



Oyu Tolgoi LLC

Health, Safety, Environment, Security and Communities

Mineral Waste Management Plan

Mineral Waste Management Plan		
Effective Date: 2013.09.01	Document Number: OT-10-E13-PLN-0001-E	Version: 1.4

CONTENTS PAGE

1	INTRODUCTION	4
1.1	PURPOSE.....	4
1.2	APPLICATION.....	4
1.3	COMMENCEMENT.....	4
1.4	AUTHORITY AND MANAGEMENT	4
2	SCOPE.....	5
2.1	SCOPE OF THIS MANAGEMENT PLAN.....	5
2.2	OVERLAPS WITH OTHER MANAGEMENT PLANS	5
3	ROLES AND RESPONSIBILITIES.....	5
3.1	KEY ROLES AND RESPONSIBILITIES FOR MANAGEMENT PLAN IMPLEMENTATION	5
3.2	KEY INTERFACES.....	6
4	PROJECT STANDARDS	6
4.1	APPLICABLE MONGOLIAN LAWS AND NATIONAL STANDARDS.....	7
4.2	DEIA REQUIREMENTS.....	8
4.3	OTHER COMMITMENTS TO AND REQUIREMENTS OF MONGOLIAN GOVERNMENT AUTHORITIES	8
4.4	APPLICABLE INTERNATIONAL STANDARDS AND GUIDELINES	9
4.5	APPLICABLE RIO TINTO STANDARDS.....	9
4.6	SUMMARY OF APPLICABLE PROJECT STANDARDS	9
5	MANAGEMENT CONTROLS.....	9
5.1	GENERAL APPROACH TO WASTE MANAGEMENT.....	9
5.2	WASTE MANAGEMENT PLANNING	10
5.3	IMPLEMENTATION AND OPERATION	10
6	IMPLEMENTATION SCHEDULE	17
6.1	REVIEW AND REVISION OF THIS MANAGEMENT PLAN	17
7	MONITORING.....	17
7.1	OVERVIEW OF MONITORING REQUIREMENTS.....	17
7.2	KEY PERFORMANCE INDICATORS	17
7.3	KEY MONITORING ACTIVITIES.....	19
8	TRAINING.....	21
8.1	OVERVIEW	21
8.2	INDUCTION TRAINING	21
8.3	JOB-SPECIFIC TRAINING	21
8.4	OTHER TRAINING REQUIREMENTS	21
9	AUDIT AND REPORTING.....	21
9.1	INTERNAL AUDITING.....	21
9.2	EXTERNAL AUDITING.....	21



Mineral Waste Management Plan		
Effective Date: 2013.09.01	Document Number: OT-10-E13-PLN-0001-E	Version: 1.4

9.3 RECORD KEEPING..... 21

10 DOCUMENT CONTROL..... 22

TABLES

Table 1: Key Roles and Responsibilities..... 5

Table 2: Key Management Controls 13

Table 3: Key Performance Indicators – Mineral Waste Management 17

Table 4: Key Monitoring Measures 19

Mineral Waste Management PlanEffective Date:
2013.09.01Document Number:
OT-10-E13-PLN-0001-EVersion:
1.4**1 INTRODUCTION****1.1 Purpose**

The purpose of this Management Plan is to:

- define the scope of the Management Plan and set out applicable management interfaces;
- define roles and responsibilities;
- outline the applicable Project Standards relevant to this Management Plan;
- define Project commitments, operational procedures and guidance relevant to this Management Plan and indicate OT Environmental Policy requirements that this Plan addresses;
- define monitoring and reporting procedures, including Key Performance Indicators (KPIs);
- defined training requirements; and
- establish, where necessary, references for supporting materials, system and operating procedures, and other information necessary or relevant to the implementation of this Mineral Waste Management Plan.

1.2 Application

The requirements set out in this Management Plan apply to all OT activities including contractors.

This Management Plan is based on the Rio Tinto Environment Standard for Chemically Reactive Mineral Waste Management (Nov-2017).

1.3 Commencement

This Management Plan applies from 1 January 2013.

1.4 Authority and Management

The OT Executive Committee approved this Management Plan on 1st September 2013.

The OT General Manager Health Safety, Environment, Security and Communities (HSESC) is the custodian of this Management Plan. This Management Plan will be reviewed on a two year period to determine whether any changes or updates are required to the plan unless a more frequent update is required to reflect changing Project design or procedures. Any requests for changes to this Management Plan will be subjected to the appropriate review and approval processes as outlined in the Management of Change (MOC) procedure.

Mineral Waste Management Plan		
Effective Date: 2013.09.01	Document Number: OT-10-E13-PLN-0001-E	Version: 1.4

2 SCOPE

2.1 Scope of this Management Plan

This Management Plan covers all OT operations including contractor activities.

Mineral waste comprises waste rock, overburden, tailings and ash e.g. from the Central Heating Plant. Ash will be disposed of to the mineral waste rock dumps (WRDs), as a non-acid forming (NAF) waste, where it will be encapsulated and therefore isolated from surface exposure upon closure.

This Management Plan covers all OT operations including contractor activities within and outside the Mine Licence Area. Implementation by contractors is addressed in the Contractor Management Framework (OT-07-PLN-9001).

2.2 Overlaps with other Management Plans

This Management Plan is part of the overall suite of Operations Management Plans developed for the OT Project and as described in the Environmental and Social Management Plan Framework (ESMP) (OT-10-PLN-0003).

This Management Plan has overlaps and cross-linkages to a number of other Management Plans, including:

- the Emergency Preparedness and Response Plan (OT-12-PLN-0011) in relation to accidental contamination of surface and groundwater resources and Tailings Storage Facility emergency response plan;
- the Land Disturbance Control and Rehabilitation Management Plan (OT-10-E14-PLN-0005), particularly in relation to the management of soils and the restoration of disturbed lands;
- the Water Resources Management Plan (OT-10-E11-PLN-0001), particularly in relation to potential impacts to water resources from Waste Rock Dumps (WRDs) and the Tailings Storage Facility (TSF); and
- the Mine Closure Plan (OT-10-E9-PLN-0002), particularly in relation to the restoration of the TSF and WRDs.

3 Roles and Responsibilities

3.1 Key Roles and Responsibilities for Management Plan Implementation

Principal roles and responsibilities for the implementation of this plan are outlined below.

Table 1: Key Roles and Responsibilities

Role	Responsibilities
General Manager Health, Safety Environment, Security and Communities	<ul style="list-style-type: none"> • Ensure adequate resources to allow implementation of mineral waste monitoring, mitigation, research and development activities.
Environmental Manager	<ul style="list-style-type: none"> • Submit and implement annual Environmental Management Plans. • Develop Annual Environmental Reports that describe any notable mineral waste achievements during the course of the year.

Mineral Waste Management Plan		
Effective Date: 2013.09.01	Document Number: OT-10-E13-PLN-0001-E	Version: 1.4

Role	Responsibilities
	<ul style="list-style-type: none"> Support Departmental Managers and Principal Contractors in the deployment of the Mineral Waste Management Plan.
Water and Waste Team Leader	<ul style="list-style-type: none"> Develop an annual Environmental Monitoring Plan for mineral waste. Develop mineral waste sections of the Annual Environmental Report that describe research, monitoring and impact mitigation activities for submission to the Ministry of Environment and Tourism. Implement environmental aspects of the <i>OT Integrated Mineral Waste, Acid Rock Drainage and Dump Management Plan</i>.
Open Pit and Underground Departments and Principal Contractor Managers	<ul style="list-style-type: none"> Undertake activities in accordance with this Management Plan. Utilise competent personnel for mineral waste management activities. Report all non-conformances and incidents and investigate as appropriate. Implement operational aspects of the <i>OT Integrated Mineral Waste, Acid Rock Drainage and Dump Management Plan</i>.
Workplace Supervisors / Superintendents	<ul style="list-style-type: none"> Provide oversight and conduct routine work area inspections to monitor conformance of activities relative to the requirements of this Management Plan. Record and report all mineral waste data.
All employees and contractors	<ul style="list-style-type: none"> Report any activities which could result in mineral waste having an impact on the environment. Report any activities which are in contravention to this Management Plan.

3.2 Key Interfaces

Key interfaces in the implementation of this Management Plan (i.e. roles with responsibility for delivering elements of this Management Plan) include:

- Open Pit and Underground Department, particularly in relation to the protection of land and water resources from WRDs and potentially acid forming (PAF) waste materials, and ensuring that the WRDs are constructed, capped and closed in accordance with this plan and associated documents.
- Mine Technical Services Department, particularly in relation to structural stability at mine mineral waste disposal structures and the protection of groundwater resources at Tailings Storage Facility

4 Project Standards

Applicable Standards must be complied with for all Oyu Tolgoi activities (the “Project Standards”). Oyu Tolgoi Standards comprise:

Mineral Waste Management Plan		
Effective Date: 2013.09.01	Document Number: OT-10-E13-PLN-0001-E	Version: 1.4

- applicable Mongolian National Standards;
- DEIA requirements;
- other commitments to and requirements of Mongolian Government authorities;
- applicable Lender standards and guidelines;
- applicable Rio Tinto standards; and
- other industry guidelines with which OT has committed to comply.

4.1 Applicable Mongolian Laws and National Standards

Mongolian Standards and Regulations

Mongolian environmental laws applicable to the management of mineral waste include:

- *Law on Subsoil*, 1988 and amended in 2005, which regulates the use of sub-surface materials including both economic mineral materials and non-mining related activities and prescribes the requirements for subsoil use during mining.
- *Law on Land*, 1994 and amended in 2015, regulates possession and use of state-owned land and other related issues including minimisation of environmental impact and disturbed land restoration. Land must be monitored, protected, restored and used efficiently for its permitted use. Any activities that may cause damage to human health; nature and ecological balance; or national security are prohibited. Foreign countries, international organisations, legal entities and citizens may become users of land for a specific purpose and a specific time period subject to contract conditions and in compliance with the law.
- *Law on Air*, 2012. This revised law regulates the protection of air and prevention from air pollution in order to ensure the human right to live in a healthy and safe environment, and maintain environmental balance for present and future generations. The law establishes a licensing system for certain sources of stationary pollution, and imposes fees for certain levels of pollution. Licences are required to be obtained from the local Governor.
- *The Law on Air Pollution Fee* (In force on 24th June, 2010 and amended on 23rd June, 2012) imposes an air pollution payment and a payment collection process. Emissions monitoring and a pollution mitigation technology, including Greenhouse Gas ('GHG') mitigation technology is required in all new or expanded facilities in line with international standards. The legislation also provides for a fee payment system with respect to emissions released into the atmosphere. Air Fee Laws prescribe these fees in more detail.
- *Law of Mongolia on Water*, 2012. This revised law makes provision to regulate issues arising from the protection, use and recovery of water and its basins. It sets out a regime for an inventory of water resources and outlines the powers bestowed to, and responsibilities required, across all levels of governance within Mongolia with regards to water issues. Re-use of wastewater by a legal entity is encouraged. Water use/pollution fees must be paid by the water user or persons who produce wastewater during as part of a commercial operation. A water pollution fee is determined by and collected in accordance with the procedures set forth with the Law on Water Pollution Fee, 2012. Fee amount varies from MNT 100 to 500 per kilogram.
- *Law of Mongolia on Environmental Impact Assessment*, 2012. This revised version of the Law of Mongolia on Environmental Impact Assessment which came into force 23rd June 2012 addresses the environmental impact assessment(s). Under this law a license holder must have an environmental protection and management plans which include waste rock management procedure.

Mineral Waste Management Plan		
Effective Date: 2013.09.01	Document Number: OT-10-E13-PLN-0001-E	Version: 1.4

- *Law on Waste*, 2017, this law regulates the collection, transportation, storage, reuse, and disposal of waste(s). Any business entity must meet the requirements stipulated by laws and standards in their waste handling.
- *Safety Rules for Open Pit Mines* (Approved by Minister of Industry and Trade, Order No. 98 of 2003). These safety rules cover certain regulations on waste rock and water drainage in mining companies exploiting mineral deposits by open pit mining methods within the territory of Mongolia.

Mongolian Standards and Regulations that include requirements associated with mineral waste management include:

- MNS 4943:2011 *Treated Waste Water to be Discharged to the Environment*;
- MNS 4916:2000 *Environment. Rehabilitation of disturbed land during open mining of ore gold deposits; and*
- MNS 5917:2008. *Environment. Reclamation of land disturbed by mining activities. General technical requirements*;
- MNS 3342:1982 *General requirements for protection of underground water*.

4.2 DEIA requirements

Mineral waste management and monitoring requirements set out in Environmental Protection Plans and Environmental Monitoring Plans which accompany DEIAs have been incorporated into this Management Plan.

4.3 Other Commitments to and Requirements of Mongolian Government Authorities

The key document setting out commitments to the Mongolian Government authorities is the Investment Agreement (dated 6 October 2009) for the OT Project. Chapter Six (Environment) does not refer specifically to mineral waste management; however the following articles (6.4, 6.9 and 6.10) are relevant:

- The Investor shall meet all costs for each year of implementing an environmental protection plan ("EPP") and environmental monitoring and analysis programme, in connection with implementation of the OT Project and shall provide to the State central administrative authority in charge of environment a report, prepared by a certified, independent, professional firm, on addressing the Investor's implementation of the measures specified in the EPP every 3 (three) years.
- The Investor shall submit annually a report detailing its comprehensive environmental monitoring and analysis programme associated with Core Operations to the State central administrative authority in charge of environment.
- If any material adverse impact on air, water, soil, animals, plants and subsoil is found by the environmental monitoring and analysis programme, the Investor shall take necessary measures to eliminate such material adverse impact at the Investor's expense.

Mineral Waste Management Plan		
Effective Date: 2013.09.01	Document Number: OT-10-E13-PLN-0001-E	Version: 1.4

4.4 Applicable International Standards and Guidelines

The international standards which OT will implement are those set by the International Finance Corporation (IFC) and by the European Bank for Reconstruction and Development (EBRD). These include:

- IFC *Environmental, Health, and Safety General Guidelines* (April 2007);
- IFC *Environmental, Health, and Safety Guidelines for Mining* (December 2007);
- IFC *Performance Standards on Environmental and Social Sustainability* (2006) (particularly PS1: *Social and Environmental Assessment and Management Systems* and PS3 *Pollution Prevention and Abatement*); and
- EBRD *Performance Requirements* (2008) (particularly PR1: *Environmental and Social Appraisal and Management* and PR3: *Pollution Prevention and Abatement*).

In addition, this Management Plan has taken into account the following examples of international good practice:

- EU - Directive 2006/21/EEC on the *Management of Waste from Extractive Industries*.
- EC Reference Document on *Best Available Techniques for Management of Tailings and Waste-Rock in Mining Activities* (January 2009).

4.5 Applicable Rio Tinto Standards

The primary Rio Tinto Standard that applies to mineral waste management is Environment Standard Chemically reactive mineral waste management (2017).

4.6 Summary of Applicable Project Standards

OT will comply with the more stringent of national standards, applicable lender standards and applicable Rio Tinto Standards, with the more stringent standards representing the Project Standards. In the case of Mineral Waste standards the successful implementation of this management plan will be measured on compliance with the standards for water quality (see Water Resources Management Plan OT-10-E11-PLN-0001) and air emissions related to dust (see Atmospheric Emissions Management Plan OT-10-E12-PLN-0001).

5 MANAGEMENT CONTROLS

5.1 General Approach to Waste Management

The general intent of this management plan is to ensure sound mineral and process waste management at OT by ensuring the safe handling, treatment and disposal of generated mineral wastes. This is achieved through ensuring that the mineral waste disposal facilities and sites are physically, biologically and chemically safe and secure. Mineral waste production and the resulting disturbed footprints shall be minimised and opportunities sought for waste re-use, in-pit backfilling and progressive rehabilitation where feasible and economic.

This will include mineral waste re-use through the re-use of topsoil and alluvial sands and gravels in other constructions and site rehabilitation. PAF and NAF waste rock are extensively used for TSF embankment construction and NAF and acid neutralising materials will be used in post-mining landforms for cover material, physical stability and acid buffering capabilities.

Mineral Waste Management Plan		
Effective Date: 2013.09.01	Document Number: OT-10-E13-PLN-0001-E	Version: 1.4

Progressive rehabilitation and cover of mining sites, particularly WRDs, will be undertaken as often as reasonably practicable, with the objective of creating a safe and sustainable landform, which resembles, in as far as is feasible, the hills in the surrounding landscape.

5.2 Waste Management Planning

OT will implement a mineral waste management planning approach to identify, assess and document the quantities, physical and chemical characteristics and hazards of the wastes that will be generated by mining and processing of each distinct section of the mineral deposit. This will be developed in accordance with the OT Integrated Mineral Waste, Acid Rock Drainage and Dump Management Implementation Plan and will enable OT to manage its mineral waste inventory and maintain an up to date conceptual model of the long-term physical and chemical waste behaviour and impacts on the environment. This will be validated using data from testing and monitoring.

The OT Integrated Mineral Waste, Acid Rock Drainage and Dump Management Plan contains:

- a summary assessment of the chemical and physical hazards posed by the waste and disposal facilities;
- the measures to mitigate the chemical and physical hazards;
- assignment of clear accountabilities and responsibilities for mineral waste management and for implementing the management plan on an on-going basis under actual field conditions;
- detailed on-going monitoring and data collection requirements; and
- guidance on emergency plans and contingency measures for response to unplanned conditions or unexpected impacts.

5.3 Implementation and Operation

This Mineral Waste Management Plan will be implemented by means of the OT Integrated Mineral Waste, Acid Rock Drainage and Dump Management Plan.

In addition to the OT Integrated Mineral Waste, Acid Rock Drainage and Dump Management Plan, which is related to the appropriate segregation, transport, storage and management of waste rock material the Plan is supported by the following Procedures. These present more details on specific aspects of the day-to-day mineral waste management activities at OT:

- Topsoil Handling Procedure (OT-10-E14-PCR-0001), related to the removal, handling and storage of topsoil;
- Tailings Storage Facility Project Execution and Management Plan, related to management of the tailings waste material; and
- Water Monitoring Plan (OT-10-E11-PLN-0002).

In addition, the following Procedures will support implementation of the Rio Tinto Chemically reactive mineral waste management Standard:

- Risk Register preparation under Element 3 of the OT HSESC MS (OT-03-PRC-0001-E Hazard and Risk Management).

The following table presents the key management controls that OT will implement as part of this Plan.

Mineral Waste Management Plan

Effective Date:
2013.09.01

Document Number:
OT-10-E13-PLN-0001-E

Version:
1.4

5.4 ONGOING CHARACTERIZATION AND MODELLING PROGRAMS

A large geochemical data set is already available, and it needs a continuous update as mining progresses.

- **Waste Rock and Ore**

All drill hole samples including Leco total sulfur and total carbon as part of the routine analytical suite. These data are used to refine the sulfur block model which is used for waste rock NAF and PAF segregation, to refine predictions of tailings chemistry and to predict water chemistry in the open pit and block caves at closure.

Selected blast hole samples are used for the analysis of total sulfur and total carbon at an onsite laboratory to provide real time data for NAF/PAF segregation, to support block model refinement and to provide QA/QC checks on the block model.

Analytical procedures should include full acid base accounting (total sulfur, total carbon and acid neutralization capacity) and single addition net acid generation (NAG) testing on all samples, followed by additional more specialized testing on a subset of the samples.

- **Tailings**

A representative whole tailings samples collected on a quarterly basis for full acid base accounting and NAG testing. When composite samples are available from the concentrator, then a sample representative of the entire quarter should ideally be used. If composite samples are not available then a composite or grab sample should be obtained for analysis on a monthly basis. Information on the ore feed characteristics during the production period represented by the tailings sample should also be compiled. At a minimum the head data should include total sulfur, carbon, total metals (particularly Cu) and the deposits contributing to the ore feed.

5.5 OPEN PIT AND BLOCK CAVE MANAGEMENT

The Oyu ore bodies are accessed via open pit mining and the Hugo ore bodies will be mined by block caving. It is anticipated that PAF rock will be exposed on the open pit walls and will be present within the block cave rubble zones. Contact water that collects in the bottom of the open pit and underground workings is likely to have either low pH, high salinity and/or metals concentrations above internationally recognized guideline values for release to the environment. All water pumped from the open pit or underground workings are discharged to the process water circuit. If the water is acidic it will be rapidly neutralized within the much larger volume of the alkaline process water circuit. Any precipitates generated during the neutralization process will be co-disposed within the much larger mass of tailings. Radial groundwater flow towards the open pit and underground workings will be maintained throughout operation, so the risk of contaminant release to surrounding groundwater will be negligible.

At closure it is likely that a small ephemeral or perennial pit lake will form in the bottom of the open pit. Given that evaporation is much greater than precipitation, the lake will not recover to the pre-mining water table and radial groundwater flow conditions should persist in perpetuity. There will not be any surface water or groundwater outflows from the open pit, so the risks to down gradient water resources will be negligible. Contact water from the waste rock dumps and/or the TSFs could be diverted into the open pit for evaporation as part of a long term water management strategy.

The dewatered rock mass within and surrounding the block caves will slowly relood after closure. During reflooding radial groundwater flow will be maintained towards the underground workings and the fractured rock mass, but eventually the groundwater table will recover to near the pre-mining level and flow-through conditions may be re-established. When this occurs contaminated water may begin to move laterally out of the block cave area. However, there should not be any surface water outflows

Mineral Waste Management PlanEffective Date:
2013.09.01Document Number:
OT-10-E13-PLN-0001-EVersion:
1.4

from the block cave footprints. As the residual mineralized rock mass refloods, oxygen ingress will be controlled and sulfide oxidation will be dramatically reduced. The block caves are unlikely to be an ongoing source of ARD after flooding is completed. However, water chemistry within the block cave workings and rubble zone will need to be estimated as part of the closure planning process. If required, block cave post-closure water quality could be improved by measures such as rapid reflooding of the most strongly acid generating material or the introduction of extra alkalinity during reflooding. A hydrogeologic connection with the open pit could also be created to direct groundwater flow from the block caves to the pit floor for evaporation and to maintain perpetual radial flow towards the underground workings.

Mineral Waste Management Plan		
Effective Date: 2013.09.01	Document Number: OT-10-E8-PLN-0001-E	Version: 1.2

Table 2: Key Management Controls

ID	Applicability / Activity	Control Description	Responsible Parties	Means of verification
MW01	Topsoil salvage and segregation	Prior to disturbing an area by construction (WRDs, stockpiles, TSFs and other infrastructure) or mining activities, topsoil, alluvial sand and gravels must be stripped and transported to an approved, storage location. This will be undertaken in accordance with the Land Disturbance Control and Rehabilitation Management Plan.	HSESC Department – Environmental Team Operational Departments	Internal audit programme Land Disturbance Permit
MW02	Undai River diversion	Waste rock will not be placed in the Undai River channel until the Undai Diversion dam has been completed.	Open Pit Department	Complete-no monitoring required
MW03	Undai River diversion	An impermeable impoundment will be built across the inactive Undai River channel on the southern (down gradient) side of the South WRD. The impoundment will include a collection pond upstream, which receives seepage or runoff from the WRD, any water collected will either be allowed to evaporate, or be managed in accordance with the Water Monitoring Plan.	Construction Department	Complete-no monitoring required
MW04	Mineral Waste segregation	Waste rock, unconsolidated overburden and low grade ore will be segregated based upon copper content, total sulphur content and texture in accordance with the OT Integrated Mineral Waste, Acid Rock Drainage and Dump Management Plan.	Surface Operation – Mine Technical Services for Open Pit Mining Underground Mine – Mine Technical Services for Underground Mine	Internal audit programme

Mineral Waste Management Plan		
Effective Date: 2013.09.01	Document Number: OT-10-E8-PLN-0001-E	Version: 1.2

ID	Applicability / Activity	Control Description	Responsible Parties	Means of verification
MW05	Mineral Waste segregation	All rock in the Shaft 1 development rock stockpile is considered PAF. The Shaft 1 development rock stockpile will be managed as a PAF stockpile until final disposition to the open pit PAF waste rock dump or a PAF zone of the TSF construction.	Underground Mine - Mine Technical Services	Geotechnical inspection
MW06	Mineral Waste segregation	All NAF and PAF rock will be placed in an integrated (servicing all shafts/inclines) underground mine waste rock dump that is managed and monitored in accordance with PAF standards. Same NAF rock may be placed in temporary stockpiles for reuse as construction / closure material, or else will be placed in the integrated underground mine waste rock dump.	Underground Department - Mine Technical Services	Mineral Waste Inventory Geology and Sulphur Testing Results for any reused NAF
MW07	Segregated oxide material	Segregated oxide material (SOM) will be stockpiled separately in the SOM Stockpile and treated as PAF and managed accordingly until it is either processed or capped.	Surface Operation – Mine Technical Services	Mineral Waste Inventory Geochemical analysis
MW08	Central Heating Plant Ash	Ash from the Central Heating Plant will be treated as PAF and encapsulated in the WRD.	Infrastructure - Central Heating Plant	Mineral Waste Inventory
MW09	Acid Rock Drainage	The overarching Acid Rock Drainage (ARD) control strategies for the waste rock dumps and stockpiles will comprise: 1) segregation and separate handling of NAF and PAF material; 2) containment of any contact water within the operation footprint, and 3) construction of NAF waste rock store and release covers over final PAF waste rock surfaces.	Surface Operation – Mine Technical Services Underground Department - Mine Technical Services	Mineral Waste Inventory Geochemical analysis

Mineral Waste Management Plan		
Effective Date: 2013.09.01	Document Number: OT-10-E8-PLN-0001-E	Version: 1.2

ID	Applicability / Activity	Control Description	Responsible Parties	Means of verification
MW10	Waste rock landform	The WRDs, low grade stockpiles and the SOM dump will not exceed 90 m in height above the average land surface to minimise aesthetic impacts, with each lift being not higher than 30 m in height.	Surface Operation – Mine Technical Services	Routine Survey
MW11	Waste rock landform	Final outer slopes of WRDs, low grade stockpiles and the SOM dump will be stair-stepped so that the overall toe to crest slope does not exceed 22 degrees (2.5:1 horizontal: vertical) and that no slope segment will exceed 26 degrees (2:1) after re-contouring.	Surface Operation – Mine Technical Services	Routine Survey
MW12	Waste rock Dump Closure	All PAF materials will be capped with NAF cover material when they are closed or during operations in order to protect runoff water quality, minimise infiltration, control wind erosion and allow vegetation establishment.	Surface Operation – Mine Technical Services	Rehabilitation records
MW13	WRD Management	The geotechnical and geochemical behaviour of the WRDs will be managed and monitored throughout operation and into closure, to ensure that there are no significant environmental or geotechnical risks. Any areas of concern will be subject to appropriate corrective actions to mitigate them.	Surface Operation – Mine Technical Services Underground Department - Mine Technical Services	Geotechnical Inspection Geochemical assessment (TSF) Waste Rock Material Inventory
MW14	TSF Management	The TSF shall be constructed to meet the design criteria detailed in the “ <i>OT Tailings Storage Facility Project Execution and Management Plan</i> ”. The TSF embankment has been designed and constructed to minimize the contact of tailings seepage water with PAF waste rock in order to minimise the potential for ARD formation.	Surface Operation – Mine Operation Department	Annual Design Report QA/QC Construction Report

Mineral Waste Management Plan		
Effective Date: 2013.09.01	Document Number: OT-10-E8-PLN-0001-E	Version: 1.2

ID	Applicability / Activity	Control Description	Responsible Parties	Means of verification
MW15	TSF Management	TSF embankments, WRDs and stockpiles will be visually inspected on a regular basis to identify unacceptable lateral displacement, settlement or erosion during construction and operation	Surface Operation – Mine Operation Department Underground Department - Mine Technical Services	Geotechnical Inspections
MW16	TSF Closure	When final tailings surfaces are created they will be progressively capped with NAF waste rock covers and re-vegetated to minimise the total exposed inactive tailings surface area and reduce the risk of wind erosion.	Surface Operation – Mine Operation Department	Rehabilitation records
MW17	Surface water management	Surface water and any shallow seepage from the WRDs and TSF will be managed through a series of perimeter drains and sumps, which will prevent the uncontrolled release of water and maximise the potential to recycle this water.	Surface Operation – Mine Operation Department	Geotechnical inspection TSF Seepage monitoring report
MW18	Surface water management	All contact water from the open pit, block caves, WRDs, stockpiles and TSFs will be retained on site and be discharged into the process water circuit or be put to other beneficial use.	Surface Operation – Mine Operation Department Surface Operation – Concentration Operation Department	Water balance

Mineral Waste Management Plan		
Effective Date: 2013.09.01	Document Number: OT-10-E8-PLN-0001-E	Version: 1.4

6 IMPLEMENTATION SCHEDULE

6.1 Review and Revision of this Management Plan

This Management Plan will be reviewed every two years or more frequently when operational or environmental conditions so dictate.

If material changes to operating procedures are required (as identified through the Management of Change Procedure (OT-11-PRC-0001) contained within the OT HSECS Management System), this Management Plan may be updated on an “as required” basis.

Any revisions to this Management Plan will be uploaded to the OT Portal to ensure that all OT staff have access to the latest version of this Management Plan.

7 MONITORING

7.1 Overview of Monitoring Requirements

The Monitoring measures that are to be implemented during the operations phase to assess compliance with Project Standards (see *Section 4: Project Standards*) are described in the Integrated Mineral Waste, Acid Rock Drainage and Dump Management Plan and associated procedures (e.g. Procedures set out within the Water Monitoring Plan).

In the event that monitoring identifies non-conformance with Project Standards, these will be investigated and appropriate corrective actions identified (see Element 14 Non-conformance incident and action management of the OT HSECS MS).

7.2 Key Performance Indicators

The Key Performance Indicators (KPIs) which will be used by OT to assess its performance with regards to mineral waste management are presented in *Table 3* below.

Table 3: Key Performance Indicators – Mineral Waste Management

ID	KPI	Target	Monitoring measure
MWM-KPI 01	Number of reported mineral waste management incidents	Target: zero non-compliances Minimise and continued improvement in number of reported non-compliances with this Plan.	Number of reported non-compliances per year
MWM-KPI 02	Frequency of mineral waste erosion events	Zero incidences of monitoring findings indicating that erosion or sedimentation control measures are not being properly implemented or maintained.	Number of reported sediment, erosion and structural related incidents per year based on the geotechnical inspection
MWM-KPI 03	Number of complaints related to mineral waste management	Target: zero complaints Minimise and continued improvement in number of complaints received with respect to	Number of reported mineral waste related community complaints per year (via liaison with Community Dept.)

Mineral Waste Management PlanEffective Date:
2013.09.01Document Number:
OT-10-E8-PLN-0001-EVersion:
1.4

ID	KPI	Target	Monitoring measure
		mineral waste.	

Mineral Waste Management Plan		
Effective Date: 2013.09.01	Document Number: OT-10-E8-PLN-0001-E	Version: 1.4

7.3 Key Monitoring Activities

OT’s approach to mineral waste monitoring focuses on the following key general monitoring activities:

- monitoring physical stability parameters of waste disposal structures as an early detection and warning mechanism for potential failure; and
- conducting regular monitoring of the geochemical behaviour of the waste repositories for validation or review of the waste behaviour model and early warning of potential pollution problems.

The specific monitoring measures that are to be implemented during operations are described in *Table 4* below. In the event that any monitoring results identify a non-conformance with the Project Standards, these will be recorded as incidents, investigated and corrective actions identified (see the ESMP Framework for further details).

Table 4: Key Monitoring Measures

ID	Topic/Aspects	Parameters	Methods	Periodicity	Location	Comments
MWM1	Mineral Waste Inventory	Quantity of mineral waste per year and cumulative total	An inventory, by location and NAF/PAF characteristics, will be maintained of all mineral wastes generated, wastes subject to treatment, wastes subject to disposal, recycled/reused wastes and wastes stored at specific facilities.	Quarterly	All waste dumps, stockpiles and Tailing storage Facilities	Surface Mine Operations and Underground Mine Technical Services
MWM2	Geochemistry	ARD limits	Monitor discharges from waste rock and tailings to enable early detection and management of ARD if it occurs	When seepage occurs	Stockpiles, TSFs, borrow pits, quarries, low grade ore stockpiles	See OT Integrated Mineral Waste, Acid Rock Drainage and Dump Management Plan

Mineral Waste Management Plan		
Effective Date: 2013.09.01	Document Number: OT-10-E8-PLN-0001-E	Version: 1.4

ID	Topic/Aspects	Parameters	Methods	Periodicity	Location	Comments
MWM3	Tailings Storage Facility	Geotechnical stability	Visual and geo-technical assessment of TSF embankment walls.	Daily QC inspections, weekly instrumentation reporting, and quarterly geotechnical assessments.	Embankments and perimeter	See Tailings Storage Facility Construction, Operations and Monitoring Manual
MWM4	Tailings Storage Facility	Groundwater quality standards	TSF groundwater quality monitoring and seepage pond visual inspections by HSECS Department.	Quarterly reporting of routine TSF groundwater and seepage monitoring.	TSF monitoring wells and seepages.	See Water Monitoring Plan
MWM5	Waste Rock Dumps	Groundwater quality standards	Water quality monitoring around WRDs and TSFs, including in the Undai aquifer.	Annual reporting of routine groundwater and seepage monitoring.	WRD monitoring wells and seepages (if identified)	See Water Monitoring Plan
MWM6	Sedimentation and Erosion	Slope stability	Visual assessment of Open Pit, WRD and SOM sediment, erosion impacts and stability.	Quarterly geotechnical inspection.	Open pit, WRDs, SOM.	Surface Operation-MTS's Geotechnical Team

Mineral Waste Management Plan

Effective Date:
2013.09.01

Document Number:
OT-10-E8-PLN-0001-E

Version:
1.4

8 TRAINING

8.1 Overview

All necessary training is provided as part of induction training (to provide general awareness) and job-specific training as necessary.

8.2 Induction Training

All employees of OT and Contractors working at OT will be provided with general induction, site specific induction and health, safety and environmental awareness training.

8.3 Job-Specific Training

OT Employees and Contractors with specific involvement in areas generating mineral waste will be given additional training in the implementation of the OT Integrated Mineral Waste, Acid Rock Drainage and Dump Management Plan.

Hauliers of mineral wastes will have appropriate training, and hauling will be undertaken in a manner that prevents the inadvertent or inappropriate release of mineral wastes en route.

8.4 Other Training Requirements

Additional, specialist training shall be provided to plant operators and key personnel involved in activities which involve the management of mineral waste.

9 AUDIT AND REPORTING

9.1 Internal Auditing

Periodic inspections will be carried out by operational area and HSESC superintendents / supervisors covering a range of health, safety and environmental aspects.

Any incidents identified during these inspections will be reported to the incident management system (Element 14).

Conformance will be monitored via annual internal audit program in accordance with Element 16 Performance Assessment and Auditing. This will be undertaken to assess broad compliance with requirements of HSESC management system (including ESIA and management plans).

All incidents and non-conformances identified during these inspections are reported as per the requirements of the OT HSESC Management System as described in the ESMP Framework Document

9.2 External Auditing

Conformance with this plan will be subject to periodic assessment as part of the Rio Tinto HSE Business Conformance Audit programme and by Project Lenders.

9.3 Record keeping

Records of audits, inspections and incidents will be managed in accordance with Element 8 Documentation and Document Control and Element 15 Data and Records Management.

Mineral Waste Management Plan

Effective Date:
2013.09.01

Document Number:
OT-10-E8-PLN-0001-E

Version:
1.4

Rio Tinto Business Solution shall be used to record Internal and External Audit findings and related actions and Incidents and related investigation and actions.

10 DOCUMENT CONTROL

File Name	OT-10-E8-PLN-0001-E-Mineral Waste Management Plan
Description	Including waste rock and tailings, and Central Heating Plant ash
Original Author(s)	Chemicals and Waste Management team
Creation Date	2013.09.01
Approved By	Mark Slater, GM HSE
Approval Date	2013.09.01
Change Record Number	##

Risk Ranking	Assessment Date	Risk Assessor	Review Schedule	Next Review Date
Moderate	2013.09.01	Chemicals and waste team	2 Yearly	2021.06.11

Version	Revision Date	Author(s)	Approved By	Revision Notes
1.0	2013.09.01	Chemicals and waste team	Mark Slater, GM HSE	Approved version
1.1	2013.11.23	Munkhtsatsral.L	Mark Slater, GM HSE	Corrected reference document numberings and completed the document control section.
1.2	2015.06.01	Mark Newby, Rabi Singh and Mahoney D'Alterio	GM HSESC	NOC 2015-003 Updated roles and responsibilities, included lender MOC approved MW05 and MW06 commitments, clarified MW14 commitment, updated monitoring periodicities (MWM3, 4, 5, 6). – Notice of Change 2014-3 Update Shaft 1 Waste Rock Dump Disposition and 2014-4 Update Underground Mine Waste Rock Dump Disposition
1.3	2017.11.28	Uuganbayar Buyantogtokh	Erdenebayar Naran	The plan has been reviewed as per the new Environmental standard.
1.4	2019.06.11	Mark Newby, Otgonbayar Togtokhbayer and Erdenebayar Naran, Amar-Amgalan Serjkhumbе, Uuganbayar Buyantogtokh	GM HSESC Murray Swyripа	NOC 2019-008 Updated reference Environmental standards; Updates department names; Improved detail means of verifications and responsible parties. Added the section from Integrated Mineral Waste, Acid Rock Drainage and Dump Management Plan