table 2.4: Central Heating Plant Emissions Estimates (mg/Nm^3)

Emission	Emission Estimate [1]	Vendor Emission Limit [2]	Emission Rates using Maximum S / N Content of Coal [3]	Emission Rates using Typical S / N Content of Coal [4]	IFC EHS Guidelines, Thermal Power 2008	EU LCP Directive 2001/80/EC	Chinese Emission Limits [5]
NO_x	1,662	750	3,719	3,185	510 [5]	400	
SO_2	437	(900)	1,115	669	900-1,500	850	900
PM	94	50 [6]	N/A	N/A	50	100	50

[1] Calculated using ENVIRON Air Dispersion Modelling Report (Oyu Tolgoi Gold Mine, ENVIRON Australia Pty Ltd, 3 November, 2010, Project Number: AS110499)

[2] Email on confirmation of steam boiler emission limits from WorleyParsons China (dated 13 June 2011)

[3] Based on coal composition analysis TDM207 (Design Basis Coal and Ash Property Data of Central Boiler Plant) which indicates a maximum nitrogen content of 3.1% and sulphur content of 1.0% on a total mass basis

[4] Based on coal composition analysis (TDM207 Design Basis Coal and Ash Property Data of Central Boiler Plant) which indicates a typical nitrogen content of 2.7% and sulphur content of 0.6% on a total mass basis

[5] Communicated by email on 27th November 2010 by WorleyParson China

[6] Bag Filter Specification for 7MW boilers (Maison Worley Parsons Document Number A2MW-5741-55-DS070)

Coal for the CHP will be supplied from mines in the region (provisionally from Tsagaan Tolgoi), and it is estimated that approximately 1.9 million tonnes of coal will be required each year. The CHP, once commissioned at the start of the operational phase, will replace the nine existing smaller coal fired boilers, which will be decommissioned.

The nitrogen content of the coal is relatively high (2.7%), inferring, on a mass balance basis, high emission concentrations of NO_x. As a result, it is considered likely that irrespective of the boiler design used, the emissions would have high "chemical" NO_x levels. Nonetheless, the use of a CFB boiler design is recognised as leading to lower NO_x emissions due to the relatively low combustion temperature (850-900ºC)[9]. A discussion of the effectiveness and cross-media impacts of the use of catalytic emissions reduction technology is set out in *Section 2.4.8* below.

Coal sulphur contents infer a maximum emissions concentration that exceeds EU Large Combustion Plant Directive emission limits, although on a 'typical' coal sulphur content basis compliance with EU and IFC limits will be possible. If low-sulphur ('typical' specification) coal is used as feedstock, then exceedences of sulphur dioxide are not predicted.

In the event that a power station is built and operated at Oyu Tolgoi, the use of waste heat recovery from that power station provides an opportunity to decommission the CHP by the end of Year 4 at the latest.

Expanded Diesel Generator Power Station

The DPS installed during the construction phase (discussed in *Section 0*) will be expanded with an additional ten 2 MW output diesel generators (Cummins type) prior to, or during the early operational phase. The generators are located within a dedicated 'power generation' site within the Mine Licence Area[10]. During operations, the DPS will support the Project during emergency shutdown (e.g. if imported power is interrupted) or facility start-up only (<500 hours per annum operating time). The size of the DPS is related to the power requirements to provide emergency power and lifting power to underground operations.

Fuel for the diesel generators will continue to be sourced regionally during operations although consumption is anticipated to be significantly less than during construction. Diesel is expected to have a maximum sulphur content of 0.5%, however the Project will aim to source lower sulphur diesel when this becomes commercially and competitively available.

[9] See Section 4.1.9.2.3 (Abatement of NOx Emissions) of the Integrated Pollution Prevention and Control Reference Document on Best Available Techniques for Large Combustion Plans, July 2006. European Commission.

[10] See *Chapter A4: Project Description* for a layout plan for the Mine Licence Area.

Waste Incineration

Prior to operations, the incinerator used during construction will be decommissioned and replaced with a new unit which will meet EU waste incineration specifications in terms of destruction efficiency, residence time and emission limits[11]. Key emissions from the incinerator will include NO_x, CO, SO_2, and PM. In addition, certain trace species may be associated with incinerator operations such as metals, dioxins / furans and hydrochloric acid (HCl), although the incinerator has been specified to meet EU emission limits for these species. To minimise emissions the incinerator will include an afterburner that will destroy volatile organic compounds (VOCs) and dioxins and furans (DaFs) due to high combustion temperatures and residence times.

The incinerator will be used to burn waste engine and lube oil, oil filters, and potentially combustible medical waste to a total capacity of 100 kg/hour. The incinerator is only expected to operate on an intermittent basis for three hours per day and ten days per month. The incinerator includes a continuous emissions monitoring system within the exhaust flue.

Vehicle Emissions

During operations, the use of vehicles will be significantly less than during construction. Vehicles will predominately be used for haulage within the Mine Licence Area, including movement of mined ore, overburden, and waste rock. Outside of the Mine Licence Area, the majority of vehicle activity will comprise the movement of concentrate to China (using the Oyu Tolgoi to Gashuun Sukhait road) at a rate of approximately 80 return trips per day.

Given the relatively minor vehicle fleet required to support operations, and the significant area over which these would operate, impacts from vehicle emissions during operations is expected to be negligible and not discussed further.

Dust Emissions

Dust generated during operations will result from vehicle movement on unpaved surfaces within the Mine Licence Area and mining activities. Further dust emissions may occur from the WRD during dry and windy periods.

Significant dust generating activities outside of the Mine Licence Area are not anticipated during Project operations.

Aircraft Emissions

As noted earlier, the Project is currently supported by a Temporary Airport which will be replaced with a Permanent Airport at the start of the operations phase. During operations, the Permanent Airport is expected to operate one landing and take-off per day on average, although the aircraft operating from the airport are likely to be bigger than those used during construction.

Given the low number of flights, emissions from the permanent airport are expected to be negligible and are not discussed further.

2.4.7 Sensitive Receptors during Operations

Sensitive receptors during operations are expected to be similar to those that exist during Project construction:

- The worker accommodation area within the Mine Licence Area, which will continue to be used during operations, although the total number of workers will decrease when compared to the construction phase;
- Locations beyond the Mine Licence Area (demarcated by the boundary fence line), where summer herders can potentially roam and be exposed (over short periods) to emissions from the Project; and
- Winter herder shelters located at a minimum of 10 km from the Project.

[11] Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste

2.4.8 Assessment of Emissions from the DPS, CHP and Waste Incinerator

In order to determine the impact of operational emissions from the CHP and waste incinerator to ambient air quality, a dispersion modelling assessment has been conducted using the CSIRO TAPM model (Version 4.03). The approach is consistent with that described in *Section 2.4.4,* which also describes the impact associated with the full build-out of the DPS*,* although it will be recognised that during operations the DPS would operate during emergency periods only.

The modelling assessment has considered two environmental receptors to emissions during operations:

- Receptor 1: The highest ground level concentration predicted outside of the Mine Licence Area (representing the potential worst-case exposure scenarios to herders, assuming that they established a temporary camp site immediately adjacent to the site boundary); and
- Receptor 2: Construction worker accommodation within the Mine Licence Area.

Dispersion Modelling Results

Predicted ground level concentrations of criteria pollutants at receptors near to the DPS are presented in *Table 2.5*.

Table 2.5: Dispersion Modelling Results for Stationary Operational Emission Sources (CHP and Incinerator)

Parameter	Averaging Period	EU Ambient Air Quality Standard (µg/m^3)	Permitted Number of Exceedences per Year	Modelled Result Receptor	
				1	2
Sulphur dioxide (SO_2)	1 hour 24 hours	350 125	24 3	112 23	51 8
Carbon monoxide (CO)	8 hours	10,000	N/A	256	126
Nitrogen dioxide (NO_2)	1 hour Annual	200 40	18 N/A	161 8	149 1
PM_{10}	24 hours Annual	50 40	35 N/A	5 <1	2 <1
$PM_{2.5}$	Annual	25	N/A	5	<1

The modelled data indicates that the normal operations of the CHP and waste incinerator are not expected to result in exceedances of applicable ambient air quality standards. As the DPS will be used as an emergency back-up, emissions from the DPS (described in *Section 2.4.4*) will be infrequent and are unlikely to occur during the periods that are likely to cause high ground level concentrations. Notwithstanding the intermittent and short term operations of the DPS, the Project will continue to be committed to sourcing low sulphur diesel where commercially available and not excessively expensive.

Mitigation Measures

Although the DPS, when used as an emergency back up during the operational phase, is expected to have the potential to generate ground level concentrations of SO_2 in excess of international ambient air quality guidelines as a function of local diesel sulphur content (see Section 2.4.4.1), the low impact of other stationary combustion sources during operations is reflective of mitigation measures intrinsic in the Project design:

- Stacks for emission sources have been optimised using a recognised dispersion model;
- The permanent waste incinerator is designed and will be managed to international standards in terms of emission limits;
- The CHP will include SO_2 abatement (using lime)[12] and a baghouse to minimise dust emissions (waste will be disposed into the TSF);

[12] The manufacturers of the CFB have indicated that this approach will result in up to 80% removal efficiency of SO_2 from the emissions stream.

- The CHP will utilise a circulating fluidised bed boiler to reduce NOx by the use of low temperature combustion;
- Continuous monitoring will be used on the CHP and waste incinerator to monitor actual emission levels; and
- The waste incinerator (to be constructed at the Waste Management Centre) will include an afterburner that reaches the temperatures required to destroy dioxins and furans, and most volatile organic compounds.

In relation to the CHP, the emissions estimates (*Table 2.4*) suggest that NO_x emissions concentrations will be in excess of international good practice guidelines. While catalytic emissions reduction might be a technically feasible abatement option, this technology requires the use of Ammonia or Urea as a reagent. When the impact of the production and transportation of Ammonia (a highly hazardous substance) is taken into account, together with the reduction in boiler efficiency and together with the potential hazardous waste generated from spent catalysts, the "cross-media" impacts suggest that catalytic emissions reduction is not the best environmental option.

Given that the emissions from the CHP are not predicted to be a significant contributor to ground level concentrations of NO_x, and that no sensitive receptor is identified from the model as being impacted, catalytic emissions reduction is not seen to be a viable emissions reduction option on both environmental impact and cost-effectiveness grounds. The proposed replacement of the CHP by the Oyu Tolgoi Power Plant in Year 4 will remove this emissions source, and the Power Plant is being designed to meet all Lender and Project Standards,

2.4.9 Assessment of Dust from Mining Activities

Dust will be generated during operational mining activities predominately from the movement of vehicles, clearance and transport of ore and waste rock. Dust generated within the Mine Licence Area is highly unlikely to cause nuisance to receptors outside of the Mine Licence Area boundary given that in excess of 90% of total airborne dust returns to the earth's surface within 100 m of the emission source and over 98% within 250 m[13]. However, under strong wind conditions, these effects could extend further. As the closest approach of activities within the Mine Licence Area to permanent receptors is 10 km and temporary receptors is 2 km, dust nuisance is highly unlikely to occur.

Rock blasting in the open pit will be undertaken below ground level and will -generate dust in the immediate vicinity to the blasting activity, but as this will generally be coarser material this will be very local and will not be significant for receptors most closely located to mining activities. Dust from conveyors will be controlled by water suppression where required and feasible (taking account of sub-zero temperatures in the winter).

Mitigation Measures and other Project Commitments

Ambient air quality monitoring throughout the life of the Project will be used to plan the control and continuous improvement of dust mitigation measures. There are no permanent herder winter camps within 10 km of the mine and therefore no herders will be permanently impacted by dust, and dust from the mining is unlikely to cause any significant nuisance issues given the distance from the open pit to the boundary of the Mine Licence Area. Oyu Tolgoi will aim to operate good practice approaches to dust management, address dust sources on an as-needed basis as detailed in *Chapter D2: Atmospheric Emissions Management Plan*. This is particularly applicable where working near to sensitive receptors (such as worker accommodation or close to herder summer shelters) with unfavourable wind conditions. Any actions to control dust through water suppression will be balanced against the Oyu Tolgoi objective of minimising water use on site and where needed and appropriate, other non-water dust palliatives would be used.

2.4.10 Assessment of Dust Generation from the Tailings Storage Facility

The Oyu Tolgoi mine tailings contain fine rock particles which could be susceptible to wind erosion. These tailings will be deposited in the TSF which is divided into two cells each of which covers an area of 2,000 m by 2,000 m. The high evaporation rates in the South Gobi region will serve to dry out the

[13] United States Environmental Protection Agent (USEPA) AP-42

tailings, and the arid, cold climate, with regular freeze/thaw cycles and hot windy summers in the region, could also weather the protective tailings crust surface and promote further wind erosion.

Mitigation Measures and other Project Commitments

A specific assessment of the TSF has been conducted[14] to assess the risk of airborne dust, which examined the impact of different surface conditions on susceptibility to erosion. This study concluded that dust generation is not expected due to crusting tendency of the tailings, however should this not be the case, it could be an issue which would have to be managed through the establishment of interim and final slope restoration, application of appropriate cover material, the use of wet suppression or dust palliatives.

Decommissioning and Closure Impacts and Mitigations

The detailed sequence of site closure activity is still subject to definition and, at this stage, a conceptual closure and reclamation plan has been developed. The dismantling of the processing plant and removal of equipment and rehabilitation of the site will not generate excessive dust impacts and the requirement for significantly less earthmoving will mean that such impacts are substantially less than those faced during construction. Oyu Tolgoi will minimise additional land surface disturbance and ensure that all rehabilitation is undertaken promptly. This will include the Mine Licence Area and the Gunii Hooloi borefield. No additional air quality impacts are expected during the decommissioning phase. Refer to *Chapter D21: Mine Closure and Rehabilitation Framework*.

2.4.11 Residual Impacts after Mitigation

No significant residual impacts are anticipated in terms of air quality provided the mitigation measures proposed are implemented and monitored for effectiveness.

2.4.12 Summary of Impacts and Mitigation Measures

A summary of potential impacts and proposed mitigation measures as described above is summarised below

[14] Klohn Crippen Berger (2007), Oyu Tolgoi: Tailings Dust Emission Potential and Control, December 2007

Table 2.6: Construction and Operational Phase Impacts and Mitigation Measures

Impact	(1) Receptor/ Beneficiary	(2) Phase	(3) Impact Categorisation	(4) Potential Significance	Design and Mitigation Measures	Management Plan	Residual Significance
Deterioration of ambient air quality resulting from DPS operation (up to twenty 2 MW diesel generator units)	*Worker accommodation area, temporary herder camps outside of the Mine Licence Area*	Construction	**Duration:** Short-term **Extent:** Highly localised **Likelihood**: Certain	**Significance**: Major (Adverse)	▪ Assessment of need to retrofit catalytic converters on existing Sunfall units. Retrofitting will be undertaken if demonstrated to be an effective means of improving ambient air quality at key receptors. ▪ All new units (Cummins) to be designed and equipped with air cleaning equipment to international air emission standards. ▪ Sourcing low-sulphur fuel if this is commercially and competitively available.	Air Quality Management Plan	**Minor (Adverse)**
Deterioration of ambient air quality resulting from mobile and stationary equipment	*Worker accommodation area, temporary herder camps outside of the Mine Licence Area*	Construction	**Duration:** Short-term **Extent:** Localised **Likelihood**: Certain	**Significance**: Minor (Adverse)	▪ Adequate maintenance of vehicle and equipment. ▪ Use and maintain vehicles/ equipment in accordance with manufacturer guidelines. Replace vehicles/equipment when condition is seen to be deteriorating excessively. ▪ Speed limitation of 80 km/h in all areas and as low as 10 km/h in sensitive receptor locations (e.g. camps) including tracking of vehicle speeds on GPS system. ▪ Provision of compacted granular wearing course on all graded roads. ▪ Provision of wet dust suppression and/or dust palliatives in sensitive receptor locations. ▪ Restriction on vehicular usage in off-road areas and informal tracks, including tracking of vehicles on GPS system.	Air Quality Management Plan	**Negligible (Adverse)**
Deterioration of ambient air quality as a result of earthworks activities	*Worker accommodation area, temporary herder camps outside of the Mine Licence Area*	Construction	**Duration:** Short-term **Extent:** Localised **Likelihood**: Certain	**Significance**: Minor (Adverse)	▪ Borrow pit locations are and will continue to be consulted upon with communities and any borrow pits seen to cause community concern are not used. Provision of wet dust suppression or dust palliatives in sensitive receptor locations. ▪ Controlled loading and unloading of haulage vehicles. ▪ Undertaking formal rehabilitation of all	Air Quality Management Plan	**Minor (Adverse)**

Impact	(1) Receptor/ Beneficiary	(2) Phase	(3) Impact Categorisation	(4) Potential Significance	Design and Mitigation Measures	Management Plan	Residual Significance
					decommissioned borrow pits, quarries and temporary roads, including re-planting of local vegetation species. ▪ Placement of stockpiled topsoil on completed earthworks surfaces (e.g. road verges) including formal planting of local vegetation species on completed earthworks surfaces (e.g. road verges).		
Deterioration of ambient air quality resulting from stationary combustion source operation during power failure (short term use of the expanded DPS)	*Worker accommodation area, temporary herder camps outside of the Mine Licence Area*	Operation	**Duration:** Short-term **Extent:** Highly localised **Likelihood**: Certain	**Significance**: Major (Adverse)	▪ Retrofitting catalytic converters on existing Sunfall units to international air emission standards. ▪ All new units (Cummins) to be to international air emission standards.	Air Quality Management Plan	**Minor (Adverse)**
Deterioration of ambient air quality resulting from waste incinerator and CHP operations	*Worker accommodation area, temporary herder camps outside of the Mine Licence Area*	Operation	**Duration:** Long-term **Extent:** Highly localised **Likelihood**: Certain	**Significance**: Minor (Adverse)	The existing CHP and waste incinerator used during construction activities will be replaced. The replacement units will have the following features: ▪ Appropriately designed CHP stack configuration. ▪ Incinerator designed and equipped with comprehensive air cleaning equipment to full EU incineration standards. ▪ Design measures described in proceeding section. ▪ CEMS for the hazardous waste incinerator and coal fired boilers	Air Quality Management Plan	**Minor (Adverse)**
Dust generated by mining activities	*Worker accommodation*	Operation	**Duration:** Long-term **Extent:** Highly localised **Likelihood**: Certain	**Significance**: Minor (Adverse)	▪ Provision of wet dust suppression or dust palliatives in sensitive receptor locations.	Air Quality Management Plan	**Negligible (Adverse)**
Deterioration of ambient air quality resulting from concentrate/ materials/	*Worker accommodation area, temporary*	Operation	**Duration:** Long-term	**Significance**: Minor (Adverse)	▪ Adequate maintenance of vehicle and equipment.	Air Quality Management Plan	**Negligible (Adverse)**

Impact	(1) Receptor/ Beneficiary	(2) Phase	(3) Impact Categorisation	(4) Potential Significance	Design and Mitigation Measures	Management Plan	Residual Significance
personnel road transportation	*herder camps outside of the Mine Licence Area*		**Extent:** Localised **Likelihood**: Certain		▪ Use and maintain vehicles/ equipment in accordance with manufacturer guidelines. ▪ Speed limitation of 80 km/hr in all areas and as low as 10 km/hr in sensitive receptor locations including tracking of vehicle speeds using GPS system. ▪ Provision of compacted granular wearing course on all graded roads. ▪ Provision of sealed wearing course on main concentrate road from Oyu Tolgoi to Gashuun Sukhait. ▪ Restriction on vehicular usage in off-road areas and informal tracks, including tracking of vehicles on GPS system. ▪ Provision of wet dust suppression and/or dust palliatives in sensitive receptor locations.		

2.5 GREENHOUSE GAS EMISSIONS

Greenhouse Gases (GHGs) reflect those constituents of the atmosphere that are capable of absorbing and emitting radiation within the thermal infrared range. This process is the fundamental cause of the 'greenhouse effect', a natural phenomenon caused by atmospheric constituents which include water vapour and carbon dioxide (CO_2).

Of global concern, the 'man-made' greenhouse effect is the enhancement of Earth's natural greenhouse effect by the addition of GHGs from the burning of fossil fuels (mainly petroleum products, coal, and natural gas).

This section provides a summary of the key sources of GHG associated with the Oyu Tolgoi Project, in addition to mitigation measures and management practices for on-going GHG quantification and reductions[15].

This section also provides a summary of international agreements, and guidelines applicable to the Project.

2.5.1 International Protocols and Agreements – the Kyoto Protocol

The Kyoto Protocol is a protocol to the United Nations Framework Convention on Climate Change (UNFCCC), an international treaty produced at the United Nations Conference on Environment and Development (UNCED), informally known as the Earth Summit, held in Rio de Janeiro, Brazil, from 3–14 June 1992. The treaty is intended to achieve "*stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.*"

The Kyoto Protocol establishes legally-binding commitments for the reduction of four greenhouse gases (carbon dioxide, methane, nitrous oxide, sulphur hexafluoride), and two groups of gases (hydrofluorocarbons and perfluorocarbons) produced by "*Annex I*" (industrialised) nations, as well as general commitments for all member countries.

At the time of writing there were 193 parties to the protocol which was initially adopted for use on 11 December 1997 in Kyoto, Japan and which entered into force on 16 February 2005. Mongolia ratified the Kyoto Protocol in 1999.

2.5.2 Equator Principles and IFC Performance Standards

The Equator Principles are a common set of principles agreed by the majority of the world's leading financial institutions that define basic environmental and social standards to be met when lending to major investments such as the Oyu Tolgoi Project. Essentially, the Equator Principles commit financial institutions to ensuring that projects to which they lend comply with IFC Performance Standards and EHS Guidelines.

With regards to GHGs, IFC guidelines as set out in *Performance Standard 1: Social and Environmental Assessment and Management Systems* which states that "*Risks and impacts will be analysed for the key stages of the project cycle, including preconstruction, construction, operations, and decommissioning or closure*" and "*the Assessment will also consider potential trans-boundary effects, such as pollution of air, or use or pollution of international waterways, as well as global impacts, such as the emission of greenhouse gases*"[16].

Guidance Note for Performance Standard 3: Pollution Prevention and Abatement (para 34) states "*Clients are encouraged to disclose their GHG emissions annually through corporate reports, or through other voluntary disclosure mechanisms currently being used by private sector companies internationally".*

[15] Greenhouse Gas Emissions Inventory and Initial Estimate, August 2011, Sustainability

[16] EBRD has similar requirements in Performance Requirement 3: Pollution Prevention & Abatement, paras 17, 18 &19.

2.5.3 GHG Emission Estimate Methodology

The GHG emissions inventory was developed in 2010 in accordance with international good practice and 0in line with the Rio Tinto Greenhouse Gas Emissions Standard (2008). The scope of work for the development of the Greenhouse Gas Emission Inventory included the following steps:

- Identifying current and future greenhouse gas emission sources;
- Collecting and/or estimating emission values for each source;
- Applying calculation technique (IFC Greenhouse Gas Emissions Calculator);
- Recording emission estimates during construction and production;
- Disaggregating total emissions into the three World Business Council's Sustainable Development (WBCSD) reporting categories, which are:
    - Direct emissions;
    - Energy related emissions; and
    - Indirect emissions.
- Producing a report outlining all emissions which will guide Oyu Tolgoi personnel on future data collection requirements.

A copy of the Greenhouse Gas Inventory Report is attached as *Annex C2-A*.

The emission of GHGs during construction and operations are released from a number of activities that are common to both phases (for example use of vehicles for mining and transportation). Additionally, there are significant sources of GHG associated the operational phase (for example the operation of the CHP). As emissions occur from a range of sources, key emission factors during both of these phases of the Project have been considered.

The inventory has considered:

- Direct GHG emissions: those produced by activities under the control of Oyu Tolgoi; and
- Indirect GHG emissions: those produced by third parties for goods or services consumed by the Project.

The key GHG emission generating activities considered in the inventory for the Oyu Tolgoi Project include:

- Vegetation clearing;
- Building construction;
- Road construction;
- Other construction; and
- Fuel use – mobile vehicles.
    - Onsite vehicles;
    - Supply vehicles;
    - Personnel transport – air; and
    - Personnel transport – road.
- Fuel use – stationary combustion
    - Diesel generators; and
    - Boilers.
- Electricity consumption; and
- Waste.
    - Landfill;

- Compost;
- Incinerated; and
- Recycled.

- Explosives; and
- Process inputs – chemicals.

There are several types of greenhouse gases emitted from Project related activities. A very high proportion of the emissions of GHG emitted from the Oyu Tolgoi Project will be CO_2. In addition, there might be some minor emissions of methane (CH_4) and nitrous oxide (N_2O). It is standard practice for emissions of the different types of GHG to be estimated and presented as tonnes of CO_2-equivalent (CO_2-eq) to capture all GHG emissions. The principal source of factors for GHG estimates is the IFC Greenhouse Gas Emissions Calculator[17].

2.5.4 Construction Phase Impacts and Mitigation measures

According to the current estimate, the total annual average greenhouse gas emissions for the Oyu Tolgoi Project during the construction phase will be 1,350,000 tonnes CO_2-eq / year.

The key direct sources of GHG during the construction phase include the operation of mobile and stationary construction equipment using diesel fuel.

Mitigation Measures and other Project Commitments

Oyu Tolgoi is committed to supporting informed action to stabilise and potentially reduce GHG concentrations through sustainable long-term emissions reduction programmes that do not entail excessive cost. Notwithstanding this commitment, many of the emission sources during construction period may be impossible to avoid, which is particularly true of diesel consumption from the DPS, coal combustion at the small-scale coal-fired boilers, and diesel consumption by vehicles and other stationary plant.

Areas where GHG emissions may be reduced include the development of procurement plans that target suppliers with good standards of environmental management, and particularly the implementation of energy efficiency programmes (that will particularly focus on the efficient use of fuel, maintenance of engines, etc.).

2.5.5 Operational Phase Impacts and Mitigations

The direct emissions of GHGs during the operational phase of the Project will mainly arise as a result of coal combustion from the CHP (the major source) and diesel consumption from vehicles and the DPS. It is estimated that the annual average emissions of greenhouse gases during the operational phase will be 1,850,000 tonnes CO_2-eq /year. This includes the consumption of electricity generated in China, but does not include a future Mongolian power supply to replace Chinese power, as required under the terms of the Oyu Tolgoi Project Investment Agreement. Changes to the power supply will be reflected in the preparation of a revised and updated greenhouse gas emissions estimate. Greenhouse gas emissions from a power plant located in Mongolia and built to supply the Oyu Tolgoi Project would be addressed as part of the scope for a supplemental ESIA for the Oyu Tolgoi Power Plant.

Mitigation Measures and other Project Commitments

Similarly to the construction phase, emissions of GHG will be unavoidable, although certain measures will be adopted to manage, record and potentially reduce emissions of GHG:

- Oyu Tolgoi will develop protocols to record applicable data during operations for the on-going maintenance of the GHG inventory;
- Oyu Tolgoi will develop a GHG policy committing the company, at a management level, to recording and where practicable reducing GHG emissions during operations; and

[17] Greenhouse Gas Emissions Inventory Management Plan for Internal Business Operations 2009

- Energy efficiency will be used as a KPI for production operations in terms of CHP performance, concentrate production (using imported power) and diesel consumption by mining equipment and other transport related emissions. Energy efficiency will have an economic benefit for the Project with consequently and proportionate reductions of either direct or indirect GHG emissions.