3. Waste

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1 General Background

To define the waste streams which occur during the lifetime of the Rosia Montana Project, a distinction is made between extractive and non-extractive wastes:

- Extractive wastes are defined by the Mine Waste Directive as follows: "Waste resulting from the prospecting, extraction, treatment and storage of mineral resources and the working of quarries." They are covered in Subsection 2.
- Other waste which "is generated by the prospecting, extraction and treatment of mineral resources and the working of quarries, but which does not directly result from those operations" is called non-extractive in the following. Non-extractive wastes are covered in Section 3.

The following extractive and non-extractive waste streams will occur and must be managed:

- Extractive wastes:
    - Tailings;
    - Waste rock;
    - ARD treatment sludge;
    - In-pit/on-shore treatment sludge (using flooded Cetate pit as settling pond)
    - Soil (topsoil, subsoil, overburden)

- Non-extractive wastes:
    - municipal and similar waste (divided in fractions for recycling);
    - used oil;
    - lead-acid batteries;
    - non-lead acid batteries;
    - waste aerosol containers;
    - hazardous demolition waste;
    - asbestos demolition waste;
    - reagent spill cleanup wastes (not including cyanide spill cleanup);
    - production packaging waste;
    - waste electric and electronic equipment;
    - end-of-life vehicles;
    - used tyres;
    - used oil filters;
    - inert and non-hazardous construction and demolition waste; and
    - medical waste.

It must be emphasised that Mercury generated in the process is a sellable by-product and is therefore not treated as waste.

This Section is particularly closely related to:

- the Tailings Management Facility Plan with respect to TMF dam stability and operation
- the Mine Rehabilitation and Closure Plan with respect to closure and rehabilitation of the waste storage facilities
- and the Water and Erosion Control Management Plan with respect to impacts of the wastes on ground and surface water.

For example, requirements such as compliance with the Government Urgency Ordinance (GUO) no. 244/2000 regarding dam safety, are satisfied in the TMF Management Plan.

2 Extractive Waste

2.1 Applicable regulations for extractive waste

It is expected that the EU regulations on Extractive Waste, notably the provisions of the Mine Waste Directive (Directive 2006/21/EC on the management of waste from extractive industries, amending Directive 2004/35/EC”), will be transposed into Romanian legislation shortly. The Terms of Reference issued by the Romanian Government, specifically require that the Mine Waste Directive be taken into consideration in the preparation of the EIA documents.

With regard to extractive wastes, the EU *Landfill Directive*[i] specifically exempts “the deposit of unpolluted soil or of non-hazardous inert waste resulting from prospecting and extracting, treatment, and storage of mineral resources and the working of quarries.” This exemption has been transposed into Romanian regulation, and is reflected in the final language of the *National Plan for Waste Management* published by the Government of Romania in 2004.[ii]

The regulatory approach to these exempted extractive wastes has been the subject of much discussion within the EU in recent years, and concerns were significantly heightened as a result of the Baia Borsa and Baia Mare accidents. The *Directive of the European Parliament and of the Council* 2006/21/EC *on the management of waste from extractive industries, amending Directive 2004/35 EC*[iii] (in the following referred to as the *"Mine Waste Directive"*) has been developed by the EU to provide substantial clarification and guidance with regard to the regulatory status of tailings management facilities, waste rock stockpiles, and ancillary facilities. In keeping with the precedents established for other EU directives it is expected that this Directive will be finalised and adopted by the Government of Romania in the near future, and will provide an approach that specifically recognises the unique management issues associated with topsoil, overburden, waste rock, and tailings.

Important EU regulations applicable to this Project are as follows:

- the EIA Directive[iv];
- the Water Framework Directive[v] ;
- the Mine Waste Directive[vi];
- the IPPC Directive[vii];
- the Seveso Directive.

Important international conventions applicable to this Project are as follows:

- the Aarhus Convention[viii];
- the Espoo Convention[ix].

According to the Ministerial Order MO 863[x], the Project must comply with the following according to the relevant activities:

- Best Environmental Practice (BEP);
- Best Available Techniques (BAT) ;
- IPPC databases/BREFs;
- Recommendations of the Helsinki Commission (HELCOM).

2.2 Best Environmental Practice (BEP)

BEP is defined by HELCOM Recommendation 13/6[xi] to mean the application of the most appropriate combination of measures. In selecting for individual cases, at least the following graduated range of measures should be specifically considered as an integral part of the waste management strategy:

- recycling, recovery, re-use;
- avoiding the use of hazardous substances and products and the generation of hazardous waste; (...)
- in determining what combination of measures constitute best environmental practice, in general or individual cases, particular consideration should be given to:
    - environmental hazard of the product, its production, its use and ultimate disposal;
    - substitution by less polluting activities or substances;
    - scale of use;
    - advances and changes in scientific knowledge and understanding;
    - time limits for implementation;
- if the reduction of inputs resulting from the use of best environmental practice does not lead to environmentally acceptable results, additional measures be applied;
- in order to attain the objectives, the intensified exchange of information and knowledge regarding best environmental practice be promoted;
- the definition of best environmental practice be revised when appropriate.
    - (...)
    - the Helcom precautionary principle (...);

2.3 Best Available Techniques (BAT)

BAT is defined by HELCOM Recommendation 12/3[xii] to mean the latest stage of development (state of the art) of processes, of facilities or of methods of operation which indicate the practical suitability of a particular measure for limiting discharges. In determining whether a set of processes, facilities and methods of operation constitute the best available technology in general or individual cases, the following are specifically relevant for the waste management strategy:

- comparable processes, facilities or methods of operation which have been recently successfully tried out;
- the nature and volume of the effluents concerned;
- the Helcom precautionary principle
- the definition of best available technique be reviewed, when appropriate.

BAT is also defined by the IPPC Directive 61/96/EEC[xiii], in Article 2 to mean the most effective and advanced stage in the development of activities and their methods of operation, which indicate the practical suitability of particular techniques for providing, ,the basis for emission limit values to prevent and, where that is not practicable, to reduce emissions and the impact on the environment as a whole.

2.4 BREF Documents

The following BREF documents are of particular relevance for the extractive waste management in this Project:

- the Best Available Techniques for Management of Tailings and Waste-Rock in Mining Activities[xiv];
- IPPC Reference Document "General Principle of Monitoring"[xv].

As a reference for mining practice throughout the EU, the study "Management of Mining, *Quarrying and Ore-Processing Waste in the European Union"[xvi],* prepared by BRGM for the European Commission, DG ENV, has some relevance.

The most comprehensive document is the BAT (Best Available Techniques) Document for the Management of Tailings and Waste-Rock in Mining Activities[xvii] and the Province of Ontario (Canada), *Rehabilitation of Mines – Guidelines for Propone*nts[xviii]. Other international projects which have the objective of defining the state of the art are the MIRO (Mineral Industry Research Organization)[xix], the CLOTADAM project[xx] and regional initiatives[xxi]

The EU BREF Document has been developed as a supportive document to the EU Mine Waste Directive[xxii]. In the development of this document, a number of other reference documents, recommendations and guidelines have been taken into consideration, such as the following:

- ICOLD documents;
- The Canadian Mine Environment Neutral Drainage 1998 (MEND 1998) Program;
- The Canadian Guide to Tailings Management;
- International Network for Acid Prevention (INAP)[xxiii];
- and many others.

While this document does not set legally binding standards, it is meant to give information for the guidance of industry, EU Member States and the public on achievable performances, emissions etc. Multinational research programs such as the CLOTADAM (CLOsure of TAilings DAMs), initiated at the EU level, have contributed to the BREF documents.

2.5 Other HELCOM Recommendations

Other HELCOM Recommendations which have been identified as relevant or useful for the Roşia Montană Project are listed below:

- HELCOM 24/5[xxiv] recommends that industrial emissions and discharges of hazardous substances and nutrients be minimized by effective use of BAT;
- Although the HELCOM 24/5[xxv] on waste handling does not apply to this Project which falls under the Mine Waste Directive, the general principles set out in this Recommendation are complied with.

2.6 Waste and waste facility classification

Article 3(1) of the Mine Waste Directive, defines wastes in accordance with Article 1 (a) of Directive 75/442/EEC (EU Waste Directive).

Waste facilities are defined in Article 3 (15) of the Mine Waste Directive as facilities for the accumulation or deposit of extractive waste, for the particular time periods designated.

Moreover, Article 5 (3) together with Annex II of the Mine Waste Directive requires, as an integral part of a waste management plan, the characterization of wastes in accordance with Commission Decision 2000/532/EC (Waste Classification Scheme), as well as the classification of a waste facility in accordance with the criteria laid down in Annex III of the Directive.

The following table classifies the extractive waste streams and waste facilities according to these Directives.

Table 3-1. Waste classification and the classification of a waste facility in accordance with Commission Decision 2000/532/EC , Article 5(3), Article 3 (15), Annex II and Annex III of the Mine Waste Directive

Extractive waste stream	Construction and demolition storage area according to Article 2 (3) MWD	Waste classification, Commission Decision according to (2000/532/EC)	Stored in...	Storage time in years, in accordance with Article 3 (15) of the MWD	Category A facility (see Table 3.2-7) according to Annex III of the MWD
Tailings	non-inert	010307*	Tailings management facility (TMF)	No time limit	Yes
Waste rock (partially ARD generating)	non-inert	010101 (partially ARD generating)	Backfilled pits, Waste rock heaps	> 1 year	No
ARD treatment sludge	non-inert	010307*	During operations and early closure phase: TMF Closure and post-closure phase: Open pit (flooded)	No time limit	TMF: yes Pit: no
Sludge from on-shore pit water treatment plant (closure phase only)	non-inert	010307*	Open pit (flooded), using pit as settlement for solids	no time limit	No
Unpolluted topsoil and subsoil	inert	010101	Topsoil and subsoil storage heaps	> 3 years	No

2.7 Waste Management Objectives

As stated in the Preamble (Points 3 and 13) and Article 5 (2) of the Mine Waste Directive,

- Waste Minimization;
- Waste Reuse and Recycling;
- Waste treatment close to origin;
- Minimization of waste harmfulness;

shall be the objectives of the waste management strategy.

The implementation of these concepts is demonstrated in the following sections for the different waste streams.

2.8 Extractive waste streams

2.8.1 Tailings

2.8.1.1 Description of operations generating the wastes

General

The tailings arise from the processing of the ore mined in the pits. The process plant will be located on the side of a ridge between the Salistei Valley and the Roşia Valley. This location was chosen for its proximity to the Cârnic and Cetate pits, which provide the majority of the proven and probable reserves, as well as its proximity to the TMF to be situated in the Corna Valley.

Ore preparation and processing methods are BAT (see Section 6.1.2.3 of Non-ferrous Metals Industries BREF of 2001[xxvi] and Section 3.1.6 of the Management of Tailings and Waste-Rock in Mining Activities of 2004[xxvii]) and incorporate the following, principal elements:

- single stage crushing of Run of Mine (ROM) ore by means of a gyratory crusher;
- stockpiling of crushed ore;
- reclaim of crushed ore and wet grinding using a Semi-Autogenous Grinding (SAG) mill followed by two ball mills in a parallel configuration;
- cyanide leaching, commencing in the grinding circuit, from which a classified fine product passes to the carbon-in-leach tanks to undergo agitation and a continued cyanide leach;
- adsorption of extracted gold and silver onto activated carbon within the carbon-in-leach tanks, followed by separation of the loaded carbon and elution of the gold and silver from the activated carbon in pressure vessels;
- electro-winning to recover gold and silver stripped from the activated carbon, as a precious metals sludge, and smelting of this sludge to produce gold and silver (doré) ingots;
- thickening of the tailings;
- detoxification of residual cyanide in the tailings, before the tailings leave the process plant containment zone;
- transport of detoxified tailings slurry via pipeline, and deposition in the TMF impoundment;
- reclamation of pooled water from the TMF for recycling and re-use in the process plant; and,
- abstraction of fresh water from the Arieş River.

Gold extraction process using Cyanide

The technology to process the ores and to detoxify the tailings is BAT (see Section 2 of the EIA).

The main process for gold/silver extraction is performed in the carbon-in-leach circuit. During the reaction the gold forms a gold cyanide complex in alkaline solution.

As CN^- is the active ion in the gold/silver extraction process, it is important that the cyanide be stabilised by the maintenance of a sufficiently high pH. This is achieved through the addition of hydrated lime slurry to the carbon-in-leach feed and as required to carbon-in-leach tanks. At a pH value of about 10, approximately 90% of the cyanide is present as the

CN^- ion, with more and more becoming protonated (i.e. bound with hydrogen ions) as the solution pH falls.

The carbon-in-leach slurry discharge is gravity-fed to the carbon safety screens and then flows into the tailings thickener. The carbon safety screens capture any activated carbon that has bypassed the internal carbon retaining screens in the carbon-in-leach tankage.

This slurry is mixed with flocculants in the feed-well of the thickener in order to assist the settling of solids. The thickener provides a method to increase the solids content of the underflow slurry and will generate a relatively clear overflow. Water (overflow) from the thickener will report back to the milling circuit for re-use and recovery of contained cyanide values.

The thickened tailings will then be pumped to a SO_2/air cyanide detoxification circuit where the WAD cyanide in the thickener underflow will be reduced to levels below applicable EU standards. The treated tailings will then be delivered to the TMF. This process is described in more detail below.

Cyanide Detoxification

The Project will use an internationally recognised BAT for cyanide detoxification through the employment of the Inco SO_2/air detoxification process on the tailings discharge residue. This is a proven technology that has been adopted in more than 90 mines world-wide. WAD cyanide concentrations are expected to be reduced using the SO_2/air process to levels that comply with EU standards, before the treated tailings leave the confines of the process plant.

A more detailed description of the thickening and cyanide detoxification process is provided in Section 2 of the EIA; the detoxification process itself is described further in the following paragraphs.

Detoxification Facilities

The cyanide detoxification facilities will consist of two tanks operating in parallel. Treated water or freshwater will be added to the cyanide detoxification feed header to dilute the underflow of tailings thickener from normally 60% solids to 50% solids. Water addition will be based on density and flow measurements of the thickener underflow. The resulting diluted thickener underflow will be directed to the two tanks of the cyanide detoxification facilities.

Compressed air, provided by four compressors discharging at a pressure of 250 kPa, will be added to each tank through a sparger. Airflow will be controlled in each tank through a rotameter. The source of SO_2 is sodium metabisulphite ($Na_2S_2O_5$) solution, which will be metered into each tank. The addition rate of SO_2 will be based on the concentration of WAD cyanide in the tailings stream and the tailings solution flow. The cyanide concentration will be determined by the plant operator and entered into the control system. The detoxification reactor feed flow will be measured and the mass flow of cyanide calculated by the control system. The control system will then adjust the flow of the SO_2 to effect detoxification.

A copper sulphate ($CuSO_4$) solution will also be metered into each tank to maintain the required concentration of copper ion in the solution to catalyse the detoxification reaction. Because of the composition of the Roşia Montană ores and the resulting fluid chemistry, copper sulphate may not need to be routinely added to maintain the required copper concentration. Copper sulphate control is managed by the control system, which adjusts the dose rate based on the measures flow of solution into the detoxification reactors.

Lime slurry will be added to each tank via a ring main system, in order to control the pH in the tanks at 8.5.

Concerning mineral exploitation and treatment the alternative evaluation in the EIA, Section 5, included the major aspects of:

- Technologies for Ore Extraction Alternatives,
- Development of Preferred Extraction Technology,
- Alternate Lixiviants and
- Alternative Methodologies for the Cyanide Detoxification Process

Numerous alternatives have been considered but are not preferential from a waste management perspective, taking into account all key aspects, when compared to the chosen alternative. The considerations also included the use of less dangerous substances for the treatment of the mineral resources.

Tailings discharges from the cyanide detoxification facility

The detoxified tailings will be deposited as slurry via pipeline to the TMF. The decant water will be recycled from the TMF back to the process plant via a floating barge and pumping system. The seepage expected to occur through the main dam will be collected directly in the Secondary Containment System located downgrade from the toe of the embankment. The Secondary Containment System will consist of a deep sump excavated into rock and a specifically designed system to pump water over the TMF embankment and back into the tailings impoundment.

Auxiliary processes: Addition of Lime

Lime will be used in the gold ore processing plant. The ore will be crushed, wet ground, and leached in a series of agitated carbon-in-leach tanks using a dilute cyanide solution. Dry lime will be added to the SAG mill feed conveyor, and slaked lime will be added to the agitated carbon-in-leach tanks for pH control. Slaked lime will also be dosed onto the detoxification reactors to control the pH level if required.

The lime sludge resulting from this process is mixed with the tailings before the tailings **reach the pump box**. The amount and chemical characteristics of lime sludge generated at this point is negligible compared to the volume of tailings.

2.8.1.2 Quantities

The operation of the Project will generate tailings at a rate of approximately 13 Mt/year for approximately 17 years, producing a total of approximately 214,9 Mt of detoxified tailings. The mining and processing operation will require the construction and operation of a Tailings Management Facility (TMF) to be located in the Corna Valley, situated immediately to the south of the plant site. The TMF has been designed to have the following final dimensions:

- Area: 363,13 ha;
- Maximum dam height: 180 m.

Table 3-2. Tailings Volumes

Components	Volume in Mio. m^3
Consolidated Tailings and Pore Water	153
Water in Decant Pond	1*

(*) under normal average operating conditions (source: Volume 8 - Appendix F of Final Rosia Montana Project Engineering Review Report, MWH, March 2005)

2.8.1.3 Physical/chemical properties

General Description of the Tailings Material in TMF

The tailings can be characterised as ground rock, with the gold and silver extracted using cyanide, which will include precipitate from the treatment of the residual cyanide content.

Moreover, the TMF will contain minor amounts (compared to the volume of the tailings) from the following processes:

- Acid Rock Drainage (ARD) treatment sludge in a ratio of approximately 1:500 to tailings in the TMF;
- Carbon fines from carbon reactivation which are not reusable in the elution process;
- Concrete rubble (in demolition phase) and/or limestone to enhance the buffer capacity of the tailings

Radiological characteristics: no geological and technical indications.

Physical Characteristics[xxviii]

- Approximate Tailings Solid Constituents: 49 %
- Average Specific Gravity (Solids): 2.5...2.7 g/cm³
- Vertical Permeability of the settled tailings: (4.4...9.4) x 10^{-8} m/s
- Reduced Permeability of tailings with consolidation.

Table 3-3. Size Distribution of Tailings Material[xxix]

Size (µm)	Mass					
	RM 1		RM 2		RM 3	
	%	Cumulative % Passing	%	Cumulative % Passing	%	Cumulative % Passing
+ 300	0.11	99.89	0.04	99.96	0.11	99.89
-300 + 212	1.95	97.94	2.28	97.68	2.36	97.53
-212 + 150	12.36	85.57	12.49	85.18	13.42	84.11
-150 + 106	22.34	63.23	20.51	64.67	21.59	62.52
-106 + 75	13.23	50.00	12.83	51.85	12.55	49.97
-75 + 38	17.46	32.54	16.69	35.16	16.27	33.70
-38	32.54	0.00	35.16	0.00	33.70	0.00
P80	*139 µm*		*139 µm*		*142 µm*	

Chemical and mineralogical characteristics of the tailings solids

The samples reported in Table 3-4 represent the first years of the TMF operation but can also approximately represent the samples for the entire operation phase (Source: Ausenco Report[xxx])

Three samples, which represent the ore blends from the first seven years of mining, .were tested The samples are described as follows:

- Sample RM1 – Dacite dominated with 80 percent from Cârnic and 20 percent from Cetate, representative of Years 1 through 3;
- Sample RM2 – Dacite and mixed breccia with 33 percent from Cârnic and 67 percent from Cetate, representative of Year 4; and
- Sample RM3A – Dacite dominated with 100 percent from Cârnic, representative of Years 5 to 7.

The chemical analyses results of the solids as shown in Table 3-4 are an approximation of the tailings composition. According to the Engineering Review Report[xxxi], this represents the final tailings deposited in the TMF.

Table 3-4. Solid Phase Analyses Results

Element	RM1	RM2	RM3A
Al (%)	5.05	5.15	4.35
As (ppm)	100	90	130
Ba (ppm)	410	370	320
Bi (ppm)	<10	<10	<10
C Total (%)	0.13	0.23	0.04
C Organic %	0.03	0.04	<0.03
Ca (ppm)	510	920	40
Cd (ppm)	<5	<5	<5
Co (ppm)	7	9	7
Cr (ppm)	10	20	<10
Cu (ppm)	188	70	30
Fe (%)	2.58	2.84	2.18
Hg (ppb)	150	70	180
K (%)	7.53	7.69	7.86
Mg (ppm)	1600	2620	1550
Mn (ppm)	3100	3400	230
Mo (ppm)	<5	<5	<5
Na (ppm)	988	1450	1030
Ni (ppm)	5	15	5
P (ppm)	400	400	200
Pb (ppm)	85	62	23
S (%)	2.01	1.98	1.41
Sulphide S (%)	1.82	1.90	1.16
Sb (ppm)	5	<5	<5
Sr (ppm)	35	37	27
Te (ppm)	1.8	0.4	<0.2
Ti (ppm)	1700	1900	1670
V (ppm)	58	69	63
Zn (ppm)	316	133	56
Zr (ppm)	16	17	20

The relative abundances of minerals in the ore and tailings material are given in Table 3-5. The three samples consist predominantly of potassium feldspar, quartz and mica. Pyrite is the only sulphide present in noticeable quantities varying from 2.3 wt% to 5.1 wt% (Source: Ausenco Report[xxxii]).

Table 3-5. Mineral abundances in tailings material (wt%)

Mineral name	RM1	RM2	RM3A
Apatite	0.20%	0.18%	0%
Barite	0%	0%	0%
Chalcopyrite	0.05%	0%	0%
FeMn_Carbonate	1.30%	0.80%	0%
Galena	0%	0.12%	0%
Muscovite	10.90%	12.00%	13%
Orthoclase	60.50%	59.10%	67.20%
Pyrite	4.70%	5.10%	2.30%
Quartz	22.10%	22.40%	17.50%
Rutile	0.22%	0.38%	0.13%
Sphalerite	0.08%	0%	0%

General Hydrochemical Characterisation of the Tailings Material

- Potential acid generation is indicated in laboratory testing.
- Based on the rate of tailings placement, acid generation is not expected.
- Acid generation is not predicated unless the tailings are exposed to oxidation for an extended period (likely years).
- In general the tailings solid can therefore be characterized as relatively benign and non-acid generating.

Tailings Material Humidity Cell Testing Results

- Principle: Simulation and acceleration of weathering and oxidation.
- Procedure: Water quality analysis from 26 weekly cycles with 3 simulated tailings samples.

Major Results:

- pH-value decreasing during the testing to near-neutral values.
- Occasional slight exceedances of the NTPA 001/2005 manganese standard

Composition of aqueous tailings (after detoxification)

The composition of the aqueous tailings collected in the decant pond is shown in Table 3-6.

Table 3-6. Composition of the TMF decant water (detoxification plant effluent [xxxiii]), *laboratory results*

All values in mg/l	Sample		
Parameter	RM 1	RM 2	RM 3A
Total Cyanide	1.13*	5.09*	3.29*
WAD Cyanide	0.37*	0.77*	0.22*
Thiocyanate	70	69	91
Cyanate	390	390	350
Thiosalts	<2	<2	2.50
Ammonia	6.6	7.3	25
Gold	0.0085	0.043	0.0165
Silver	<0.05	<0.05	<0.05
Aluminium	<0.2	0.20	0.20
Arsenic	0.30	<0.2	0.20
Boron	0.20	0.20	0.40
Barium	<0.05	<0.05	<0.05
Beryllium	<0.02	<0.05	<0.02
Bismuth	<0.02	<0.02	<0.02
Calcium	401	675	707
Cadmium	<0.5	<0.1	<0.5
Cerium	<0.010	<0.010	<0.010
Cobalt	0.40	0.40	0.80
Chromium	<0.2	<0.2	<0.2
Cesium	<0.02	<0.02	<0.02
Copper	0.10	0.10	0.10
Dysprosium	<0.010	<0.050	<0.010
Erbium	<0.010	<0.050	<0.010
Europium	<0.002	<0.050	<0.002
Iron	0.20	1.4	1.0
Gallium	<0.2	<0.1	<0.2
Gadolinium	<0.05	<0.05	<0.05
Germanium	<0.5	<1	<0.5
Hafnium	<0.1	<0.1	<0.1
Mercury	<0.01	<0.01	<0.01
Potassium	142	136	132
Lanthanum	<0.010	<0.010	<0.010
Lithium	<0.1	<0.1	<0.1
Magnesium	5.4	14.4	8.2
Manganese	0.30	0.80	<0.1
Molybdenum	0.4	0.3	0.4
Sodium	725	900	705
Niobium	<0.1	<0.1	<0.1
Neodymium	<0.010	<0.010	<0.010
Nickel	0.20	0.40	0.20
Phosphorus	<1	<0.5	<1
Lead	<1	<1	<1
Praseodymium	<0.005	<0.005	<0.005
Rubidium	0.35	0.35	0.50
Sulphur	660	1030	962
Sulphate(1)	1980	3090	2886
Antimony	0	0.28	0.06

Scandium	<0.5	<0.1	<0.5
Selenium	<5	<5	<5
Silicon	8	6	8
Samarium	<0.010	<0.010	<0.010
Tin	<0.2	<0.2	<0.2
Strontium	1.4	2.1	2.1
Tantalum	<0.005	<0.005	<0.005
Terbium	<0.005	<0.005	<0.005
Tellurium	<0.1	<0.1	<0.1
Thorium	<0.010	<0.010	<0.010
Titanium	<0.2	<0.2	<0.2
Thallium	<0.010	<0.010	0.030
Thulium	<0.005	<0.005	<0.005
Uranium	<0.010	<0.010	<0.010
Vanadium	<0.5	<0.5	<0.5
Tungsten	<0.1	<0.1	<0.1
Yttrium	<0.010	<0.010	<0.010
Ytterbium	<0.010	<0.010	<0.010
Zinc	<0.2	<0.1	<0.2
Zirconium	<0.1	<0.1	<0.1

* The data results from laboratory tests. Under large scale operating conditions, the Cyanide concentrations are expected to be in the range of CN_{tot} = 12-15 mg/l and CN_{WAD} = 5...10 mg/l[xxxiv].

Cyanide concentration in the Tailings

The concentrations of WAD cyanide that will be discharged with the tailings are in compliance with the limits imposed under Article 13 (6) of the Mine Waste Directive.

The CN_{tot} concentrations are expected to drop below 0.1 mg/l within 4-6 months, according to the numerical cyanide modelling results contained in the Engineering Review Report[xxxv]. More conservatively, a time period of around 3 years is assumed for the Cyanide concentration to drop below 0.1 mg/l, as indicated in the conclusions drawn from the numeric modelling[1].

TMF seepage quality

Seepage quality will be dominated by the process water quality for years after closure. Seepage transport modelling of cyanide suggests that process water will not appear at the Secondary Containment Dam sump for the first eight years[xxxvi].

Cyanide concentration in the seepage is likely to be substantially reduced due to the attenuation processes in the TMF. Seepage is pumped back into TMF. An ARD component in the seepage is not expected because the rapid accumulation of tailings will inhibit ARD generation. Prompt closure of the TMF and placing a cover containing an oxygen barrier will also prevent ARD generation. In addition, the large mass of initially alkaline tailings at closure will help to neutralise any ARD infiltrating into the tailings.

[1] See Page 10, point 1 of the Modeling Report prepared by Elbow Creek and Page 26 of the Tailings Management Facility Geochemistry and Water Quality Report prepared by MWH (both part of Appendix F to the Engineering Review Report)

2.8.1.4 Description of the chemical substances used

Before discharge into the TMF, the tailings are treated in a detoxification circuit within the process plant. The detoxification technique used is based on the reduction of Week Acid Dissociable (WAD) cyanide concentration using the SO_2-air process to levels that comply with EU-Standards (see Section 2.8.1.1 and Section 2 of the EIA).

The following reagents and chemicals will be required in the process (see Section 2 of the EIA for more details on the use of these chemicals in the technological process):

- flocculants;
- sodium hydroxide;
- hydrochloric acid;
- sodium metabisulphite;
- copper sulphate;
- smelting fluxes (including silica, potassium nitrate, soda ash and borax);
- lime;
- activated carbon; and,
- carbon dioxide.

2.8.1.5 Description of deposition method and classification of waste facility

According to Article 9 and Annex III of the Mine Waste Directive, a waste facility shall be classified under category A if at least one of the criteria in the following table applies.

Table 3-7. Criteria for the classification of a waste facility as Category A

Criterion for Category A	Characteristics of waste facility
Failure or incorrect operation, e.g. the collapse of a heap or the bursting of a dam, could give rise to a major accident, on the basis of a risk assessment taking into account factors such as the present or future size, the location and the environmental impact of the waste facility.	yes (see EIA Section 4.7: Risks)
Waste facility contains waste classified as hazardous under Directive 91/689/EEC above a certain threshold.	yes
Facility contains substances or preparations classified as dangerous under Directives 67/548/EEC or 1999/45/EC above a certain threshold.	yes

Article 11 (2b) of the Mine Waste Directive requires the operator to demonstrate that suitable construction, management and maintenance methods are applied for waste facilities.

The TMF will be designed as a depository for the treated tailings residue. The Corna Valley TMF site provides the required design storage capacity for the life of the mine, plus an additional contingency capacity. In addition it has the advantage of being close to the process plant and open pit sites, thus minimising the project footprint. The following design components will be included in the TMF:

- a rock fill embankment (dam) to retain the treated tailings;
- a cofferdam and surface water runoff diversion channels;
- an impoundment to store treated tailings, upstream of the embankment;
- a detoxified tailings delivery pipeline and decant water reclaim barge and pumping system;

- a secondary containment and seepage water pumpback system, with (in later phases of the Project) a series of passive/semipassive treatment lagoons downstream of the embankment, should treatment and discharge of seepage be a desired water management option;
- a comprehensive geotechnical monitoring system; and,
- service roads.

TMF dam

The TMF will include a starter dam and a cofferdam that will be contained within the main rock-fill embankment. The TMF dam (Main embankment) will be constructed in stages during the operation phase of the project with the starter dam being the first stage. In addition, the TMF will contain a Secondary Containment Dam downstream of the main rock-fill embankment dam. All of these dams will be constructed within approximately 2 to 3 years during the construction phase of the project using materials from the following primary sources:

- dedicated quarries containing rock including andesite, dacite and rock from the mine pre-stripping activities; and,
- clay overburden from the dam foundation preparation, quarry pre-stripping, and/or borrow areas within the TMF basin.

Secondary Containment System

Minor seepage through the upper (pervious) section of the main embankment is expected, is normal for any dam, and is a design feature that contributes to progressive dewatering of tailings within and behind the dam structure. This will result in decreased pore pressure and increased stability over time. Seepage through the dam will be collected directly in the Secondary Containment System, located near the final downstream toe of the embankment as noted in Exhibit 3.2-4**.** For design purposes, seepage is estimated at approximately 9 m^3/hr to 45 m^3/hr for the starter dam and final tailings dam, respectively. The Secondary Containment System will consist of a 10 to 15 m deep sump excavated into weathered rock in conjunction with a zoned rockfill dam and a pumping system to pump seepage water over the TMF embankment and back into the tailings impoundment.

Alternatives

According to Article 11 (2a) of the Mine Waste Directive, the selection of the TMF location must satisfy the criteria under Article 11(2a) of the Mine Waste Directive. The site for the TMF was selected from several alternatives, considering a broad range of technical, social, economic and environmental issues as discussed in Chapter 5 (Alternatives) of the EIA. An optimisation study has been performed to select the optimum dam alignment in the Corna Valley for the purpose of minimising dam fill material while maximising storage capacity and stability in line with best practice applied to the specific site characteristics.

Arrangements for monitoring and inspections in accordance with Article 11 (2c) of the Mine Waste Directive are addressed in Section 2.8.2.

The arrangements for closure and after-closure of the TMF, required according to Article 11 (2d, e) of the Mine Waste Directive are described in Section 2.9 and, in more detail, in the Mine Rehabilitation and Closure Plan.

2.8.1.6 Waste transport system

The tailings are pumped as a slurry through a tailings delivery pipeline from the processing plant to the TMF over a distance of approximately 4 km.

More details on the delivery system are already contained in Section 2.8.1.1 above and in the *Tailings Management Facility Plan.*

2.8.1.7 Conditions of the land to be affected by the waste facility

According to Article 5 (3h) of the Mine Waste Directive, a survey of the condition of the land to be affected by the waste facility has to be provided.

Both Cârnic Waste Rock Disposal Site (see Section 2.8.2) and the TMF are proposed to be located in Corna Valley. The TMF is the largest single structure of the Project. At the final stage, the TMF including the impoundment and the dam, is expected to cover an area of 363,13 ha.

The land use of the Corna Valley is primarily agricultural, with a series of farmsteads established within the valley floor. Agricultural activity includes grazing of cattle and sheep with pasture land cut for hay as conserved winterfeed. Small areas of land in the narrow valley floor and in more gently sloping areas of the valley sides have been cultivated to grow root and vegetable crops and fruit trees. However, these areas represent a very small proportion of the total agricultural land. Overall, this section of the valley is generally of restricted agricultural use (generally Class V for pasture and hay production), though there are areas that support Class II for pasture land. Crops (orchards and potatoes) are limited to Class VIII or lower.

Loss of existing land and land uses in Corna Valley is assessed as being of moderate significance on a local scale. However, on a regional scale, the loss of such an area of low-class agricultural land is not significant.

2.8.1.8 Description of the possible impacts on the environment

a) Water

According to Article 13 (1) of the Mine Waste Directive, the operator has to

- evaluate the leachate generation potential and predict the expected leachate quality
- prevent/minimize ground/surface water or soil contamination
- collect/treat contaminated water

Seepage water quality issued from TMF has been modelled using a conceptual model simulation for water quality in the TMF in combination with geochemical modelling including the evolution of possible ARD Generation.

The major prediction results can be summarized as follows:

- Seepage water quality is predicted to be dominated by process water chemistry. Conservatively, the TMF dam seepage quality is assumed to be the same as shown in Table 3-6.
- During the period dominated by process water chemistry the significant parameters (from a comparison with the NTPA 0012005 standard) will be
    - Total Dissolved Solids (TDS),

- Calcium,
- Sulphate,
- Ammonium
- Arsenic
- Molybdenum
- Cyanide

- The most valid ARD concern is that ARD may be generated on the TMF surface during a prolonged mill/process plant shut down, or at the end of processing prior to closure and this could result in subsequent acidification of the decant pond. From this point of view, it is of particular importance to start rehabilitation of the TMF as soon as possible. However, the placement of the cover system requires that the tailings are sufficiently consolidated to support heavy machinery.
- The occurrence of cyanide in the seepage is uncertain; occurrence of cyanide in the seepage will probably not occur in a level of concern. Also for heavy metal concentration the relatively low level in the process solution is expected to attenuate further through additional adsorption and precipitation.

Rainwater Leachate Test Results have been carried out for ARD treatment sludge, which is also disposed of into the TMF, with the following results:

- Indication for Calcium, Sulphate and pH-value to be elevated with respect to Romanian Standards.
- Because of ratio of 1:500 to Tailings no effect on water quality is to be expected.

In summary, the following processes and requirements are closely intertwined and require an optimized time schedule for closure of the TMF area which will be developed and incorporated into the updated Mine Closure Management Plan once precise information on the tailings composition and geotechnical and hydraulic properties are available during operation:

- Prevention of acidification: this requires that the surface of the tailings is either kept under water or is quickly covered with an oxygen barrier.
- The cover placement requires sufficient geotechnical stability of the tailings surface which is achieved only after some time of consolidation.
- The cyanide concentration in the decant water pond degrades within some months to some years to levels which may make active removal of cyanide redundant.
- On the other hand, fast flooding of the Cetate pit is desirable in order to prevent continued oxidation of the sulphidic parts of the pit walls.

During operations and at closure, the dam seepage rate will be approximately 77 m^3/h, which is reduced over time due to the placement of a cover system on the TMF[xxxvii].

Semi-passive treatment systems for the dam seepage water will be developed based on the guidelines developed by the PIRAMID Consortium, which was funded by the European Commission[xxxviii xxxix].

A series of two cells and one pond will be constructed to form the entire semi-passive treatment system. The cells and pond will be operated in series with an anaerobic cell used for initial treatment, followed by an aerobic cell, and then a mixing pond. The mixing pond will be used to provide a single discharge point where “clean” site runoff and Wastewater Treatment Plant (treated ARD) water can be co-mingled and discharged to the environment. The anaerobic cell will function to consume acidity (if present), generate alkalinity, and remove metal contaminants. In addition, the anaerobic cell will be effective in removing cyanide if it is present in the seepage. Anaerobic conditions are achieved using organic matter that produces a strong reducing environment and promotes certain bacteria that result in chemical transformation of metals, sulphate and cyanide. Water is allowed to permeate through a layer of organic compost into an underlying limestone gravel layer and then is discharged from the system. The organic layer acts as the reducing environment and the limestone gravel increases alkalinity, if ARD is present. Nitrogen compounds, such as nitrate, will also likely be present in the seepage due to the degradation of cyanide. De-nitrification will also reduce the concentration of these compounds and produce nitrogen gas.

The aerobic cell will polish the water by removing additional metal constituents and oxygenating the water prior to discharge into the mixing pond. The aerobic wetland will remove additional metals by sedimentation of suspended flocs, filtration of flocs by plant stems, adsorption of aqueous metal species, precipitation of hydroxides on plant stems and by direct plant uptake. Common reed species such as *Typha latifolia* and *Phragmites australis* are commonly used in aerobic cells. Any remaining nitrogen compounds will act as fertilizer for the plant growth and will be consumed.

The mixing pond is used to mix water coming from the aerobic cell and water from Corna stream and act as a final sedimentation pond. After mixing of the two water types in the pond, the resulting water will be discharged back into the Corna drainage.

b) Dust and gas emissions from the waste facility

A detailed account of the dust and gaseous emissions from the TMF is contained in Section 4.2 of the EIA and in the *Air Quality Management Plan*. These documents also contain model results to predict the impact of the TMF on air quality.

In summary, the following emissions are generated by the TMF:

- Gaseous cyanide (HCN) is released (volatilized) from the decant pond surface.
- Dust can be blown off the tailings beaches if they are dry.

The dust generation is suppressed by the cover system which is placed on the TMF shortly after the end of the operations phase, and in operation phase by maintaining of the tailings beach wet due the slurry discharge from the dam top.

The release of HCN from the decant pond has been evaluated using predictive models for summer and winter conditions[xl]. The results can be summarized as follows:

- Maximum concentrations are less than 400 μg/m³.
- As would be expected, the air concentrations during winter are lower than during summer which is the critical period and important for evaluating the Project's HCN emissions.
- The 1-hour maximum concentration resulting from the model is 361 μg/m³ above the source area.
- Outside the source area, the concentration quickly drops below 80 μg/m³.
- Washout of HCN from the air would lead to an elevated concentration of HCN in the rainwater. However, by inference from international experience and due to the low atmospheric concentrations, CN concentrations in the rainfall are unlikely to be measurable above the background.

2.8.1.9 Description of the preventive measures taken to minimize impacts

In particular, measures for the prevention of water status deterioration in accordance with Directive 2000/60/EC pursuant to Article 13 and for the prevention or minimisation of air and soil pollution have to be described.

Groundwater could be impacted by any of the surface waters discussed in Section 2.8.1.8. Impacts could potentially be related to acid rock drainage, trace quantities of cyanide or other process related constituents migrating to groundwater. Therefore, in order to prevent any such impacts, a number of engineering measures have been incorporated into the designs for the waste rock and low-grade ore stockpiles and the TMF. These measures exploit the favourable natural hydrogeologic conditions of the site, which include “gaining stream” conditions (i.e., groundwater discharges to surface water), a low permeability subsurface geology and locally, old mine workings that act as groundwater drains. Such favourable hydrogeologic conditions will, in combination with selected engineering measures, result in all process flows being contained and managed.

The hydrogeologic conditions at the site have been extensively studied (see *Engineering Review Report, Report 2, Groundwater and Surface Water Characterisation Report* [xli]), and are summarised in the following paragraphs, along with the containment measures that will be incorporated into the embankment designs to protect groundwater. In addition, groundwater-monitoring systems will be installed, including monitoring wells downstream of the SCD and at other key locations. These monitoring wells will be established such that conversion to a groundwater recovery system will be available as an option if any contamination is detected.

Corna Valley Hydrogeology

There are two primary components of the hydrogeologic system within Corna Valley that make it suitable for the containment of tailings and protection of groundwater resources. These components include gaining stream conditions within the Corna Valley and low permeability geologic formations beneath the dam and tailings basin.

“Gaining stream” conditions: Water levels measurements in the piezometers installed in the area of the TMF show that the predominant direction of groundwater flow within the bedrock formations is down the valley slopes. In other words, toward and along the axis of the valley. Groundwater in the Corna Valley flows southwest in the direction of the valley along the axis, and on the sides of the valley, groundwater flows towards the valley floor. Exhibit 3.2-1 indicates the general groundwater flow direction. Evaluations of hydrographs indicate that in general water levels are seasonally relatively stable, with some variation at specific piezometer locations. These data indicate that the stream flowing down the Corna Valley is a gaining stream (i.e. groundwater flows toward the stream due to driving hydraulic head from elevations higher than the stream, therefore the stream gains water from groundwater discharge). During an average precipitation year, it also appears that this observation holds true throughout the whole year. More information on this condition and details regarding water level measurement locations are provided in the *Hydrogeological Baseline Report (Baseline Report 3)*.

This means that groundwater in the Corna Valley watershed discharges to the Corna Valley stream or recharges the shallow alluvial aquifer and flows down valley and discharge into the Abrud River, as noted in Exhibit 3.2-1. This flow path is the same as surface water in the Corna Valley. Consequently, provided that these groundwater flow directions are maintained as part of the TMF construction and operations, then no groundwater will be discharged outside of the area where water quality is routinely monitored, tested, and (if necessary) treated. The engineering containment measures discussed subsequently demonstrate how groundwater flow directions will be maintained during construction and operation of the TMF; predicted groundwater flows after tailings placement are shown in Exhibit 3.2-2. While the majority of groundwater flow from the facility will be directed toward the seepage collection facilities downstream of the TMF dam, at or near the facility's maximum elevation, a small portion of groundwater may flow back toward the Cetate pit. If groundwater from the TMF seeps to the pit system, it will mix with water to be managed and treated in that hydrologic system.

Subsurface aquifer: In addition to the groundwater flow direction discussed in the previous section, there tends to be a downward vertical gradient between the alluvium and bedrock as well as between the shallow and deeper portions of the bedrock. Additional technical details and discussions of current drilling and testing programs supporting the assessment of a downward vertical gradient at the site are presented in *Engineering Review Report 2, Groundwater and Surface Water Assessment Report*.[xlii] The downward gradient means that there is potential for a downward flow of groundwater. However, two aspects of this system suggest that this will not occur, or may only occur at a minimal level. First, the difference between the horizontal and vertical hydraulic conductivities in most groundwater systems is very large (typically 10:1 or greater). As such, groundwater tends to predominantly flow in a horizontal direction, with orders of magnitude less vertical flow. Second, significant changes in hydraulic conductivities exist between the hydrostratigraphic units underlying the site. These are: 1×10^{-6} to 1×10^{-4} m/s in the alluvium; 1×10^{-7} to 1×10^{-8} m/s in the colluvium, 1×10^{-7} to 1×10^{-5} m/s in the weathered bedrock; and 1×10^{-7} to 1×10^{-9} m/s in the competent bedrock (commonly referred to as the "black shales"). The hydraulic conductivity of the competent bedrock is low, which means that it is effectively an aquiclude (i.e. there is a minute vertical flow and only minimal horizontal flows of groundwater in this hydrostratigraphic unit). In summary, the TMF dam, Secondary Containment System, and tailings basin are underlain by bedrock that in its natural condition has very low permeability and restricts groundwater flow to the shallow subsurface. In addition, engineering measures are proposed (as described below) that will improve the containment characteristics of the TMF.

Corna Valley Engineering Containment Measures

There are four major engineering components of the TMF dam in the Corna Valley that have significant groundwater protection features. These include a pervious dam cross-section, a low permeability starter dam and colluvial layer in the facility basin, a secondary containment system and collection basin, and a treatment system to manage any seepage water. These are all intended to work in conjunction with the favourable hydrogeologic conditions to provide a substantial level of groundwater protection. Each is described in more detail below.

Pervious Dam Design: As previously noted, current groundwater flow directions are towards the centreline of the valley and then downstream. When the valley is filled in with tailings, the groundwater levels will rise. In order to maintain the flow directions towards the valley, in particular along the centreline of the dam, the cross-section of the dam is being designed as a pervious section; dam details are presented in Exhibit 3.2-3.

Although consideration was given to a low-permeability option, the pervious concept was selected for a number of important reasons. First, a pervious dam allows drawdown of the line of saturation in the upper part of the valley, which will have the effect of reducing the potential for changing the groundwater flow direction and allowing seepage from the tailings basin to enter the adjacent valleys. Second, a pervious dam concept provides a higher margin of structural safety over the long term in comparison to a low-permeability dam, since a lower saturation line or phreatic boundary will be created. Less saturation translates to considerably less stress on the upper structure of the dam. This is shown graphically in Exhibit 3.2-3. Third, a secondary containment system will be constructed to collect and reclaim the seepage, which will occur in association with the pervious components of the Tailings Dam. Finally, use of pervious dam construction procedures during final dam raising is much simpler and, hence, less risky or prone to the introduction of construction errors than would be the case for a low-permeability dam.

Low Permeability Starter Dam and Basin Colluvial Layer: As noted in Exhibit 3.2-4, the starter dam will include a low permeability core that will extend through the alluvial deposits at the bottom of the valley (see Exhibit 3.2-5) and will employ grouting methods to maximise contact with the underlying low permeability bedrock units. In addition, the low permeability colluvial layer that is present throughout most of the TMF basin will provide additional containment as well as reduction of vertical seepage. The colluvial layer will be surveyed in advance of the accumulating tailings deposit, and, where found to be discontinuous, it will be augmented by placement of an engineered barrier layer consisting of either a compacted layer of colluvial material or a manufactured material such as a geosynthetic clay liner. Such improvements will result in the completion of a continuous barrier layer beneath the tailings material.

Secondary Containment System: The Secondary Containment System will be located immediately downstream of the main dam, and will be designed to collect and contain seepage from the tailings impoundment. The system will include a sump excavated into weathered rock, upstream from a small zoned rock fill secondary containment dam. The dam will have an emergency spillway installed on the right abutment. A slurry wall will also be excavated and installed below the impervious core dam (see Exhibit 3.2-3). The slurry wall under the dam and the dam construction materials will be designed to minimise the chance of seepage. The containment system will be supplemented by a series of monitoring wells, which can be converted into pumping wells for groundwater recovery, if contaminated seepage is detected.

The water level in the operational sump will be maintained at a level below the surrounding groundwater levels (both upstream and downstream) to facilitate capture of any near-surface groundwater seepage. Hydrological studies indicate that the sump and basin above the dam will contain all floods up to the 24-hour, 100-year event. Groundwater modelling has been conducted to evaluate potential seepage from the Secondary Containment System. Results indicate low levels of seepage below the facility, which will only occur in those infrequent intervals when water levels in the sump and Secondary Containment Sump are not maintained below the surrounding groundwater levels. For normal operating conditions, seepage from the surrounding area is expected to accumulate in the Secondary Containment Systems sump. For very short intervals immediately after storm events, some potential exists for seepage to occur out of the sump. However, seepage rates in such circumstances will be very low, due to the low permeability of the bedrock formation, dam core, and slurry wall, and since water levels in the sump will only be higher than the surrounding groundwater levels for very short periods of time

The containment berm will function to collect surface water from small to moderate storm events that can then be pumped to the TMF. However, flows greater that the 100-year, 24-hour storm event will be passed over the berm. In this case, the concentration of contaminants in the discharge will be well below the NTPA 001/2005 standard due to the mixing ratio of pond water and the undisturbed water.

Secondary Treatment: While the dam seepage can be contained throughout the life of the Tailing Management Facility by pumping the seepage back to the decant pond, it may be beneficial during operation and closure to have the option of discharging this water if applicable discharge standards can be met. This would assist in reducing the volume of water in the decant pond, if needed, and would help facilitate the long-term closure of the facility. During operation, a contingency cyanide treatment system will be constructed. This system will be capable of further treatment of the low residual concentrations of cyanide to so that the decant water can be discharged to the environment. The system will be based on established technology such as the INCO/peroxide process with additional treatment utilizing the ARD treatment system to address constituents such as sulphate. In addition, while the systems to collect and pump this water back to the TMF remain available, a system of aerobic and anaerobic treatment cells for semi-passive treatment of low levels of cyanide, associated constituents, and acid rock drainage may also be developed and optimised. This system will be evaluated for possible use in closure.

Cover system placed on TMF during closure: It is BAT to prevent acidification of tailings at the outset and only then to manage (treat) the ARD[xliii] if that is required. During operations with tailings saturated, acidification will not be an issue, but with decreasing pore water level in the tailings body during closure, it may become a problem, as the geochemical analyses of the tailings material show[xliv]. Once acidification has started, it is harder to stop and mitigate than if it is prevented by appropriate measures from the beginning. If oxygen diffusion is safely suppressed, acidification can be prevented. Therefore the same design principles are applied as for the PAG sections of the waste dumps, i.e. as follows:

- 10 cm topsoil; vegetated by shallow-rooted plants such as grass to prevent erosion and assist evapo-transpiration
- 80-140 cm subsoil of clayey silt;
- 30-40 cm subsoil of compacted clayey silt as an oxygen barrier.

The hydraulic properties and the range of the infiltration rate which can be plausibly assumed is the same as for the PAG sections of the waste dumps, i.e., 5-20 % of the annual precipitation.

In summary, the surface and groundwater system in the Corna Valley can effectively be maintained as a closed system during normal operating conditions, with no release of water or sediment downstream except those designed to bypass the TMF and secondary containment through diversions. Monitoring systems will be in place to confirm that the containment systems are effective. For extreme precipitation events, a system for controlled discharge and/or treatment and discharge has been developed. These results will be achieved through the combined effects of:

- favourable hydrogeologic conditions (i.e. a gaining stream in the Corna Valley);
- favourable geologic conditions (i.e. low permeability bedrock); and
- appropriate water management/engineering measures (i.e. low permeability core through any alluvial deposits for the starter dam, contact grouting in the zone of contact with the low permeability bedrock units, a pervious dam design above the starter dam, a secondary containment and seepage pump-back system, and secondary treatment options via a system of semi-passive treatment cells, an appropriate cover system on the TMF at closure).

In addition, the ability to monitor and recover groundwater, treat seepage through semi-passive treatment cells, and discharge treated water from the tailings facility are options that provide additional measures of flexibility and control in the operation of the TMF.

2.8.1.10 Identification of possible accident hazards

Section 7 ("Risks") of the EIA and the *Emergency Preparedness and Spill Contingency Plan* are devoted to major risks and accident hazards such as TMF dam failure. The major hazards and the protection/mitigation measures can be briefly summarized as follows:

- Cyanide Release
    - Release of cyanide solution to the environment through rupture or leakage of the tailings delivery pipeline. In the case of a pipeline rupture, the collection channel under the pipeline will capture any tailings material.

Liquid tailings will flow in this channel either into the TMF pond or back to the ore processing plant site.
    - Release of CN to the environment via significant loss from the TMF (see "Decant pond spillover")
- Tailings dam failure due to
    - Seismic loading (earthquake);
    - Foundation failure;
    - Erosion or piping failure;
    - Man-made threats.

  is extremely low, because all international and Romanian standards have been used in the design of the TMF.
- Decant pond water spillover
    - The TMF pond is designed to hold 2 PMP events.
    - The risk that more than 2 PMP events must be stored is acceptably low.

2.8.1.11 Major accident prevention policy and information to be communicated to the public

The whole scope of safety measures for accident or incident situations is presented and described in the *Emergency Preparedness and Spill Contingency Plan.*

According to Article 6 of the Mine Waste Directive, the tailings management facility is also subject to the regulations of the Seveso II Directive (96/82/EC, amended by 2003/105/EC). The requirements according to the Seveso II Directive are fulfilled by the *Safety Report*. Transboundary Effects are covered by Article 16 of the Mine Waste Directive.

A major-accident response plan will be detailed as part of the operational *Emergency Preparedness and Spill Contingency Plan*, based upon Romanian and internationally recognised protocols.

2.8.2 Waste rock

2.8.2.1 Description of operations generating the wastes

Mining operations for the Roşia Montană Project will employ conventional open-pit mining techniques for drilling and blasting, loading and haulage operations, using blast-hole drills, hydraulic shovels, front-end-loaders and off-road dump trucks.

Approximately 256,9 million tonnes of waste rock are contained within the pit designs, with a waste-to-ore strip ratio of 1.2:1. Quarried rock and pre-stripped waste rock will be used as appropriate for construction of the Corna Valley TMF embankments and other impoundments. If not required for construction, waste rock will be hauled to the Cetate and/or Cârnic stockpiles and, via transfer mining, into the mined-out pits (mainly Cârnic, Orlea and Jig). It is BAT[xlv] to use transfer mining as long as there is an excavation void which can be economically backfilled.

During the design phase of the project the methods for both mineral extraction and treatment have been chosen based on a number of aspects, especially with regards to the reduction of waste generation and its potential harmfulness. Evaluations of these alternatives have been provided in the EIA, Section 5 ("Alternatives").

The consideration of alternate mineral extraction methods showed considerably lower mine waste production as an effect of underground mining methods. On the other hand, these alternatives would generate costs commonly as much as five to ten times higher than open pit mining. The difficulty of controlling the production grade of ore is also a drawback of a block-caving alternative. Either of these conditions could have a potentially devastating effect on project economics.

2.8.2.2 Quantities

Table 3-8 contains the total amount of waste rock and overburden which is generated during the Project's lifetime.

Table 3-8. Waste Rock Quantities

Components	Amount
(Massive) Waste Rock	256,9 million tonnes
Overburden	approx. 0.59 million m^3

As was indicated in Section 2.8.2.1, some of the waste rock and overburden will be used to construct impoundments while the remaining quantities will be backfilled into open pits or, if this is not feasible or economically sensible, on waste rock facilities. The respective amounts are shown in the following tables.

Table 3-9. Destinația materialelor

Year	Material Destinations									
	Crusher ot Crs Stkp Ktonnes	Cetate Stkp Ktonnes	TMP Const Ktonnes	Cetate Dump Ktonnes	Cârnic Dump Ktonnes	Cârnic In-Pit Ktonnes	Orlea In-Pit Ktonnes	Jig Pit In-Pit Ktonnes	Mausoleum In-Pit Ktonnes	Total material Ktonnes
Preproducție	420	312			343					1075
1	11342	7807	4812	9125	2914					36000
2	13014	8561	4147	4515	6263					36500
3	13320	3751	3196	8287	7946					36500
4	13190	3251	6449	1349	12261					36500
5	13300	4015			18685					36000
6	13515	1538	3895		17052					36000
7	14248		2877		18875					36000
8	13990		2150		19860					36000
9	14881		2838	11	14664	3606				36000
10	15413		2530			15057				33000
11	15317		2125			15558				33000
12	13712		5622					12330	1936	33600
13	14212		2299				15111	1614		33236
14	5796		4885				1739			12420
15			2941							
16			2941							
	185671	29235	53707	23287	118863	34221	15850	13944	1939	471831

Table 3-10. Physical characteristics of the open pits

Pit name	Volume (1000 tonnes)	Footprint (ha)	Backfill amount (1000 tonnes)	Backfilled with material from … pit
Cârnic	227,355	27,43	34,221	Cetate, Jig, Orlea
Jig	15,525	18.2	13,944	Cetate
Orlea	66,022	26,51	16,850	Cetate
Cetate (marginea de sud)	162,930	4,93	1936	Jig
Total	471,832	77,07	66951	

Table 3-11. Physical characteristics of waste rock stockpiles at closure

Waste rock stockpile name	Footprint (ha)	Amount (million t)
Cârnic	139.16	109.391
Cetate	38.2	21.300
Total	177,36	130.691

Approximately 47 million tons of waste rock and overburden will be used to construct the TMF dam.

2.8.2.3 Physical/chemical properties

Waste rock is the rock with sub-economic concentrations of gold and silver (< 0.6 g/t gold) that will be excavated to access the ore. The majority of this waste rock will come from the Cetate and Cârnic mine pits (82 percent), with the remainder originating from the Orlea and Jig pits. Waste rock produced during the development of the mine will consist of dacite, vent breccia, Cretaceous sediments, black breccia and andesite. Most of this rock will be either unaltered or have undergone dominantly argillic hydrothermal alteration (clay-pyrite), with lesser amounts of quartz-adularia-carbonate-pyrite alteration. Sulphides that may react to form ARD occur in the waste rock associated with the alteration but also can occur as a primary minerals in the black shales that dominate the Cretaceous sediments.The majority of the waste rock will be deposited in waste rock stockpiles located adjacent to the main pit complex and Tailings Management Facility. The stockpiles will be an engineered structures designed to minimise environmental impact and facilitate closure.

Some of the waste rock will be hauled from the open pits for use in the construction of the tailings dam. As this dam will be raised in successive “lifts” through the project life to allow impoundment of accumulating tailings solids, waste rock may continue to be deposited through the construction and operation stages. In the dam construction, potentially acid-generating rock will be selectively placed in deeper sections of the dam in order to minimise oxidation and the reaction of sulphides.

As part of an initial evaluation of the possible environmental impacts of the waste rock, the mineralogy of six representative samples was investigated. Optical microscopy was carried out as part of the mineralogical characterisation. This study found that potentially ARD-generating pyrite is found as free grains, or locked within the quartz, or as inclusions with feldspars. Calcite grains (ARD neutralising) were found in two of the six examples as a minor or trace constituent. Potassium feldspar, muscovite and kaolinite are abundant in most of the samples. The presence of pyrite indicates the rock has some potential to generate ARD. However, since some of the pyrite is encapsulated in quartz, the potential for it to react with water and oxygen is reduced and the full ARD potential of the waste rock may not be realised. Additional data, relative to the major and trace element chemical composition of the forecasted waste rock, which have been derived from XRF and other chemical analyses are presented in the *Geochemistry Characterisation Report*, *Engineering Review Report*.

The lithology classes of the waste rock are:

- Dacite;
- Vent breccia;
- Black breccia;
- Andesite; and
- Cretaceous sedimentary rocks.

Radiological characteristics: no geological and technical indications

Physical Characteristics (Source: *Rosia Montana Project Engineering Review Report, Volume 1, Text, March 2005, prepared by MWH Inc., Mining Group, Chapter 8.3)*

- Moist Density 1.7 t/m^3
- Effective shear angle 37°
- Total shear angle 37°

Chemical Characteristics

A comprehensive testing program has been completed to assess the geochemical characteristics of the waste rock. It is documented in the *Engineering Review Report, Appendix B (Geochemistry Characterisation Study).* This testing has included:

- mineralogical evaluations;
- acid-base accounting (ABA) testing of waste rock, tailings, low-grade ore, and construction rock samples;
- long-term laboratory-scale column leach tests on select waste rock samples;
- long-term field-scale column leach tests on a representative range of waste rock types; and
- laboratory-scale humidity cell tests of tailings from selected ore composites, which are still in progress.

These tests are intended to provide site-specific data on acid generating potential and the approximate timing of the start, if any, of the production of acid rock drainage that must be reflected in the operational planning of the mine. The testing performed to date has produced sufficient results for characterisation and the development of Project planning.

The dacite and vent breccia was further classified by silicified/potassic alteration type (abbreviated as SIK), and non-silicified/non-potassic (NSIK), which is generally argillic but may include unaltered rock or other less intense alteration types. The classifications were based on the geologic and resource model for the project, which was used to project relative percentages of each individual waste rock classification (Source: *Rosia Montana Project Engineering Review Report, Volume 3, Appendix B, Geochemistry Characterisation Report, Final for Engineering Review Report, March 2005, prepared by MWH Inc., Mining Group, Table 4.1)*

Table 3-12. Acid-Base Accounting Characteristics of Rosia Montana Waste Rock

Lithology	Percent of Waste Rock	ABA Classification (Acid Generation Potential)
Andesite	3.6 %	None
Black Breccia	15.3 %	Likely
NSIK Dacite	16.9 %	Possible
SIK Dacite	2.2 %	Likely
Existing Waste Rock Dumps	0.2 %	Likely
Sedimentary Rocks	5.3 %	Low
NSIK Vent Breccia	52.5 %	Low
SIK Vent Breccia	4.0 %	Likely
Weighted Median Classification	100 %	Low

Note: Potential ARD characteristics are only partially predictable by lithology.

General hydrochemical characterisation of the waste rock material:

- Wide range of potential Acid Rock Drainage (ARD) -generating behaviour based on ABA laboratory testing (Table 2).

- In general the Waste Rock solid can therefore be characterized with low to possible potential to ARD-Generation with slightly more neutralising potential compared to acid generation potential (Table 2).
- Periods and areas of ARD generation are possible.

Based on weighted averages of the waste rock geochemical tests, the overall waste rock mass will generate near-neutral pH water. However, other tests of specific waste rock types from the mineralised zone indicate that at least some portion of the rock extracted may have the potential for acid generation upon exposure to air and water. In their actual condition, the waste rock stockpiles will be a heterogeneous accumulation of rock types with differing potentials for acid generation. While testing indicates that most of the runoff and seepage from the waste rock areas may be relatively benign, it is expected that some areas may generate acid. The surface composition of the stockpiles will also change with time during their development, and acid generation could occur during some periods from some zones, but then cease if the zone is covered with material with a lower acid generation potential. Because of the anticipated variability in acid generation potential from the waste rock stockpiles, RMGC will incorporate specific measures to protect potentially affected groundwater and surface water regimes.

2.8.2.4 Description of the chemical substances used

The waste rock material is not treated.

2.8.2.5 Description of deposition method

a) Backfilling of open pits

It is a BAT to backfill waste rock into mine pits if transfer mining can be used, i.e., during the mining process, transferring the waste rock from the active pit to another pit which is already mined out. [xlvi]

In the Roşia Montană Project, according to the waste rock balance of the mine plan, the following scheme has been adopted:

- the Jig pit will be fully backfilled by transfer mining
- the Orlea and Cîrnic pits will be partially backfilled by transfer mining so that some parts of the pit walls will not be covered with backfilled waste material
- transfer mining is not applicable to the Cetate pit which will be mined last and will be flooded (only a small amount of waste rock will be backfilled onto the southern rim of the pit).

b) Waste rock heaps

Drainage features will also be constructed for each stockpile. The near-surface foundation conditions within the stockpile areas and the low-grade ore stockpiles are composed of black shales; surface soils consist of colluvium and/or weathered shale.

As part of the site preparation, topsoil and subsoil materials will be removed and stockpiled for use during closure. The foundation soils beneath the waste rock and low-grade ore stockpiles consist of weathered black shale or colluvial deposits consisting of clayey, silty sands to silty clays. Recompacted samples of these materials have exhibited low permeability (in the range of 1×10^{-7} to 1×10^{-10} m/sec) when tested in the laboratory.

Therefore, stripping topsoil and subsoil materials while leaving the weathered bedrock and/or colluvial deposits, will result in a low permeability layer beneath these stockpiles.

The stockpiles will all include a designed drainage layer at their bases. The drainage layer will be constructed out of coarse-grained, durable rock from mine pre-stripping or waste rock materials. Such coarse, free draining material will provide a large contrast in permeability relative to the low-permeability native soils, and will facilitate the lateral drainage of any seepage to the perimeter of the stockpile.

Diversion channels around the waste rock piles will capture potential surface waste run-on and divert it around the piles. Run-off from the waste rock piles reports to the water management system and will be collected within the TMF or one of the water management impoundments, which will allow pumping to the Wastewater Treatment Plant or the process plant.

The use of low permeability foundation soils in combination with the lateral drainage at the base of the stockpiles will minimise the potential for infiltration of acid rock drainage if it occurs into the groundwater. However, any potential seepage from the waste rock or low-grade ore stockpiles will either flow to the Corna Valley or Roşia Valley.

Waste rock material will be categorised in terms of its potential to generate acid drainage and will be disposed of within the designated sites to minimise ARD potential. A waste segregation strategy will be implemented which is described in detail in the Mine Rehabilitation and Closure Plan and is summarized in Section 2.8.2.9.

The areas and amounts stockpiled in the waste rock facilities are contained in Table 3-11, while the amounts backfilled into the open pits are shown in Table 3-10.

2.8.2.6 Waste transport system

Hydraulic shovels and haul trucks will be the primary equipment used for loading and hauling. The waste rock will be transported on haul roads to mined-out pits (transfer mining) or to the dumps.

Typical distances are about 1 to 3 km. The waste rock will be transported in dry condition.

2.8.2.7 Conditions of the land to be affected by the waste facility

<u>Cârnic Waste Rock Heap:</u> Both Cârnic Waste Rock Disposal Site and the TMF (see Section 2.8.1) are proposed to be located in Corna Valley.

The land use of the Corna Valley is primarily agricultural, with a series of farmsteads established within the valley floor. Agricultural activity includes grazing of cattle and sheep with pasture land cut for hay as conserved winterfeed. Small areas of land in the narrow valley floor and in more gently sloping areas of the valley sides have been cultivated to grow root and vegetable crops and fruit trees. However, these areas represent a very small proportion of the total agricultural land. Overall, this section of the valley is generally of restricted agricultural use (generally Class V for pasture and hay production), though there are areas that support Class II for pasture land. Crops (orchards and potatoes) are limited to Class VIII or lower.

Loss of existing land and land uses in Corna Valley is assessed as being of moderate significance on a local scale. However, on a regional scale, the loss of such an area of low-class agricultural land is not significant.

<u>Open Pits and Cetate Waste Rock Disposal Site:</u> The current land-use of this area is a mix consisting of the existing mining operations, including the open pits and waste disposal areas; outcrops; woodland consisting primarily of conifers; and areas of urban and urban fringe development.

A large part of the site consists of current or historic mining areas. The use of these areas is not to be altered by the development and as such there is no identified land use impact. The soil resource associated with the old mining areas is significantly depleted, leaving either bare rock or raw, shallow soils resulting from the weathering of the *in situ* materials that have not yet developed a biologically active horizon. These are therefore not capable of supporting productive use.

Most of those soils are covered in coniferous woodland with a very low land-use potential and, due to the thin soils and very steep slopes, are categorised as Class VI for pasture land. Again, Class I being optimal conditions and Class X being the least optimal conditions. The quality grade assessment of traditional land uses of the Project area (pasture, hay production, orchards, and potato crops) for this area yielded the land use – pasture as having the highest quality grade or class (Class VI for pasture) of the four land uses assessed.

2.8.2.8 Description of the possible impacts on the environment

a) Water

Waste rock facilities may have an impact on the ground and surface water quality. The ABA testing of waste material presented in the *Engineering Review Report, Appendix B – Geochemistry Characterisation Study* has revealed the following geochemical characterization of the waste rock which is expected throughout the mine life.

Table 3-13. Seepage Water Quality Issued from Waste Rock (Examples)

Parameter	Unit	Cetate Seepage (Station S031)	Field Column Leachate (VXB07)
pH	Std. Units	6.5	7.0
Conductivity	mS/cm	489	3340
Calcium	mg/L	62.4	327
Magnesium	mg/L	18.4	458
Sodium	mg/L	6.12	14.4
Sulphate	mg/L	140	2168
Arsenic	mg/L	0.0048	0.0093
Cadmium	mg/L	0.0024	ND
Chromium	mg/L	0.0019	0.0181
Copper	mg/L	0.0058	0.0171
Iron	mg/L	1.1	0.06
Manganese	mg/L	0.675	0.50
Nickel	mg/L	0.0049	0.0397
Selenium	mg/L	0.0092	0.0426
Zinc	mg/L	0.0226	0.186
Note: Data collected at station S031 by RMGC; ND = not detected			

"None" and "low-acid generating potential" account for 61.4% of the waste rock (i.e., clearly dominating the geochemical characterisation), while material rated "likely" or "possibly" ARD generating accounts for 38.6%. Overall, there is a net neutralising potential of the waste rock material which will be placed on waste rock facilities or backfilled into the open pits through transfer mining.

The main conclusion relevant to the waste rock seepage quality predictions drawn from the geochemical testing program is that it is likely to have the characteristics of a neutralised ARD, with neutral pH, low concentrations of heavy metals but elevated contents of Sulphate, Calcium, Magnesium and TDS. It is expected to be similar to the Cetate waste dump seepage (third column of Table 3-13).

With the encapsulation of PAG material by either stack-dumping or placing a more sophisticated cover on the end-dumped PAG material, seepage from the NAG portions will clearly dominate the seepage, and the resulting seepage quality from the waste dumps can be discharged without treatment in the closure and post-closure phase.

In the operations phase, when more statistically relevant waste rock samples become available, the predictions for the chemical composition of the waste rock seepage will be continuously updated.

b) Dust and gas emissions from the waste facility

There are dust emissions during haulage of the waste material. A detailed account of the dust emissions from haulage is contained in Section 4.2 of the EIA and the *Air Quality Management Plan*.

Mitigation measures include watering the haul roads and wastes.

Uncovered, fine-grained waste material may be prone to dust generation, which is suppressed during closure by covering the wastes with a soil cover.

2.8.2.9 Description of the preventive measures taken to minimize impacts

According to Article 10 of the Mine Waste Directive, the operator, when placing extractive waste back into the excavation voids (pits) for rehabilitation and construction purposes, must take appropriate measures to ensure

- the stability of the extractive wastes
- that pollution of soil, water is prevented
- that sufficient monitoring is carried out.

Article 13 (5) of the Mine Waste Directive stipulates that, when placing extractive waste back into excavation voids, which will be allowed to flood after closure, the operator shall take the necessary measures to prevent or minimise water status deterioration and soil pollution.

The minimization of the impacts is achieved by favourable natural conditions and engineering methods which are described in the following:

Roşia Valley Hydrogeology

Seepage from the Carnic waste dump reports to the Corna valley which is described in Section 2.8.1.9, in the context of the TMF.

Seepage from the Cetate waste dump and from the backfilled pits reports eventually to the Roşia valley.

The Roşia Valley is similar to the Corna Valley (see Section 2.8.1.9) in that there are two primary components of the hydrogeologic system that makes it suitable for the storage of acid rock drainage runoff water while still protecting the groundwater resources. These components include gaining stream conditions within the Roşia Valley, and a low permeability geologic formation beneath the Cetate Water Catchment Dam and its associated storage basin.

- **“Gaining stream” conditions:** The Cetate Water Catchment Dam and the Cetate waste stockpile area are located in the Roşia Valley. Several piezometers located near the dam and waste rock stockpiles were used to interpret the groundwater flow pattern in the valley.The interpreted contours indicate that the direction of groundwater flow is variable (northerly, southerly and westerly) towards the axis of the valley. These data indicate that the stream is a gaining stream, which suggests that any water that currently flows into the Roşia Valley watershed or recharges the water table aquifer will flow down the valley and will not migrate to adjacent valleys and groundwater containment. More information on this condition and details regarding water level measurement locations are provided in the *Hydrogeological Baseline Report (Baseline Report 3)*.

- **Sub-surface aquiclude:** Hydrogeological data indicate there is a downward vertical gradient between the alluvium and bedrock and between the shallow and deeper portions of the bedrock, which will result in a downward flow of groundwater. However, like the Corna Valley, the dominant nature of horizontal groundwater flow and the low hydraulic conductivity of the underlying competent bedrock (1×10^{-7} to 1×10^{-9} m/s) are conditions that make it highly likely that groundwater will continue to discharge to the stream and/or become baseflow. These observations have been confirmed by water level measurements from multiple piezometer installations in the valley. Consequently, the surface water and groundwater system within the Roşia Valley will be confined to the near surface groundwater system (baseflow) and the surface water system.

Roşia Valley Engineering Containment Measures

The Roşia Valley is also similar to the Corna Valley in that the engineering components of the Cetate Water Catchment Dam (see Exhibit 3.2-6 for cross-sectional details) will also significantly enhance the protection of groundwater. These components include contact grouting between the core and the substrata, as well as strategy for maintaining low water levels in the impoundment in normal operating conditions. These measures are intended to work in conjunction with the favourable hydrogeologic conditions in the Roşia Valley in order to provide groundwater protection. Each measure is described in more detail as follows:

- **Low permeability core dam and seepage cut-off;** as shown in Exhibit 3.2-6, the Cetate Water Catchment Dam will include a low permeability core that will extend to the crest of the dam. The core will be constructed from re-compacted clayey silt and colluvial deposits that will be obtained from within the valley. A cut-off trench will be excavated below the core along the dam alignment through any alluvial deposits that are encountered in the floor of the valley. In addition, below the base of the clay cut-off wall constructed in the trench, grout will be placed into the upper zones of the bedrock to seal the contact zone that could potentially be conduits for seepage.
- **Pond operations:** The Cetate Water Catchment Dam is intended to impound seepage as well as acidic drainage from historic mining operations as well the new mine development. The water within the impoundment will be regularly pumped to the Wastewater Treatment Plant for treatment, and either discharge to the environment or recycled to the processing plant for use as process water. The operational water level in the pond is expected to be low due to the continual requirement for water treatment and process water use. Therefore, the potential for seepage out of the basin will be very limited. Discharge may occur in the unlikely event of storm events exceeding the 100-year, 24-hour event. In fact if the pond is operated at the normal operating level, events up to and exceeding the 100,000-year, 24-hour event would be contained. Under normal operating conditions, dilution would be sufficient such that discharge standards would be met with the possible exception of pH. Meeting a neutral pH standard during an extreme storm event is not practicable because the pH of rainfall is typically slightly acidic and does not meet that standard of between 6.5 and 8.5 (NTPA 001/2005). However, as a mitigation measure, the dam spillway and shell will be constructed of limestone to add alkalinity and increase pH in any water that is discharged during an extreme storm event.

Waste segregation strategy

In order to minimize the formation of ARD, RMGC will implement a waste segregation and waste encapsulation strategy which is described in the following.

- Waste rock dumps will be piled up using a combination of end-dumping and stack-dumping. End-dumping will be used for the dumps basements and for the outer rim of the dump, where the NAG material will be used, while stack-dumping, which leads to higher compaction, will be used for the inner parts of the dump, where the PAG material will be deposited. The compaction associated with stack-dumping minimises exposure to oxygen and water around the body of compacted PAG material. Stack-dumping allows the use a relatively thin cover system without strict requirements to be applied on the waste dumps.
- End-dumped PAG material will be deposited in a small section along the outer rim of the waste dumps and covered with a less permeable cover system than the (larger) NAG portion where the water balance and oxygen ingress is less of a concern. Wherever technologically feasible, PAG material which is end-dumped according to the mine plan will be covered and encapsulated with NAG material which is re-handled after the end of the operations phase, in order to minimise the amount of sub-soil and top-soil needed for a more elaborate cover.
- The material which will be backfilled to the open pits will be sorted in a way, that PAG material will predominantly be placed at the bottom of the backfill or be covered by at least 10 m of NAG material, so that oxygen contact with the PAG material is minimised.

More details on the waste segregation strategy are contained in the *Mine Rehabilitation and Closure Plan.*

Water treatment

During the operations phase (i.e. where stack-dumping of ARD generating material is not yet completed, and end-dumped ARD material may still be uncovered), the occurrence of ARD which needs treatment is possible. In this case, the water captured in the drainage ditches around the waste rock facilities will be directed to the ARD treatment plant before discharge into the environment.

The infiltration water which seeps through the backfilled waste material into the pit and reports to the underground mine workings will eventually be captured behind the Cetate dam. It is then directed to the ARD treatment plant for treatment.

Cover placement

At closure, a cover will be placed on the waste rock piles and the backfilled open pits.

For the NAG material and portions of the waste rock dumps where PAG material is stack-dumped and "encapsulated" by NAG material, design criteria for the cover systems are as follows:

- prevention of inadvertent access to the wastes;
- support of vegetation ;
- improvement of visual appearance;
- prevention of dust blown off the wastes;
- erosion control.

The minimum thickness for achieving the design criteria for NAG material is 30 cm, consisting of the following:

- 10 cm topsoil; with vegetation cover
- 20 cm subsoil of clayey silt.

Additionally, for the PAG material which is end-dumped separately without encapsulation by NAG material, the design criteria additionally include the following:

- minimization of water infiltration into the wastes;
- minimization of oxygen entry to the wastes.

To achieve these additional design criteria, the cover must be significantly thicker, and possess sufficient long-term stability of its hydraulic and gas transport properties.

Based on international experience, adapted to the climatic conditions, the following Store & Release Cover (SRC) complemented by a layer of low oxygen diffusion is proposed (this is comparable to similar cover systems across the EU[xlvii], [xlviii]):

- 10 cm topsoil; vegetated by shallow-rooted plants such as grass to prevent erosion and assist evapo-transpiration
- 80-140 cm subsoil of clayey silt;
- 30-40 cm subsoil of compacted clayey silt as an oxygen barrier.

Due to compaction, the oxygen barrier maintains a high pore saturation and thus effectively inhibits oxygen diffusion (oxygen diffusion is highly dependent on the saturation of soil pores with water). The use of water-saturated oxygen barriers as part of a cover is BAT[xlix]. Long-term stability of the oxygen barrier can be guaranteed if frost cracking, root penetration and other long-term perturbation effects are safely precluded. The Romanian standard for frost-safe constructions is 90 cm. The test plots described in the *Mine Rehabilitation and Closure Plan* will demonstrate under site-specific conditions that root penetration by local species will not damage the oxygen barrier and, if this turns out to be a potential problem, the cover configuration will be changed.

Along with its significant reduction of oxygen diffusion, the PAG cover will also reduce infiltration. Based on international experience with similar cover systems[l], the infiltration rate for comparable cover systems under similar climatic conditions as in Roşia Montană is in a range of 10 to 25 % of the annual precipitation. Since detailed test data for the Project area are not available yet, this conclusion has been drawn from relevant and comparable case studies. One of the biggest mine closure projects in Europe, but also worldwide, is the Wismut remediation project (Germany)[li]. Under this mine closure program various types of soil covers are being constructed for some 30 individual waste rock dumps, backfilled open pits, and tailings ponds at about ten individual mining and milling sites, with a total area of about 1000 ha. The cover types designed by Wismut according to BAT include the types foreseen for Roşia Montană, i.e. simple thin-layer covers, which must fulfil the minimum cover requirements (erosion control, re-vegetation, prevention of access to the waste rock or tailings), as well as more sophisticated store-and-release covers as described above. Much experience has been obtained concerning the performance of these SRC systems, as they are the most common cover type at Wismut sites and elsewhere.

More information on the cover system is contained in the *Mine Rehabilitation and Closure Plan*.

In summary, the surface and groundwater system in the Roşia Valley will effectively be a closed system, with no environmentally significant impounded drainage escaping downstream except in very unusual circumstances, such as extraordinary storm events (although dilution from such events should result in concentrations below standards). This result will be achieved through the combined effects of:

- favourable hydrogeologic conditions (i.e. a gaining stream);
- favourable geologic conditions (i.e. low permeability bedrock and low-permeability colluvial materials; and
- appropriate engineering measures (i.e. the installation of a low permeability dam core, a cut-off wall installed in a trench excavated through the alluvial deposits, and contact grouting into the competent bedrock, treatment of seepage, waste segregation and stack-dumping of PAG material, placement of sophisticated cover on end-dumped PAG material).

2.8.2.10 Identification of possible accident hazards

A possible accident hazard of waste rock facilities is slope instability and slope failure which results in a displacement of waste material and may cause injuries to workers and damage to property. However, the design of the waste dumps follows guidelines which safely preclude slope failure.

2.8.3 ARD treatment sludge

2.8.3.1 Description of operations generating the wastes

As is evident from the comparison of the expected water quality at different sources (see Table 3-6, Table 3-12), the water treatment plant must cope with the following constituents:

- pH;
- heavy metals;
- metalloids (Arsenic);
- neutral salts (Sulphate, Calcium).

It is BAT to use lime precipitation to treat ARD[lii], possibly adding ferric salts to remove arsenic. However, lime precipitation alone does not achieve the low Romanian standards for Sulphate and Calcium in effluent (and TDS which, as a sum parameter, is closely related to both). Therefore, additional treatment technologies which can serve as an add-on to simple lime treatment have been investigated and compared. A detailed evaluation of feasible technologies and the selection of the technology which is preferred under the current knowledge is contained in Section 5 (Alternatives) of the EIA.

The optimal solution to meet NTPA 001/2005 standards for all water constituents was found to be the following combination of Gypsum and Ettringite precipitation:

1) Lime precipitation to pH=10.5, separation of the Gypsum sludge;

2) Ettringite precipitation to pH=11.5, separation of the Ettringite sludge;

3) re-neutralisation to pH=8.5 by HCl or CO_2.

The water treatment process and the corresponding waste amounts of the Gypsum/Ettringite process have been modelled[liii] in a report based on the current Adit 714 mine effluent, using a code (AquaC) which is mainly based on PHREEQ-C.

Conservatively assuming Sulphate concentrations of around 2000-3000 mg/l and total Iron concentrations of 300-600 mg/l, a specific waste generation of 10 kg/m³ (rounded) of dry residues is a reasonable and sufficiently conservative prediction.

On-shore treatment

During closure, an additional on-shore treatment system for the Cetate pit water is foreseen in order to neutralize any acidity and maintain an environmentally benign state so that the pit lake serves its intended beneficial post-closure purpose (see *Mine Rehabilitation and Closure Plan*).

It is assumed that an on-shore treatment plant will be erected which will add lime to water abstracted from the pit, neutralize it and discharge it back to the pit. The pit is used as a settling pond for the precipitates which has the advantage that no separate waste management or disposal is required. Adding excess alkalinity to the water which is pumped back to the pit will help to maintain a pH buffer so that water quality remains benign until the sulphide-rich parts of the pit walls (which are below the level that can be collected and gravitationally drained to the Roşia valley) have ceased to oxidize and generate low-pH runoff.

As the pit water is not discharged into the environment beyond the project confines, pit water quality needs not achieve the NTPA 001/2005 standard, but it must be in a neutral range to accommodate the aquatic life and serve birds and animals as drinking and bathing water. Based on hydrochemical modeling[liv], adding 0.65 kg $Ca(OH)_2$ per m³ water is sufficient to neutralize the water and add some excess alkalinity (pH of the water discharged into the pit is 9). The specific amount of treatment waste resulting from in-pit treatment is 1.1 kg (solids) per m³.

At a treatment capacity of 1000 m³/h, exchanging the pit lake volume once would take approximately one year, so that approximately 10000 tons (solids) of gypsum and hydroxide sludge will settle in the pit annually. This amount is very small compared to the volume of the pit water body.

In-pit treatment (i.e., using the pit as a settling pond) is international practice[lv], [lvi], [lvii] and has the advantages that

- the neutralizing potential of the sludge can be used to buffer the pH of the pit;
- costs are lower because the underflow sludge must not be dewatered;
- no additional disposal site must be operated and maintained.

2.8.3.2 Quantities

Table 3-14 and Table 3-15 summarizes the wastes generated by pH, SO4, Ca and metal treatment in the closure and post-closure phase. It must be emphasised again that the assumptions on which these estimates are based are very conservative, as required by Annex 3 of MO 863/2002[lviii] if uncertainties in these assumptions cannot be eliminated.

Table 3-14. Waste generation by pH, SO_4, Ca and metal treatment, operations phase

Flow*	Flow rate (m^3/h)	Specific waste amount generated (kg solids/m^3)	Annual amount generated (t/y)
From Cetate dam to ARD treatment plant (#27)	280	10	24528
Cirnic waste drainage holding pond to ARD treatment plant (#31)	32	10	2803
SCD pond to ARD treatment plant (#19)	-	10	
Total	312	10	27331

* The numbers in parentheses refer to the Water Balance Schematic[lix] which is also part of the Water and Erosion Management Plan and Section 4.1 of the EIA

This corresponds to a total amount of **465.000 tons (dry substance)** for the entire operations phase.

Table 3-15. Waste generation by pH, SO_4, Ca and metal treatment, closure phase

Flow*	Flow rate (m^3/h)	Specific waste amount generated (kg solids/m^3)	Annual amount generated (t/y)
From Cetate dam to ARD treatment plant (#27)	221	10	19360
Cirnic waste drainage holding pond to ARD treatment plant (#31)		10	
SCD pond to ARD treatment plant (#19)	77	10	6745
Subtotal	298	10	26105
On-shore/In-pit treatment	1000	1.1	9636

* The numbers in parentheses refer to the Water Balance Schematic[lx] which is also part of the Water and Erosion Management Plan and Section 4.1 of the EIA

2.8.3.3 Physical/chemical properties

The residues by pH, SO_4, Ca and metal water treatment can be characterised as a minor waste stream in terms of quantity and relevance from the environmental point if view. Physical and radiological characteristics as well as chemical composition nevertheless can be characterised as follows:

The residues from gypsum precipitation will be separated. As a result of the calcium carbonate precipitation cca. 1 kg dry substance/m^3 sludge will be generated, which will consist mainly of ferric hydroxide (approximately 0.6 kg dry substance/m^3) and gypsum (approximately 0.4 kg dry substance/m^3).

The leachate of the sludge contains calcium as well as sulphate. The concentrations will be limited by the solubility limit of gypsum. However, in the leachate there will be no release of heavy metals, unless under acid conditions.

As result of the Ettringite precipitation approximately 6 kg dry substance per m^3 treated water will be generated which occur nearly completely as Ettringite. Chemically, Ettringite is a Sulphate (Hydrated Calcium Aluminum Sulfate Hydroxide) with the formula

$$Ca_6Al_2(SO_4)_3(OH)_{12} - 26H_2O.$$

The leachate of the sludge will not contain any relevant pollutant concentrations unless leached under acidic conditions, where aluminium as well as calcium and sulphate will solute.

Radiological characteristics: no geological or technical indications

2.8.3.4 Description of the chemical substances used

In the ARD treatment process, the following substances are used:

- $Ca(OH)_2$ for pH increase of gypsum precipitation
- Calcium Aluminate ("Walhalla Lime") for pH increase of Ettringite precipitation
- HCl or CO_2 for re-neutralization
- flocculants to assist flocculation in case part of the sludge is recycled in a HDS scheme

2.8.3.5 Description of deposition method and classification of waste facility

According to the different phases of mine development for this waste stream, the project design provides the following disposal arrangements:

- During the operation phase the Waste Water Treatment Plant clarifier underflow solids slurry will be disposed in the TMF as an additional deposition in a ratio of 1:500 to the tailings material.
- During the mine closure phase this waste stream is planned to be sunk in the Cetate open pit mine lake as the TMF will no more be available for waste deposition in this phase of the project.

Additional details concerning these aspects of the extractive waste management measures are available from the *Tailings Facility Management Plan* and the *Mine Rehabilitation and Closure Management Plan*.

2.8.3.6 Waste transport system

During operations phase and early closure phase, the ARD sludge is pumped through a separate pipeline to the tailings pump box at the detoxification plant, is commingled there with the tailings and pumped to the TMF in the same pipeline as the tailings.

As soon as the TMF cover is placed during the closure phase and in the post-closure phase, the ARD sludge is pumped through a pipeline into the Cetate pit which will be flooded.

2.8.3.7 Conditions of the land to be affected by the waste facility

As the ARD treatment sludge is pumped to the TMF during operations and early closure and to the flooded Cetate pit during closure and post-closure, the statements under Sections 2.8.1.7 and 2.8.2.7 apply.

2.8.3.8 Description of the possible impacts on the environment

a) Impacts on Water

The environmental impacts of the disposal of the ARD sludge on the TMF are negligible compared to the impact which is caused by the tailings disposal due to

- the much smaller amount of ARD sludge compared to the amount of tailings
- the much less toxic properties of the ARD sludge, compared with the tailings.

It therefore seems justified to refer to Section 2.8.1.8 for the period in which the ARD sludge is disposed into the TMF.

If the ARD sludge is disposed of into the flooded Cetate pit, the sludge may dissolve and release heavy metals and major neutral ions (Sulphate, Calcium) into the pit water if the pit water becomes acidic. However, the pit water is not discharged directly into the environment. Pit water reporting to the underground mine workings can always be captured behind the Cetate dam and pumped back to the ARD treatment plant, so that no contamination is released into the environment.

Moreover, there are preventive measures which minimize the risk that the ARD generated by sulphidic portions of the pit walls turns the pit water acidic. These measures are described in Section 2.8.2.9.

b) Dust and gas emissions from the waste facility

There will be no dust or gas emissions generated by the ARD treatment wastes or caused by their disposal.

2.8.3.9 Description of the preventive measures taken to minimize impacts

As the ARD sludge is disposed of either in the TMF or the flooded Cetate pit, the same statements as those made for the Rosia and Corna valleys, respectively, apply (see Sections 2.8.1.9 for Corna valley, Section 2.8.2.9 for the Rosia valley).

Additionally, there are the following preventive measures with respect to the flooded Cetate pit (see also *Mine Rehabilitation and Closure Plan*):

- gravitational diversion of low-pH runoff from sulphide-rich parts of the pit walls so that this water does not cause a deterioration in the pit lake quality;
- in-pit treatment by lime addition has proved a successful option provided the generation and inflow of low-pH water can be minimized[lxi], [lxii]. This is achieved by
  - fast flooding after the end of active mining so that sulphide-rich rock surfaces are submerged as soon as possible;
  - securing the pit walls from failing (which would open new surfaces to oxidation);
  - neutralising the sulphide-rich generating portions of the pit walls with suitable methods such as;
    - Strategic placement of mixtures of limestone and organic matter;
    - Application of proprietary products (e.g., bactericides or chemical sealants) on relevant areas;

  - Application of oxygen-consuming biological methods ("biomats") which also neutralize low-pH runoff;
  - Covering sulphide-rich areas with a mineral or synthetic layer;
- adding a sufficient amount of alkalinity to the pit lake (e.g., excess alkalinity from on-shore treatment) which safely neutralizes the acidity rinsed off the upper layer of the pit walls for a limited period of time;
- (semi-) passive in-pit treatment by the addition of organic matter, fostering the growth of Sulphate-reducing bacteria. Wood sawdust, spent mushroom compost, hay and straw, partially treated cattle manure, sewage sludge from the Project sewage treatment plant, and waste potato skins are among the organic waste materials that have been more or less successfully used in acid mine water remediation.[lxiii]
- placement of coarse-grained limestone in the pit to provide the Carbonate buffer necessary for neutralization;
- careful diversion of undisturbed drainage away from the pit and prevention of drainage from waste rock facilities from entering the pit.

In-pit treatment (alkalinity production) using Sulphate-reducing bacteria (SRB) has been shown at different mine sites to be a viable and long-term sustainable method to manage low-pH pit water.[lxiv] A condition for in-pit treatment is that the zones with high SRB activity are not stirred and dispersed in a storm event, which could be the case in a deep pit such as Cetate. Methods used to stimulate SRB activity will include the following:

- neutralisation to raise the pH level into a range suitable for SRB activity;
- organic addition to develop anoxic conditions and encourage and feed sulphate-reducing bacteria; and,
- fertilisation to stimulate natural organic production in the lake.

2.8.3.10 Identification of possible accident hazards

There are no accident hazards which must be considered in the disposal of ARD treatment sludge.

2.8.4 Soil

2.8.4.1 Description of operations generating the wastes

Topsoil is the upper layer of the ground surface (after grubbing and removal of saleable timber) and **subsoil** is the lower layer of the ground surface above the rock; although identified as a waste, both topsoil and subsoil will be stockpiled for reuse in the revegetation of excavated areas of the site, in the closure phase of the mining operation.

According to the BAT/BREF Document for the Management of Tailings and Waste-Rock in Mining Activities (2004)[lxv], reclamation is defined as "restoration of land and environmental values of a mine site after the ore is extracted. Reclamation operations are usually underway as soon as the ore has been removed from a mine site. The process includes restoring the land to its approximate original appearance by restoring topsoil and planting native grasses and ground covers."

Conservation of soil for rehabilitation purposes is an important element of the Roşia Montană Project. Preventing wastage of the topsoil resource while stockpiled is also considered as part of the Roşia Montană Project *Water Management and Erosion Control Plan.*

During the construction and operation phases, the sites listed in Tables 3-15 and 3-16 will be stripped of soil which will be stockpiled for later use in the closure phase to cover the waste sites.

Preparation of the site for mining will begin with logging of merchantable timber and firewood from the site including the footprint of the open pits, stockpiles, plant site area, and roads. Timber and firewood will be sold or used for other beneficial purposes in accordance with Government of Romania forestry regulations. Remaining vegetation (e.g. tree stumps) will be grubbed out, the topsoil/organic materials and the subsoil will be removed and stockpiled in five stockpiles, different for topsoil and for subsoil, for use during progressive rehabilitation and site decommissioning activities.

Prior to construction, the corresponding surface area will be stripped of topsoil. Scarification and compaction of the exposed colluvial and/or weathered bedrock materials will provide a semi-impervious layer under the waste rock stockpiles. In some cases preparation of the construction or mining or waste sites (such as the TMF starter dam) will involve removing trees, vegetation, excavating a cut-off trench into relatively solid weathered rock, and covering the surface of the weathered rock at the base of the cut-off trench with a concrete mat.

2.8.4.2 Quantities

An estimated total of 973 hectares of soil will potentially be stripped.

For the different facilities of the project Table 3-16 gives an overview concerning the arising soil quantities.

Table 3-16. Estimated volumes of topsoil and subsoil (in m^3) to be stored (from Section 4.4 - Soil of the EIA)

Volumes of stripped soil by industrial facility type		
Facility	Upper horizons m^3	Lower horizons m^3
Plant	102239,13	1034747,67
Construction site facilities	1190,01	17850,08
Cetate water impoundment and dam	24093,04	57160,45
Tailings Management Facility Corna	541048,02	1865442,32
Cetate waste rock pile		
Cîrnic waste rock pile	302777,77	391165,23
Low-grade ore stockpile		
Plant access road	17107,79	23492,12
Road DJ 742 diversion	68202,10	259631,98
Inert waste dumps	0,00	0,00
Explosives storage	679,14	1584,66
Sulei Andesite Quarry	45157,91	74344,59
La Paraul Porcului Sandstone Quarry		
Orlea Pit	179520,20	441341,49
Jig Pit		
Cetate Pit		
Carnic Pit		
Collecting ditches \ water diversion	36138,08	53107,28
Haul roads and site roads	43245,07	53026,72
TOTAL	1361398,26	4272894,59

2.8.4.3 Physical/chemical properties

The overburden soil is relatively diverse in terms of type and sub-type, due to the numerous soil characteristics (thickness, parent material, grading of deposits, texture class and skeleton content) in associations with the site characteristics (relief, slope gradient and subjacent rock). At a basic level the soils can be characterised as those within the Cambisol class and those that are of a non-evolved or loose class:

- Cambisol Class – with sub-types of: bruni eu-mesobasic with typical and lithic sub-types; and acid bruni soils with typical, andi, lithic, andi-lithic sub-types.
- Non-evolved or loose soil classes – typical regosols, colluvisols and lithosols.

Exhibit 3.2-7 presents the locations of the 8 units of soil types and subtypes and 19 units of associations of soil types and soil subtypes that were delineated within the investigated site. Soils were defined as per the principles and criteria of the Romanian Soil Rating System[lxvi] and further correlated with the World Reference Base for Soil Resources[lxvii], as follows:

- Typical Bruni Eu-mesobasic Soils (Eutric-Cambisols)
- Lithic Bruni Eu-mesobasic Soils (Lepti-eutric Cambisols)
- Andi Bruni Eu-mesobasic and Andi-Lithic Bruni Eu-mesobasic Soils (Andi-eutric Cambisols and Andi-lepti-eutric Cambisols)
- Typical Acid Bruni and Lithic Acid Bruni Soils (Dystric Cambisols, Eutric Cambisols and Lepti-dystric Cambisols)
- Andi Acid Bruni and Lithic Andi Acid Bruni Soils (Andi-dystric Cambisols and Andi-lepti-dystric Cambisols
- Typical Regosols (Eutric Regosols)
- Typical Colluvisols (Fluvisols)
- Typical Lithosols (Eutri-lithic Leptosols)

For the different facilities of the project Table 3-15 shows the composition of the soils considering the principal soil types and reflecting the surface areas of these soil types. The minor shares of rocky areas (112,000 m^2), open pits (199,000 m^2) and lakes (3000 m^2) are not classified in Table 3-17.

Table 3-17. Stripped surface areas in relation to types of soil (excluding lakes and rock areas)

Facility	Total impacted area	Principal soil type (m²)							
		Dystric Cambisol BO	Lithosol LS	Regosol RS	Eutric Cambisol BM	Andosol AN	Rocks Z	Pits	Lakes
Processing	51.37	448231.65	16196.13	19795.28	22918.98	4068.83			2541.39
Construction camp	1.18	11800							
Low grade ore	26.97	157061.13	14738.98	18014.31	22249.71			57674.30	
Cetate dam	16.84	73365.96	8806.53	8998.01	77215.47				
TMF Corna Vally	363.13	1198546.61	493379.3	411771.06	1486070.21		4262.02	36828.14	451.00
Cetate waste rock stockpile	38.21	150009.45	41387.73	50585.01	140137.26				
Cirnic waste rock stockpile	139.17	935135.97	116208.3	201639.02	94756.16		9375.82	34579.10	
Plant access road	11.77	20344.45	416.99	51.05	96893.94				
Diversion of road 742	44.88	320064.86	9075.11	32592.74	87036.61				
Construction and Demolition waste storage a rea	0.59							5883.74	
Explosive storage	0.2	1800				200.00			
Sulei andesite quarry	11.33	100190.78	12874.54			200.00			
La Piriul Porcului sandstone quarry	4.55	40940.29	4529.37						
Orlea Pit	45.04	25461.9	101186.3		285357.26		38427.45		
Jig Pit	18.5	129495.61	55483.83						
Cetate Pit	69.09	199332.67	42549.58	695.83	5840.93		22676.57	419803.57	
Cirnic pit	72.84	193803.86	71430.25				33468.49	429744.56	
Water collectors and diversions channels	22.25	105228.83	26847.18	15250.18	71574.40	163.85	1414.54	2067.13	
Exploitation and technologic roads	35.81	195905.899	20379.75	12336.56	65420.40	90.09	2410.46	61539.25	
Total	973.63	4306719.919	1035490	771729.05	2455471.33	4722.77	112035.35	1048119.79	2992.39

Some of these soils were found to exist by pedological techniques including analytical soil sampling and research of existing national base soil maps and pedo-geochemical characteristics, rather than the profiles taken alone. A description of each of the main types is presented in the *Rosia Montana Project Baseline Report 6, Soil Baseline*, for further details.

2.8.4.4 Description of the chemical substances used

No chemicals are used.

2.8.4.5 Description of deposition method

The proposed locations of the four soil stockpiles are south of the plant site, west of Sulei quarry, north-west end of TMF dam, and south and west of the final dam footprint in the Corna Valley.

At closure, the soil heaps are gradually removed as the soil is used to cover the waste facilities, mainly the

- TMF basin
- TMF dam face
- Cetate and Carnic waste heaps
- partly and completely backfilled open pits.

2.8.4.6 Waste transport system

Hydraulic shovels, excavators and haul trucks will be the primary equipment used for loading and hauling. The soil will be transported on haul roads to the soil storage facilities.

Typical distances are about 1 to 3 km. The soil will be transported in dry condition.

2.8.4.7 Conditions of the land to be affected by the waste facility

The topsoil stockpiles and the subsoil stockpiles are expected to cover some 40 ha of the land altogether. The total area of these stockpiles is limited by the circumstance that about 30 % of the soil to be stripped in the operational phase can be reused during the same phase and only 70 % need to be stored for later reuse in the closure phase.

Land use at the stockpile locations is primarily agricultural with cattle and sheep pasturing and fields for forage and limited woodland. Sterilisation of the soil resource under the topsoil piles will be temporary for the life of the Project. Following removal of the topsoil stockpiles the soils are expected to return to their original use for their original use as supporting fodder for grazing and forage.

2.8.4.8 Description of the possible impacts on the environment

The environmental impacts will be minimal, as the soil stored is inert. During the operations phase, the soil heaps will vegetate by free succession which provides an additional protection against erosion and dust generation.

2.8.4.9 Description of the preventive measures taken to minimize impacts

As the predicted impacts are minimal, no specific preventive measures are taken.

2.8.4.10 Identification of possible accident hazards

No hazards may originate from the soil heaps are known.

2.9 Monitoring

2.9.1 General

Control and monitoring procedures for the extractive industries waste management measures have been developed considering the requirements of Article 11 (2)(c) in the *EU-Directive for the Management of Waste from the Extractive Industries* (Directive 2006/21/EC or Mine Waste Directive). According to the Preamble (Point 20) of the Mine Waste Directive, a monitoring and control system for the after-closure period must be laid down, similar to the Directive 1999/31/EC (EU Landfill Directive). Further details concerning the control and monitoring procedures can be taken form the *Environmental and Social Monitoring Plan* for the

- Pre-Construction/Construction Phase Monitoring,

- Operational Phase Monitoring and
- Closure Phase Monitoring

The environmental monitoring programmes include such activities as:

- Physical Stability Monitoring
- Chemical Stability Monitoring
- Air Quality Monitoring
- Surface Water Monitoring
- Hydrogelogy/Groundwater Monitoring
- Biological Monitoring.

2.9.2 Monitoring of the TMF

A number of instruments will be used at the tailings dam and the Secondary Containment Dam. The different types of instruments that are currently planned include the following:

- vibrating wire piezometer;
- hydraulic piezometer;
- slope indicators (inclinometers);
- deformation monitoring stations;
- piezometer nests for groundwater monitoring; and,
- a V-notch weir for flow measurements.

A total of six vibrating wire piezometers are planned for installation in each of the three elevation locations within the central core of the starter dam section. In addition, two vibrating wire piezometers are planned at two elevations within the foundation, immediately downstream of the central grout curtain. Two vibrating wire piezometers will be installed at two locations in the downstream shell to determine if there is an unexpected rise in the line of saturation for this area. These piezometers will monitor the under-drainage system.

Nine hydraulic piezometers will be installed in the upstream tailings beach. The piezometers will tentatively be located about 200 m apart from each other across the valley. Five piezometers will be located 100 m upstream of the dam centreline and three piezometers will be located 200 m further out on the beach with one planned closer to the right abutment. The hydraulic piezometers will be installed from the beach and will be raised in advance of the tailings beach. The purpose of the piezometers is to determine the line of saturation in the tailings and to determine the rate of water level drop after the spigotted tailings are moved to another area.

Two temporary slope indicators are planned for installation on the downstream slope of the starter dam and on a lower berm of the final dam. The purpose of the slope indicators is to check for possible downstream shear deformation at shallow depth in the bedrock.

A permanent nest of piezometers will be provided on each ridge of the Corna Valley, upstream of the tailings dam, for monitoring groundwater levels and quality. An existing nest on the left ridge will be used for this purpose and a new nest will be installed on the right ridge.

A V-notch weir will be provided in the valley channel just upstream of the sump. During sustained dry periods, the flow at this weir should be indicative of the seepage rate through and under the tailings dam.

Two sets of vibrating wire piezometers will be located in the Secondary Containment Dam, both upstream and downstream of the grout curtain. These piezometers will assess the hydraulic containment of the Secondary Containment Dam. Survey deformation stations will be established on the dam to monitor any potential movements.

Downstream of the dam, it is planned to monitor groundwater levels and quality from the existing piezometer nest.

2.10 Closure of the waste facilities

2.10.1 Mine closure plan

According to the Article 5 (3f) of the Mine Waste Directive, the operator has to propose a plan for closure, including rehabilitation, after-closure procedures and monitoring as provided for in Article 12 of the Mine Waste Directive.

The environmentally safe closure and decommissioning measures of the extractive waste facilities including the Tailings Management Facility (TMF) are described in the *Mine Rehabilitation and Closure Management Plan*.

The individual measures for the individual waste facilities have been described briefly in the previous sections, i.e.,

- 2.8.1 for the tailings management facility (TMF)
- 2.8.2 for the waste rock heaps and backfilled open pits
- 2.8.3 for the disposal of ARD sludge in the flooded Cetate pit.

2.10.2 Financial guarantee

According to the Preamble (Point 25) and Article 14 of the Mine Waste Directive, a financial guarantee must be sufficient to cover the cost of rehabilitating the waste facilities; the rehabilitation costs must in turn be assessed and the rehabilitation work performed by an independent and suitably qualified third party. The mine facility rehabilitation procedures are described in the Waste Management Plan.

RMGC will also comply with Directive 2004/35/EC on environmental liability with regard to the prevention and remedying of environmental damage. In accordance with this Directive RMGC undertakes to take all reasonable efforts to minimize environmental damage and to restore the environment so that no environmental liability will arise. Adequate financial resources are secured for the closure and post-closure phases to rehabilitate the mining site and ensure that any environmental damage will be remedied to avoid leaving behind environmental liabilities.

Articles 7-2(d) of the EU Mine Waste Directive and the ToR of the EIA require that the proponent has adequate arrangements by way of a financial guarantee or equivalent, as specified under Article 14 of the EU Mine Waste Directive, so that "all obligations under the permit issued pursuant to this Directive, including after-closure provisions, are discharged".

There are three (3) components which must be clearly distinguished:

- The technical concept of the mine closure, time estimates of the activities, including the post closure phase, is contained in the Mine Closure and Rehabilitation Plan. Specific Waste Management issues are addressed under the *Waste Management Plan*.
- Cost estimates, which are broken down according to the relevant activities and time periods, are provided as part of the Engineering Review Report[lxviii].

- Arrangements of financial instruments to guarantee that funds are available when they are needed, including the NPV calculations, are provided by RMGC in the appropriate form.

2.11 Consultation procedure

According to the Preamble (Point 26) of the Mine Waste Directive, a common consultation procedure must be set up to facilitate consultation among neighbouring countries, if trans-boundary effects are a consideration for the project concerned.

The classification of the TMF as a Category A waste facility necessitates the application of Article 16 of the *Mine Waste Directive*, regarding Transboundary effects In this context, the ESPOO Convention applies.

Under normal operating and closure conditions, there are no measurable transboundary impacts. Transboundary impacts may only occur, even if in a very attenuated fashion, during a singular disruptive event (see Section 2.8.1.10). For this very unlikely case, transboundary effects are limited to the water path and are described in Section 4.1 (Water) of the EIA, of the "Transboundary Effects" subsection.

Moreover, the consultation and emergency response procedures are described in the major-accident response plan which is part of the operational *Emergency Preparedness and Spill Contingency Plan*, and is based upon Romanian and internationally recognised protocols.

2.12 Record keeping

2.12.1 General requirements

According to Article 17 (2) of the Mine Waste Directive, the operator has to keep up-to-date records of all waste management operations.

Waste facility inspection records, training records, and all other records generated as a result of the implementation of this plan will be forwarded for filing and retention in accordance with Section 5.3 of the *Roşia Montană Project Environmental and Social Management Plan* and MP-12, "Management of Environmental and Social Management System Records."

2.12.2 Record-keeping for extractive waste management operations

The Waste Management Co-ordinator is responsible for keeping records of all waste administration.

For the extractive wastes, the following records will be kept:

- Design documents for all waste facilities, i.e.,
    - TMF
    - Waste dumps
    - Backfilled open pits
    - Topsoil and subsoil stockpiles
- Design documents for all waste-generating facilities, i.e.,
    - Ore-processing and detoxification plants
    - ARD treatment plant
    - On-shore pit water treatment plant

  - Contingency cyanide removal system
- Waste stream records according to the *Waste Management Plan*,
- Waste haulage reports
- Monitoring records for all waste facilities
- Closure documentations for all waste facilities

For reporting details of waste generation data to the authorities, see also Section 3.10.

2.13 Summary of extractive waste amounts and classifications

Table 3-18. Waste Generation, Management and Disposition – Construction phase (2 years)

Waste Name [2]	Waste Category [3]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code *	Code on main hazardous feature [4]	Waste management – amount estimated to be generated annually			Disposal facility
						Utilisation[5] (Reused/ Recycled)	Elimination[6] (Disposed)	Closing stock[7] (Stored)	
Soil	Waste from mining and quarrying operations	0.25 M m^3 (approx. 0.5 Mt)	S	010101	none			0.25 M m^3	Topsoil and subsoil storage heaps
Waste rock	Waste from mining and quarrying operations	24 M t[3]	S	010101	none	24 M t			Construction of Tailings Facility Management (TMF) Starter Dam

* Designates a hazardous waste.

[2] In accordance with the List comprising waste, provided in Annex no. 2 of GD no. 856/2002.

[3] Categories and subcategories based on those established by the National Plan for Waste Management, Government of Romania, 2004 and the Directive of the European Parliament and of the Council on the management of waste from extractive industries(Directive 2006/21/EC), amending Directive 2004/35 EC [2003/0107(COD)], Brussels, February 2003.

[4] In accordance with Annex 1E of Law 426/2001, Characteristics of Wastes that Make them Dangerous.

[5] Waste is re-used onsite.

[6] Waste is disposed offsite; see "Disposal facility" column regarding disposition options (e.g. reuse, recycling, landfill disposal).

[7] Waste is disposed of onsite; see "Disposal facility" column regarding disposition options (e.g. reuse, recycling, and landfill disposal).

Table 3-19. Waste Generation, Management and Disposition – Operations phase (17 years)

Waste Name [8]	Waste Category [9]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code *	Code on main hazardous feature [10]	Waste management – amount estimated to be generated annually			Disposal facility
						Utilisation [11] (Reused/ Recycled)	Elimination [12] (Disposed)	Closing stock [13] (Stored)	
Tailings	Waste from the physical and chemical treatment of ores	13 M t [14]	SS	010307*	H 14		13 M t		Tailings Management Facility (TMF)
Soil	Waste from mining and quarrying operations	0.25 M m^3 (approx. 0.5 Mt)[15]	S	01 01 01	none	soil reuse from storage heaps (30 % of soil stored in operational phase, i.e., approx. 0.08 Mt)		soil stored in storage heaps (70 % of soil generated in operational phase, i.e., approx. 0.17	Topsoil and subsoil storage heaps

* Designates a hazardous waste.

[8] In In accordance with the List comprising waste, provided in Annex no. 2 of GD no. 856/2002.

[9] Categories and subcategories based on those established by the National Plan for Waste Management, Government of Romania, 2004 and the Directive of the European Parliament and of the Council on the management of waste from extractive industries(Directive 2006/21/EC), amending Directive 2004/35 EC [2003/0107(COD)], Brussels, February 2003.

[10] In accordance with Annex 1E of Law 426/2001, Characteristics of Wastes that Make them Dangerous.

[11] Waste is re-used onsite.

[12] Waste is disposed offsite; see “Disposal facility” column regarding disposition options (e.g. reuse, recycling, landfill disposal).

[13] Waste is disposed of onsite; see “Disposal facility” column regarding disposition options (e.g. reuse, recycling, and landfill disposal).

[14] Averaged over entire operations phase

[15] Averaged over entire operations phase

Waste Name [8]	Waste Category [9]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code *	Code on main hazardous feature [10]	Waste management – amount estimated to be generated annually			Disposal facility
								Mt)	
Waste Rock	Waste from mining and quarrying operations	12 M t [16]	S	01 01 01	none		12 M t		Pit backfill (4.3 M m^3) Waste rock heaps (7.7 M m^3)
ARD treatment sludge	Waste from the physical and chemical treatment of ores	27.300 t [17]	SS	010307*	H 14		27,300 t		Tailings Management Facilty (TMF)

[16] Averaged over entire operations phase

[17] Averaged over entire operations phase

Table 3-20. Waste Generation, Management and Disposition – Closure phase (5 years)

Waste Name [18]	Waste Category [19]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code *	Code on main hazardous feature [20]	Waste management – amount estimated to be generated annually			Disposal facility
						Utilisation [21] (Reused/ Recycled)	Elimination [22] (Disposed)	Closing stock [23] (Stored)	
Soil	Waste from mining and quarrying operations	negligible	S	01 01 01	none	soil reuse from storage heaps (70 % of soil stored in ope-rational phase)			Topsoil and subsoil storage heaps
ARD treatment sludge	Waste from the physical and chemical treatment of ores	≤ 26,100 t	SS	01 03 07*	H 14		26,100 t		Early closure phase: TMF Subsequently: open pit (flooded)
In-pit treatment sludge	Waste from the physical and chemical treatment of ores	9,636 t	SS	01 03 07*	H 14		9,636 t		open pit (flooded) using pit as settlement for solids

* Designates a hazardous waste.

[18] In In accordance with the List comprising waste, provided in Annex no. 2 of GD no. 856/2002.

[19] Categories and subcategories based on those established by the National Plan for Waste Management, Government of Romania, 2004 and the Directive of the European Parliament and of the Council on the management of waste from extractive industries (Directive 2006/21/EC), amending Directive 2004/35 EC [2003/0107(COD)], Brussels, February 2003.

[20] In accordance with Annex 1E of Law 426/2001, Characteristics of Wastes that make them Dangerous.

[21] Waste is re-used onsite.

[22] Waste is disposed offsite; see “Disposal facility” column regarding disposition options (e.g. reuse, recycling, landfill disposal).

[23] Waste is disposed of onsite; see “Disposal facility” column regarding disposition options (e.g. reuse, recycling, and landfill disposal).

2.14 List of Exhibits (Extractive waste)

3 Non-Extractive Waste

3.1 Applicable regulations for non-extractive waste

During the last five years, Romania has initiated a very intensive process of transposition into Romanian legislation of EU Directives and other regulations regarding waste management, followed by the implementation of the transposed EU regulations. The negotiations with the EU were based on the Implementation Plans developed for each Directive. Due to difficulties inherent in implementing all the EU Directives before the accession date, the European Commission agreed on several justified transition periods for some of the EU Directives.

3.1.1 Romanian Regulations

Based on the Governmental Emergency Ordinance (GEO) no. 195/2005 regarding the protection of the Environmental Protection, abrogating former Law no. 137/1995, waste management must be undertaken in a manner that is protective to the human health and the environment and in compliance with the provisions of current relevant legislation.

The major planning documents in this field are the National Strategy for Waste Management and the National Plan for Waste Management, both approved by the Governmental Decision no. 1450/2004.

Romania has almost transposed the EU Directives on waste management, and is undertaking the implemention phase. The specific regulations concerning waste management are based on the EU Directives and presently include:

- Government Emergency Ordinance no. 78/2000, as amended and approved by Law 426/2001, *Waste management*;
- Government Decision no. 856/2002, *Waste management and the list of wastes including hazardous wastes;*
- Order of the Minister of the Environment and Water Management no. 95/2005, *Criteria and preliminary procedures for the approval of landfill waste and the national list of wastes accepted for each class of landfill waste;*
- Government Decision no. 349/2005, re: *Landfill waste;*
- Order of the Minister of Waters and Environmental Protection No. 757/2004, *Approval of the technical norms regarding landfill waste – the building, exploitation, monitoring and closing of the landfill sites;*
- Government Decision no. 268/2005, *Waste incineration* amending Government Decision no. 128/2002;
- Government Emergency Ordinance no. 152/2005, *Pollution prevention and integrated control*;
- Government Decision no. 124/2003, *Prevention, reduction and control of environmental pollution with asbestos;*
- Governmental Decision no. 621/2005, *Management of packaging and packaging waste;*
- Government Decision no. 662/2001, *Management of used oils*, amended by Government Decision no. 441/2002 and Government Decision no. 1159/2003;
- Government Decision no. 1057/2001, *Batteries and transformers containing certain dangerous substances;*
- Governmental Decision no. 2406/2004, *Management of end-of-life vehicles;*
- Governmental Decision no. 170/2004, *Management of used tyres;*

- Governmental Decision no. 448/2005, Waste e*lectrical and electronic equipment;*
- Governmental Decision no. 992/2005, *Restriction on usage of certain hazardous substances contained in electrical and electronic equipment;*
- Order of the Minister of Environmental and Water Management no. 901/S.B./2005, *Approval of specific measures for collection of waste electrical and electronic equipment posing risks for personnel security and health at the collection centres;*
- Government Decision no. 1357/2002, *Public authorities responsible for the control and supervision of import, export and transport of waste;*
- Order no. 2/211/118/2004 of the Minister of Agriculture, Forests, Waters and Environment , Waters and Environment; Minister of Transportation, Constructions and Tourism and the Minister of Economy and Trade, *Approval of procedures for the permitting and control of waste transport on the Romanian territory;*
- Order of the Minister of Environment and Water Management no. 344/2005 and Order of the Minister of Agriculture, Forests and Rural Development no. 708/2005, *Approval of technical norms regarding the environmental protection and especially the soil protection, when sewage sludge is used in agriculture;*
- Government Decision no. 173/2000, *Regulations on the management and control of polychlorinated biphenyls and similar compounds*, amended by Government Decision no. 291/2005;
- Governmental Emergency Ordinance no. 16/2001, *Measures for acquisition of non-ferrous metals, of their alloys and of non-ferrous recyclable waste;*
- Law no. 465/2001, Approval of the GEO no. 16/2001, *Management of recyclable industrial waste*;
- Law no. 326/2001; *Public service utilities*, amended by Government Emergency Ordinances no. 9/2002, no. 197/2002 and no. 65/2003*;*
- Government Decision no. 87/2001, *Public services for municipal sanitation*, amended by Law no. 139/2002, Government Decisions no. 35/2003 and no. 34/2004 and Law no. 131/2004;
- Order of the Minister of Health and Family no. 219/2002, *Approval of technical norms for waste generated from medical activities and of methodology for data collection for the national database regarding waste generated from medical activities,* Order no. 997/2004 and Order of the Minister of Health no. 1029/2004.

3.1.2 European Union Regulations

The European Union (EU) regulatory framework concerning waste imposes numerous requirements for Romanian legislation. The legislative waste management framework for EU member and candidate states is contained in the following documents:

- Waste Framework Directive (75/442/EEC) amended by Council Directive 91/156/EEC;
- Hazardous Waste Directive (91/689/EEC);
- Hazardous Waste List (2000/532/CE, amended by 2001/119/EC);
- Council Regulation on the supervision and control of shipments of waste within, into and out of the European Community (259/93/EEC);
- Disposal of Used Oils Directive (75/439/EEC), amended by Directives 87/101/EEC and 91/692/EEC;
- Batteries and Transformers Containing Certain Dangerous Substance Directive (91/157/EEC), as amended by 93/86/EC and 91/157/EEC;

- Landfill Directive (1999/31/EC), amended by Council Decision of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills (2003/33/EC);
- Waste Incineration Directive (2000/76/EC);
- Packaging and Packaging Waste Directive (94/62/EC);
- End-of-life Vehicles Directive (2000/53/EC);
- Waste Electrical and Electronic Equipment Directive (2002/96/EC);
- Restriction of Usage of Certain Dangerous Substance in Waste Electrical and Electronic Equipment Directive (2002/95/EC);
- Environmental Protection and especially Soil when Sewage Sludge is Used in Agriculture Directive (86/278/EEC);
- Criteria and procedures for the acceptance of waste at landfills Decision (2003/33/EC);
- Disposal of Polychlorinated Biphenyls and Polychlorinated Triphenyls Directive (96/59/EC).

3.1.3 BREF documents

The following BREF documents are of particular relevance for the non-extractive waste management within this Project:

- IPPC Reference Document on Best Available Techniques in the Non Ferrous Metals Industries, December 2001;
- IPPC Reference Document on Best Available Technique for the Waste Treatments Industries, August 2005;
- IPPC Reference Document on General Principles of Monitoring, July 2003.

The non-extractive wastes generated during the life of the Project will be, except for carbon fines, general non-specific wastes, mainly resulting from auxiliary activities supporting the mining and processing activities. Those wastes will result from the pre-construction and construction phase (construction and demolition waste), maintenance and repairing activities of mining equipment and vehicles (used oil, used tyres, scrap metal, acid lead transformers), industrial installations and devices, social activities carried out by the employees and the contractors (household type waste, sewage sludge, packaging waste from food consumption, medical waste) and mine closure/processing plant and other facilities decommissioning (demolition waste).

Except for the construction and demolition waste, all the other non-extractive wastes generated will be disposed of off-site; all the storage and preparatory activites will be carried out on-site before the waste is transported off-site.

Currently, there is no BREF Document for landfill waste. However, for the Collection and disposal of wastes, the international best practices are applicable.

The IPPC Directive requires necessary measures to be taken,upon the definitive cessation of activities, to avoid the risk of pollution and to return the site operation to a satisfactory state. The construction, operation and decommissioning and demolition of the industrial facilities will be performed taking into consideration the provisions of the IPPC Directive, namely:

- The requirement to minimise the amount of soil that needs to be excavated or replaced due to construction and ensure that excavated soil material is treated carefully (in order to avoid harmful changes of soil properties);

- The requirement to minimise the input of substances into the soil by leakage, aerial deposition and inappropriate storage of raw materials, products and residues during the operation phase;
- The assessment of historical contamination to take account of conditions prior to regulation to ensure a clean closure when a facility is shut down, e.g. clean up and rehabilitation with regard to the future use of the area.

As it is stated in the section 6.4.5 Process Residue of IPPC Reference Document on Best Available Techniques in Non Ferrous Metals Industries[lxix], the principles of BAT include waste prevention and minimisation of residues whenever practical. The same approach will be used for the non-extractive waste generated by the Project.

The IPPC Reference Document on Best Available Technique for the Waste Treatment Industries[lxx] deals with the specific waste treatment facilities, with the exception of landfills. As all the waste generated by the Project will be treated in off-site facilities, there is a limited number of BATs applicable to this Project. However, some of the BATs provided by this BREF Document could be used for the upstream treatment activities of the waste before it is shipped to off-site facilities either for recycling or for disposal. .

The BATs applicable for the management of non-extractive wastes ,as presented in section 5.1 of the Generic BAT in the IPPC Reference Document on Best Available Technique for the Waste Treatments Industries, are:

- Taking into consideration the environmental impact from the decommissioning of the unit at the stage of designing the Processing plant and auxiliary facilities (decommissioning plan for the Temporary Storage Facilities for Hazardous Waste);
- Developing a concrete knowledge of the waste that will be shipped to a specific facility for treatment and/or disposal, by taking into account:
    - Type of waste;
    - Origin of waste;
    - Treatment to be carried out;
    - Disposal facility.
- Implementing an acceptance procedure, containing at least the following elements:
    - Tests for the generated waste;
    - Making available all the necessary information regarding the nature of process(es) producing waste;
    - A system for providing and analysing representative waste sample(s);
    - Creating a waste code in accordance with the European Waste List;
    - Identifying the appropriate treatment for each waste while also identifying a suitable treatment method in consideration of the physical and chemical properties for the individual waste;
- Apply the following techniques related to storage:
    - Locating storage areas away from water courses and sensitive perimeters;
    - Ensuring that the storage area drainage infrastructure can contain all possible contaminated run-off and that drainage from incompatible wastes do not come into contact with each other;
    - Using a dedicated area/storage which is equipped with all the necessary elements to address the specific risks posed by the wastes;
    - Clearly labelling all storage drums/tanks with regard to their contents and capacity, and applying a unique identifier;

  - o Keeping records for all drums/tanks, detailing the unique identifier, capacity, its construction, including materials, maintenance schedules and inspection results, and the waste types which may be stored in the vessel;
- Perform washing processes incorporating the following procedures:
  - o Identifying the washed components that may be present in the items to be washed;
  - o Transferring the washed components to the appropriate storage and managing the waste in the same way as the waste from which it was derived;
  - o Using treated waste water from the WWTP for washing instead of fresh water;
- Maximise the use of re-usable packaging (drums, containers, palettes etc.);
- Keep a monitoring inventory of the on-site waste by using records of the amount of wastes generated on-site and records of the wastes shipped off-site;
- Prevent soil contamination by:
  - o Monitoring the surface of operational areas, and applying measures to prevent or quickly clear away leaks and spillages;
  - o Utilising an impermeable base and internal site drainage;
  - o Reducing the installation site and minimising the use of underground tanks.

The applicable BATs for monitoring the non-extractive waste generated by the Project are presented in Section 4.3.3. of the IPPC Reference Document on General Principles of Monitoring[lxxi]. The operator (waste generator) should periodically record and retain the following records, such as:

- its composition;
- the best estimate of the quantity produced;
- its disposal routes;
- a best estimate of the amount sent to recovery;
- registration/licenses for waste carriers and waste disposal sites.

3.2 Strategic Principles and Objectives in Non-extractive Waste Management

The non-extractive waste generated by the Roşia Montană Project will be managed in compliance with the strategic principles and objectives presented and approved in the National Strategy for Waste Management (NSWM).[lxxii]

The **principles** underlying waste management activities in Romania, as they are presented in the NSWM are listed below:

- The principle of the ***primary resources protection*** – is defined in the wider context of sustainable development, and it addresses the need to minimise the use of primary resources, particularly of non-renewable resources, and to enhance the efficiency of their beneficiation, with an emphasis on the use of secondary raw materials.
- The principle of ***preliminary measures***, in correlation with the principle of ***BATNEEC*** ("Best available techniques not entailing excessive costs") – states that the current technological development, the requirements concerning environment protection, and the selection and implementation of economically feasible measures represent the main aspects in need to be addressed by any activity (including waste management).
- The ***prevention*** principle – sets up a hierarchy of waste management activities, in decreasing priority order: avoidance of waste generation, minimization of waste quantities, treatment for recovery, treatment and disposal in environmentally sound conditions.
- The ***"polluter pays"*** principle, correlated with the principles of ***producer responsibility*** and ***user responsibility*** – states the need for setting up an adequate legislative and economic framework, according to which waste management costs should be covered by the generators of waste.
- The ***substitution*** principle – emphasises the need to replace dangerous raw materials with non-dangerous raw materials, thus avoiding hazardous waste generation.
- The ***proximity*** principle, correlated with the ***autonomy*** principle – states that waste should be treated or disposed of as close as possible to the site where it was generated; moreover, exports of hazardous waste should only be made to countries where appropriate disposal technologies are available, and in observance of the conditions applying to international waste trade.
- The ***subsidiarity*** principle (in correlation with the proximity principle and the autonomy principle) – states that responsibilities should be assigned in such a way as to allow waste management decisions to be taken at the lowest administrative level above the source of generation, but based on uniform regional and national criteria.
- The ***integration*** principle – states that waste management is an integral part of the socio-economic activities generating the waste.

The same strategic document (NSWM) presents the waste management **options** – waste hierarchy - that should be considered, in the decreasing order of priorities:

- waste avoidance;
- waste reduction;
- waste reuse and recycling; including energy recovery; and
- waste disposal, in a manner that is protective of human health and the environment.

The implementation of these concepts is demonstrated in the following sections for different waste streams.

In accordance with the *Waste Management Plan*, RMGC will maintain a current inventory of waste streams generated and/or managed within the boundaries of its operations. When a new waste stream is generated, the inventory will be updated and reviewed for accuracy. The Waste Stream Inventory will also serve as a top-level Waste Minimisation Plan, assisting RMGC in understanding what waste streams are generated and in identifying opportunities for waste avoidance, reduction, reuse and recycling.

The following paragraphs provide examples of RMGC commitments to waste minimisation, through the identification all waste streams that will be reused, recycled or recovered and by describing in what manner they will be re-utilised. As the Waste Stream Inventory develops during the mine construction and mine operation stages, , further opportunities for waste minimisation will be identified

3.2.1 Waste Avoidance

The following actions are examples of RMGC commitments to waste avoidance:

- During the procurement of electrical and electronic equipment, RMGC will observe the provisions of GD no. 992/2005 *on limitation of certain dangerous substances in electrical and electronic equipment*[lxxiii].
- By prohibiting the purchase of hazardous materials such as asbestos and polychlorinated biphenyls a hazardous waste stream will be prevented.
- The process plant will be designed to ensure the full containment of all areas associated with the unloading and mixing of reagent cyanide as well as the CIL and cyanide detoxification processes; use of containments and appropriately located spill collection sumps will allow any spilled cyanide-bearing materials to be recycled back to the cyanide leaching process instead of being disposed of as hazardous waste.
- Under Romanian regulations aerosol containers, regardless of their content, are considered to be hazardous waste. As a result, RMGC will implement a purchasing policy that will specifically prohibit the purchase of paint, lubricants, cleansers, and other consumable materials in aerosol form, unless such materials have a critical maintenance, safety, or operational application and no reasonable alternative is available.

3.2.2 Waste Reduction, Reuse and Recycling

Wherever practical and economical, waste will be recycled once the generation rate is minimised. Examples of waste with a potential recycle value include:

- office paper,
- aluminium package,
- paper/cardboard,
- scrap metal/equipment,
- wooden packaging materials and pallets,
- glass, and
- plastics.

Where possible, vendors will be required to accept return of used package with the purchase of new items. Examples of these types of waste include:

- used oil;
- empty used drums, containers, or crates;
- wet acid batteries; or

- used tyres; and
- waste electrical and electronic equipment.

The following actions are examples of RMGC commitments to waste reduction, reuse and recycling:

- All the recyclable waste will be shipped to the available waste collection and processing/recycling facilities existing in Alba County or Region Centre (see subsection 3.3.1.4).
- Wherever possible, obsolete electronic or electrical equipment will be donated to an appropriate charity or local educational institution.
- For RMGC and contractor fleets, battery-purchasing priority will be given to battery vendors with a take-back program.
- For RMGC and contractor fleets, tyre-purchasing priority will be given to tyre vendors with a take-back and re-tread program.
- In order to support waste minimisation efforts, sewage sludge from the Domestic Waste Water Treatment Plant may be used as soil amendment or agricultural fertiliser. The sewage sludge could also be used for land rehabilitation in areas affected by mining activities owned both by Roşiamin S.A. – during the construction and operation phases of the RMGC Project - and by RMGC until the decommissioning of the Domestic Wastewater Treatment Plant. Prior to the application of the sludge as agricultural bio-solids or its usage for land rehabilitation, the chemical characteristics of the amended soils will be tested to ensure sludge compatibility.
- A local specialised company – OMV PETROM, Alba Iulia Branch– will supply engine lubrication and transmission oils and will accept the take back of used oils. If a different supplier is used, a company specialised in used oils recovery will be identified.
- Used tyres will be used as engineering material for embankment stabilisation or as instruments to control erosion on-site or at other off-site disposal sites (landfills);
- Tyre recapping operations for large machinery may be performed by Michelin company which has recently acquired Tofan Recap in Timisoara. Where recapping is not a feasible option, the three European cement manufacturers operating in Romania – i.e., Carpatcement Holding, Holcim Romania and Lafarge Romcim are known to accept used tyres for co-incineration and energy recovery.
- Prior to releasing tyres for energy recovery purposes, RMGC will conduct a contractor audit to ensure that contractor's environmental management practices are adequate.
- The quicklime residue will be used on-site as an alkaline reagent in the ARD Treatment Plant.

3.2.3 Minimizing Waste Hazardousness

Product replacement is encouraged as a way to reduce hazardous process materials. Examples of such products include:

- electrical and electronic equipment with low content of hazardous substances;
- batteries and transformers with low content of heavy metals;
- non-hazardous aqueous grease removers and solvents; or
- water-based paints with low contents of volatile organic compounds (VOC).

3.3 Non-extractive Waste Management

The next section presents the measures proposed to be implemented in order to ensure correct management practices for all waste categories which will be generated within the Roşia Montană Project, in accordance with the *Plan B – Waste Management Plan*.

At a minimum, waste materials will be segregated into the following waste streams:

- municipal and similar waste (divided in fractions for recycling);
- inert and non-hazardous construction and demolition waste;
- asbestos demolition waste;
- detoxified cyanide spill cleanup wastes;
- contaminated soil;
- empty containers;
- lead-acid batteries;
- non-lead acid batteries;
- waste electric and electronic equipment,
- used oil;
- used tyres;
- end-of-life vehicles;
- crushed and hot-drained oil filters;
- waste aerosol containers; and
- medical waste.

Each of these waste streams will be further segregated, as necessary, to ensure that incompatible materials are not stored together or otherwise, to meet the recycling and reuse targets established by the Waste Stream Inventory. Waste storage carts, bins, or barrels will be arranged in such a way as to provide adequate access for container transfer and emergency response. Waste intended for off-site disposal will be collected at a specific transfer station designated by the Waste Management Co-ordinator.

Based on their hazardous content and landfill acceptance criteria, these types of waste can be generically classified (Ministerial Order no. 95/2005) into three major categories:

- non-hazardous waste – municipal and similar waste and production non-hazardous waste:
- hazardous waste; and
- inert and non-hazardous construction and demolition waste.

3.3.1 Non-hazardous Waste Management

The most significant types of waste in this category are the following:

- Industrial waste similar to household waste;
- Non-recyclable packaging waste;
- Other non-hazardous industrial waste without reuse/recycling options; and
- Sewage sludge.

Such waste will be managed off-site. Specific streams of waste could be either reused/recycled or disposed of by land-filling. Only the sewage sludge may be used on-site for land rehabilitation.

Wherever feasible, efforts will be made to minimise or eliminate the waste streams, and/or to re-use and recycle waste material.

The Regional Plan for Waste Management (RPWM)[lxxiv] completed in 2005 in the framework of a German Twinning Project is focussed only on municipal waste management.

In the following paragraphs the main phases of the non-hazardous waste management are presented.

3.3.1.1 Waste Collection

The waste collection will be carried out selectively. Municipal waste containers will be located around the Project site for collection prior to shipment at the waste transfer station. Other points may be temporarily located near the construction camp, construction sites or demolition activities as appropriate for the type and volume of waste generated.

For recyclable waste, a special area will be organised to store optimal waste quantities before shipment to authorised waste contractors. Acquisition of recycling services will be done based on economic efficiency criteria and in full compliance with the legal requirements for public health and environmental protection.

3.3.1.2 Waste Transport

Specialised and certified companies will be subcontracted by RMGC for non-hazardous waste transport to recycling or disposal facilities. Development of RMGC own waste transport services is not envisaged.

Preliminary estimations point to a more intense waste flow and implicitly a more intensive transit of all types of non-hazardous waste during the construction phase. During the operation phase (17 years) the waste flow will be fairly constant and it will significantly decrease by the completion of closure activities.

3.3.1.3 Waste Disposal

Land-filling will be the major option for non-hazardous waste disposal. Disposal facilities will be appropriate with respect to the types and characteristics of the generated waste and will comply with the legal requirements. In order to reduce transport costs and duration, the selection of disposal facilities will take into account their proximity.

Regional Approach for Waste Landfill

A household waste collection system is organised in Roşia Montană area. Collected waste is transported and disposed of in a local non-compliant landfill, as shown in Exhibit 3.3-1Exhibit 3.3-1 Waste Landfills 2004, Region Centre[lxxv].

The only compliant landfills in the region are located in Sibiu, Sighisoara and Brasov. Sighisoara landfill has a very limited capacity, and Brasov landfill is located at a significant distance from the site. The Sibiu landfill has enough capacity and currently is the main compliant facility for non-hazardous waste disposal in the area.

Another potential waste destination is the Alba Iulia landfill which is environmentally compliant, but scheduled to be closed by 2015.

According to the closure schedule for non-compliant landfills, approved by the GD no. 349/2005 on Waste Landfill[lxxvi], all landfills in rural areas, including the Roşia Montană landfill will be closed by mid 2009. Larger, nearby landfills, such as Abrud, Câmpeni and Zlatna, will be closed in 2009. No other new complaint landfill is foreseen in 2007 within a reasonable distance from the Project area – Exhibit 3.3-2. Exhibit 3.3-2 Waste Landfills 2007, Region Centre. This situation is explained by the very low density of population (Exhibit 3.3-3 Population Density, Region Centre) in the Abrud – Câmpeni area and by the still available disposal capacity of the existing facilities. The two proposed new landfills for 2007 in Făgăraş and Ungheni –Târgu Mureş will not be closer to the Project site than the existing Sibiu landfill.

Following Romania's accession to the EU, structural and cohesion funds will support Romanian public investments including waste disposal facilities, as illustrated in Exhibit 3.3-4 Waste Landfills 2010, Region Centre. In 2010 there will be several compliant landfills in the region, but none of them closer to the Project area than the Sibiu landfill. However, the exhibit presents the needed landfills, some of them being closer to the Project area – Alba Iulia and Câmpeni. Their necessity is correlated with the closure of smaller non-compliant landfills in rural areas, in Abrud and Câmpeni towns and with the diminishing of the of Alba Iulia landfill capacity.

The prognosis for waste landfill in 2012 shows that two new compliant landfills will be developed in Alba Iulia and Câmpeni, Exhibit 3.3-5 Waste Landfills 2012, Region Centre. In 2005, the Alba County Council started the quest for several viable sites in the Apuseni Mountain area. The year 2012 seems to be a reasonable deadline for developing a regional landfill in that area.

The Regional Waste Management Plan in Region 7 Centre identified a landfill option for the entire life of the Project, in compliance with the legal provisions for a new landfill requiring a capacity for at least 20 years of operation.

The regional approach to waste management implies also several transfer stations. One of them will be located in Abrud, that is, very close to the Project area. The non-hazardous waste generated by Roşia Montană Project will use Abrud Transfer Station as an intermediate facility towards the landfill.

Abrud Waste Transfer Station

A waste transfer station in Abrud is currently in the final planning stages. Construction will start in 2006 and is expected to be completed by 2008. The EU is funding 90% of the investment value as part of a Phare Small Scale Grant Scheme. The Abrud municipality has funded the remaining balance. In accordance with the terms of the Phare Scheme, the Abrud Waste Transfer Station will be built and operated in compliance with EU requirements for waste transfer stations.

RMGC responsibility will be limited to the waste collection and transport from the site to the Abrud Waste Transfer Station. RMGC may also contract waste collection and transport services to an appropriately certified waste operator. RMGC will remain responsible for paying the landfill disposal fee but the waste contractor will be responsible for overseeing and ensuring the proper disposal of waste at a compliant landfill.

The implementation of the project related to the Abrud Transfer Station is expected to improve the efficiency of household or similar waste management and collection from the population and small businesses, not only in Abrud but also in the other Project stakeholder localities. The Local Council of Roşia Montană is also a stakeholder in the Project. Cessation of the household waste disposal in the non-compliant facilities currently used in Roşia Montană is expected.

Exhibit 3.3-7 shows the expected route for municipal waste transport from the project site to the Abrud Waste Transfer Station. The proposed location of the Abrud Transfer Station is between the Gura Roşiei Preparation Plant and the Gura Roşiei Tailing Deposit, on the right bank of Abrudel River. Over-sized waste will not accepted at the waste transfer station. RMGC will therefore ensure that waste is appropriately sized prior to transfer.

Wastes will be transferred from the Abrud Waste Transfer Station and disposed of in one of the available, properly permitted landfills in the area, during each phase of the Project.

3.3.1.4 Waste Recycling Facilities

The recyclable waste facilities will be selected taking into account the existing processing companies located in the proximity of the site, although it is expected that some of the existing companies will close down and that other companies will be settled.

Exhibit 3.3-6 shows the exiting facilities for waste collection and processing:

- Paper/carboard – REMAT ALBA S.A. Alba Iulia;
- Plastic – REMAT ALBA S.A. Alba Iulia;
- Used oils – OMV PETROM –Alba Iulia Branch;
- Lead Transformers – REMAT S.A. Câmpeni;
- Scrap metal – REMAT S.A. Câmpeni;

and for waste recycling:

- Paper/carboard – PEHART S.A. Petreşti;
- Glass – Stimet S.A. Sighişoara.

In the Region Centre also hosts Lafarge Romcim S.A. Hoghiz, which is authorised to co-incinerate used tyres.

Holcim Romania S.A. Alesd (Bihor county) has been granted a permit for co-incineration of 220 types of wastes and has an authorisation issued by the Ministry of Economy and Trade for rubber waste recovery.

The Deva Cement Plant owned by Carpatcement Holding S.A. is under the permitting procedure for co-incineration of certain types of waste, including used oils, used tyres and packaging waste.

3.3.2 Hazardous Waste Management

RMGC expects to generate limited quantities of hazardous waste over the life of the mine, which may include paint and solvent residues, used oils, used batteries and transformers, spill clean-up waste, asbestos demolition waste, and contaminated soil.

The generation of hazardous waste will be minimised through appropriate mitigation strategies as discussed in the *Waste Management Plan*.

The hazardous waste will be collected and reduced in volume where practicable and placed in controlled storage facilities.

The following requirements will apply to the management of all hazardous wastes generated or managed by RMGC, as noted in the *Waste Management Plan* and its supporting procedures:

- each category of hazardous waste will be stored separately, according to its physical and chemical properties, as well as to the compatibility and nature of extinguishing substances which may be used for each category in the event of fire;
- hazardous waste containers may only be moved or transferred within the site by qualified personnel, using appropriate industrial vehicles or equipment;

- mine employees involved in the management of hazardous wastes will undergo basic, product specific, and annual training addressing the general requirements of hazardous waste management;
- on-site contractors will comply with the same or equivalent hazardous waste management standards for any hazardous wastes they will generate;
- on-site incineration of waste will not be permitted unless specific regulatory permits are granted to blend used oil with clean fuel for energy recovery purposes.

The following subsection presents the main phases of the hazardous waste management.

3.3.2.1 Waste Collection

Waste collection/transfer stations established for hazardous wastes or potentially hazardous materials being accumulated for recycling purposes (e.g. used oil and grease) will include an area with concrete containment berms, sloped towards a drain discharging into an impermeable sump of adequate contingency volume. Incompatible, mutually reactive materials may not be stored at the same station.

Hazardous waste collection/transfer stations will have adequately signed areas for each category of hazardous waste.

These measures will assist in proper storage and separation of hazardous waste, based on physical and chemical properties, as well as on the compatibility and nature of extinguishing substances which may be used for each category in the event of fire.

Specific requirements:

- containers used for collection and storage of site-generated hazardous waste will be compatible with the wastes being stored;
- suitable secondary containment will be provided to prevent intermixing of chemically incompatible wastes;
- hazardous waste containers will not be stored in roadways, traffic ways, pathways or in any manner capable to obstruct emergency egress;
- hazardous waste containers will be suitably marked, labelled, tagged or otherwise documented to identify the contents and hazards, in accordance with the applicable hazardous waste regulations;
- hazardous waste containers will be stacked only when the containers are structurally designed to allow for stable stacking, and the stacking can be done in a safe manner;
- hazardous waste containers will be stored with bungs, lids, caps, valves, or other openings in a closed position, except when necessary to remove or add wastes;
- hazardous waste containers will be periodically inspected to ensure that they are properly labelled, closed, and in good condition, with no signs of leakage.

Entry to all hazardous/potentially hazardous waste collection and transfer stations will be limited to authorised waste handling employees or contractors. Such stations will be equipped with adequate fire protection, emergency alarm systems and alternative exit in the event of an emergency.

Hazardous wastes will be regularly transferred to the Temporary Hazardous Waste Storage Facility for controlled storage (pending shipment to or identification of a permitted off-site treatment, storage, or disposal facility).

3.3.2.2 Temporary Hazardous Waste Storage Facility

Hazardous wastes will be regularly transferred to the Temporary Hazardous Waste Storage Facility for secure, covered, controlled storage pending shipment to or identification of a permitted off-site treatment, storage, or disposal facility.

As defined by GD no. 349/2005, Annex 1, the Temporary Hazardous Waste Storage Facility represents a permanent area designed for maximum 3 years of temporary storage before waste recovery or treatment and for maximum 1 year before waste disposal.

Nevertheless, the Temporary Hazardous Waste Storage Facility will be used to properly collect, segregate and store hazardous wastes prior to periodic off-site disposal shipments.

The Temporary Hazardous Waste Storage Facility will be built as a series of identical modules, with the number of modules determined by operational needs and by actual spill cleanup volumes.

The Temporary Hazardous Waste Storage Facility will still be in operation after the initial transfer of stored hazardous wastes to off-site facilities. Collection, temporary storage and management of each type of identified hazardous waste in the Temporary Hazardous Waste Storage Facility, will continue until all the facilities on site will be decommissioned.

If additional storage capacity will be required during negotiations for permanent disposal options, additional Temporary Hazardous Waste Storage Facility modules may be constructed as necessary, adjacent to the original facility.

The Temporary Hazardous Waste Storage Facility will therefore consist of separate bays for the management of chemically compatible waste recipients. The Temporary Hazardous Waste Storage Facility will be designed in accordance with international BMPs. As noted in Exhibit 3.3-8, each bay will have coated concrete floors built over an impermeable barrier, and will be roofed over.

Drains and sumps will be provided in each bay for secondary spill containment and for prevention of co-mingling among potentially incompatible spilled materials.

The location of the proposed Temporary Hazardous Waste Storage Facility is shown in Exhibit 3.3-9.

Unauthorised access will be forbidden to the Temporary Hazardous Waste Storage Facility.

3.3.2.3 Waste Shipment and Disposal

The hazardous waste collected at the Temporary Hazardous Waste Storage Facility, prior to shipment to or identification of the permitted offsite disposal facility, will be transported to that facility. RMGC will identify certified transporters to transfer hazardous waste to permanent off-site disposal facilities.

The transportation of waste will be done in accordance with the Common Order no. 2/211/118/2004 of the Ministry of Agriculture, Forests, Waters and Environment, the Ministry of Transportation, Construction and Tourism and the Ministry of Economy and Trade.

It is anticipated that a new landfill for hazardous waste will be constructed in Slobozia (Ialomita county), with a cell designed specifically for asbestos demolition waste.

The current facility for co-incineration in the Region Centre is Lafarge Romcim S.A. Hoghiz which is authorised for rubber waste treatment and currently follows the permitting procedure for co-incineration of about 100 types of waste including used tyres, plastic, paper, wood, packaging waste and used oils.

Lafarge Romania S.A. Alesd (Bihor county) has been granted with a permit for co-incineration of 220 types of wastes and has an authorisation issued by the Ministry of Economy and Trade for rubber waste recovery.

ECOBURN S.R.L. located in Cluj-Napoca is a proper incineration facility for medical waste disposal. Should a sterilisation facility in the area be authorised in the near future, the medical waste could be treated using that technology.

By the start of its activity, RMGC will identify and select authorised operators for disposal by incineration/co-incineration of hazardous waste amenable by such treatment.

3.3.2.4 Temporary Hazardous Waste Storage Facility Decommissioning/Land Rehabilitation

The Temporary Hazardous Waste Storage Facility will be kept functional during the decommissioning of the process plant, the explosives storage building, the fuel storage facilities, the warehouses, the plant maintenance areas, and other Project facilities that may involve the use or storage of hazardous materials, in order to provide storage capacity for any hazardous wastes that might be generated or encountered during decommissioning. It is anticipated that the decommissioning of the Temporary Hazardous Waste Storage Facility will take place around Year 19-21 of the Project.

The specific issues related to the decommissioning of the Temporary Hazardous Waste Storage Facility are further detailed in the *Mine Rehabilitation and Closure Management Plan* (ESMS Plans, Plan J). In general, decommissioning will involve the following steps:

- Shipment of all remaining hazardous wastes;
- Review of facility logs and spill history;
- Physical survey of pad, drains, sumps, and fenced area;
- Removal/recycling/disposal of portable concrete barriers;
- Removal/recycling of metal roofing.

According to the rehabilitation plan, the facility site will be cleared and flattened and left for further land use.

3.3.3 Construction and Demolition Waste Management

The entire management of inert and non-hazardous construction and demolition (C&D) waste materials will take place within Project boundaries, with all C&D inert and non-hazardous-like wastes being processed, transported and disposed of, using exclusive RMGC technical means and facilities.

In accordance with the base planning documents concerning waste management – the National Strategy for Waste Management and the National Plan for Waste Management – construction and demolition waste are classified as municipal and similar waste.

The National Plan for Waste Management defines construction and demolition waste as resulting from construction and demolition of *civil buildings and infrastructure.* The definition does not include construction and demolition waste from industrial plants (especially large plants) which may generate significant waste quantities.

The National Strategy for Waste Management has the following general objectives of construction and demolition waste management:

- Recovery and material recycling and/or energy recovery of demolition waste;
- Reuse and recycling of construction waste;
- Treatment of contaminated construction and demolition waste for recovery or disposal;
- Development of facilities for proper disposal of waste.

For the time being, no regulation exists concerning construction and demolition waste resulting from structures of this type. Disposal of such waste is commonly carried out without sorting, either in legally non-compliant municipal waste landfills, together with household and municipal waste, or in specially designed facilities for construction and demolition waste, of which there are presently very few, with none in the close vicinity of the Roşia Montană Project area.

The Ministerial Order no. 856/2002 classifies construction and demolition wastes both into non-hazardous and hazardous waste categories.

The Ministerial Order no. 95/2005 which transposes the *Annex of the European Council Decision from December 19, 2002 (Decision 2003/33/EC);concerning the acceptance of waste for a landfill,* includes certain waste types in the list of inert waste accepted for inert landfills without testing, such as: concrete, bricks, roof tiles and ceramic materials free of hazardous substances, glass, earth and gravel free of hazardous substances – provided that such waste contain a minimum possible amount of other materials (metals, plastic, organic materials, wood, rubber). Other types of construction and demolition waste are mentioned in this document, on all other lists of wastes accepted to landfill after testing and meeting quality criteria for inert waste landfills – other than those accepted without testing, for non-hazardous landfills and for hazardous landfills.

By analysing the types of waste accepted in the three types of landfills, it results that by adequate management, the majority of Project-related construction and demolition waste can fall within the inert waste category or,otherwise, within the non-hazardous waste category.

The construction and demolition waste will be generated during *the pre-construction/construction phase* when the industrial facilities and private houses and premises in the Project development area will be demolished, as well as during the *closure phase* when the majority of facilities with no further use will be disassembled and decommissioned.

A significant amount of inert and non-hazardous demolition waste will be generated on site, but in the absence of a disposal facility in the Project area. Due to the fact that large industrial waste deposits will be constructed on site, it is suggested to dispose such waste at a *construction and demolition landfill.*

In order to achieve an optimal land use, such a landfill should be located as close as possible to the future waste rock stockpiles. This could also form part of the land rehabilitation plan in the post-closure phase.

The initial landfill location is suggested to be adjacent to the waste rock stockpile in the upper end of the Corna Valley (as shown in Exhibit 3.3-9). It is anticipated that during later years of mine life the facility will eventually be covered by the extension of the Cârnic waste rock stockpile. Therefore, new landfill cells will be created periodically in either the Cârnic or Cetate waste rock stockpiles. During the final years of the mine life, after active mining is completed and the low-grade ore stockpile is being processed, a final construction and demolition waste disposal cell will be established in the Cetate waste rock stockpile near the plant site. This will be sized to accommodate the construction and demolition waste generated as part of the last years of mining and closure. This area will not be closed (i.e. covered with soil and revegetated) as part of the Cetate waste rock stockpile. However, soil cover materials will be stockpiled near the area to allow final closure of the cell after all inert waste has been disposed of.

Another option concerns the late years of the closure phase when the majority of reusable waste will be shipped offsite, and the demolition waste will consist mainly of concrete structures and soil from site cleanup. Such waste could be deposited in the TMF area which by that time will undergo closure/rehabilitation. In this way, the former construction and demolition deposit will be available during the closure/rehabilitation phase.

Disposal of crushed concrete waste in the TMF may even favourably influence the tailings, due to the alkaline character of the material which will lead to an increase in the pH level and the precipitation of heavy metals dissolved in the decant water.

The exploitation method for these disposal facilities is presented in Section 2.8.2 - Waste rock.

The environmentally safe closure and decommissioning measures of these waste facilities are described in the *Mine Rehabilitation and Closure Management Plan*.

The specific measures for each waste facility have been described briefly in the previous sections for the waste rock stockpiles.

3.4 Predicted Waste Generation Scenarios

Table 3-20 shows the predicted waste generation scenarios in the main project phases:

- Construction;
- Operation;
- Closure.

For each of the three main categories of non-extractive wastes generated during the life cycle of the Project, the source and type of waste are presented in the same Table 3-21, by associating the waste categories with the source and the main types of waste.

Table 3-21. Predicted Waste Generation Scenarios by Sources and Categories in Construction, Operation, and Closure Phases

Waste Category	Waste Subcategories	Construction Phase	Operations Phase	Closure Phase
Municipal and similar waste	*Non-hazardous industrial or commercial waste, similar to household waste*	*General household type waste:* Administrative office areas are expected to generate standard household wastes such as food scraps and general refuse. Other non-hazardous production waste (general garbage) may also be generated.	*General household type waste:* Municipal wastes generated during the operation phase will include general refuse and food scraps. Other non-hazardous production waste (general garbage) may also be generated.	*General household type waste:* During closure, a small workforce will remain at the mine to support facility decommissioning and other closure activities. Common household wastes will therefore continue to be generated. Other non-hazardous production waste (general garbage) may also be generated.
		Packaging waste (excluding production packaging waste): Paper/cardboard, plastic, metal, and glass packaging wastes as well as other general household type waste will be generated.	*Packaging waste (excluding production packaging waste):* Paper/cardboard, plastic, metal, and glass packaging wastes will be generated from the consumption of foodstuffs and other general household type waste.	*Packaging waste (excluding production packaging waste):* Paper/cardboard, plastic, metal, and glass packaging waste as well as other general household type waste will be generated, but the quantity will be significantly diminished due to the small workforce.
	Sewage sludge from the domestic wastewater treatment plant	*Sewage sludge:* A portable domestic wastewater (sewage) treatment facility will be installed for the administrative office areas, which will generate non-hazardous sewage sludge.	*Sewage sludge:* A domestic wastewater treatment plant will be built, which will generate non-hazardous sewage sludge.	*Sewage sludge:* During closure, a small workforce will remain at the mine to support facility decommissioning and other closure activities, as well as to manage the domestic wastewater treatment plant and monitor environmental conditions. Sewage sludge from the domestic wastewater treatment facility will continue to be generated during this period.
Production waste	*Hazardous production waste*	*Used oils:* Used transmission, motor, hydraulic and lubricating oils and greases will be generated by the RMGC and contractor vehicle fleets deployed during the construction phase.	*Used oils:* Used transmission, motor, hydraulic and lubricating oils and greases will be generated during operations by the RMGC and contractor equipment fleet of: hauling trucks, bulldozers, excavators, drilling rigs, and other types of vehicles and mobile equipment.	*Used oils:* Used transmission, motor, hydraulic and lubricating oils and greases will be generated during closure by the fleet of vehicles and mobile equipment used for closure and rehabilitation activities.
		Lead (acid) batteries and transformers: Used lead acid batteries will be generated	*Lead (acid) batteries and transformers:* Used lead-acid batteries will be	*Lead (acid) batteries and transformers:* Used lead-acid batteries will be generated

Waste Category	Waste Subcategories	Construction Phase	Operations Phase	Closure Phase
		by the RMGC contractor vehicle fleets deployed during the construction phase.	generated during operations by the RMGC/contractor fleet of haulage trucks, bulldozers, excavators, drilling rigs, and other vehicles and mobile equipment.	during closure by the fleet of vehicles and mobile equipment used for closure and rehabilitation activities.
		Non-lead acid batteries: Small quantities of non-lead acid batteries will be generated through the use of torches, radios, and other types of portable electric/electronic devices used by the employees during the construction phase. Most batteries will be of the dry manganese type; smaller quantities of nickel-cadmium or used rechargeable batteries may also be generated.	*Non-lead acid batteries:* Small quantities of non-lead acid batteries will be generated through the use of torches, radios, and other types of portable electric/electronic devices used by the employees during the operation phase. Most batteries will be of the dry manganese type; smaller quantities of nickel-cadmium or used rechargeable batteries may also be generated.	*Non-lead acid batteries:* Small quantities of non-lead acid batteries will be generated from the use of torches, radios, and other types of portable electric/electronic devices used by the employees during the closure/rehabilitation phase. Most batteries will be of the dry manganese type; smaller quantities of nickel-cadmium or used rechargeable batteries may also be generated.
		Asbestos demolition waste: No asbestos or asbestos-bearing materials will be permitted onsite in this phase of the project; although asbestos sheet, tile, board, or lagging that may be encountered in the demolition of structures during the construction phase. Any such wastes will be managed as hazardous production wastes.	*Not applicable.*	*Asbestos demolition waste:* As no asbestos or asbestos-bearing materials will be permitted on-site, no asbestos demolition waste will be generated in the closure phase of the project.
		Hazardous substances and waste: Construction activities are expected to generate small quantities of hazardous waste, such as paint and solvent waste, as well as oil/grease spill cleanup waste. There are no available data on the presence of polychlorinated biphenyl-bearing substances on site. Any used transformers or capacitors from historical mining operations that are suspected to contain polychlorinated biphenyl-bearing compounds or other dangerous chemicals will be considered hazardous waste and will be added this waste stream.	*Hazardous substances and waste:* Hazardous wastes are likely to be generated in small quantities during the operational phase; these may include paint and solvent wastes, along with process reagents and chemicals associated with the domestic wastewater treatment plant, the acid rock drainage water treatment plant, and the carbon-in-leach operations. Chemical reagents will be shipped in reusable, returnable bulk containers, which will minimise this waste generation stream. Cyanide will be stored in ISO-compliant double walled steel tanks in accordance with the Roşia Montană Project *Cyanide*	*Hazardous substances and waste:* Residual process chemicals, paints, and solvents, as well as spill cleanup residues may be generated during closure.

Waste Category	Waste Subcategories	Construction Phase	Operations Phase	Closure Phase
			Management Plan. Any small unused quantities of chemical reagents within these containers or tanks will be shipped back to the product manufacturers or licensed re-use/recycling facilities. Spills of cleanup wastes will be subject to appropriate neutralisation procedures; residues will then be managed as hazardous waste. Under routine circumstances, the cyanide detoxification unit is expected to prevent the generation of cyanide waste. The treatment plant will be designed to contain any spills that may occur the event of piping system failure or equipment malfunctions. No asbestos/ asbestos-bearing materials or polychlorinated biphenyl-bearing compounds will be permitted on-site during this phase of the project.	
Production waste	*Non-hazardous production waste*	*Production packaging waste:* Paper/cardboard, plastic, wood, metal, composite material and mixed packaging waste will be generated from the delivery of a wide range of supplies and equipment related to construction activities. Returnable shipping container options will be negotiated with major suppliers of consumable material in order to minimise this waste generation stream.	*Production packaging waste:* Paper/cardboard, plastic, wood, metal, composite material and mixed packaging waste will be generated from the shipment and delivery of a wide range of supplies and equipment related to the processing plant and other production facilities. Returnable shipping container options will be negotiated with major suppliers of consumable material in order to minimise this waste generation stream.	*Production packaging waste:* Paper/cardboard, plastic, metal, and composite material and mixed packaging waste will be generated from the delivery of supplies and equipment related to closure activities. Returnable shipping container options will be negotiated with major suppliers of consumable material in order to minimise this waste generation stream.
		Waste electric and electronic equipment: Electric/electronic wastes may be generated by the replacement of dysfunctional computers other electronic equipment or electric appliances. It is anticipated that all operational electronic/electrical equipment will continue to be used during the operation and closure phases.	*Waste electric and electronic equipment:* Waste electric and electronic equipment may be generated by the replacement of obsolete or dysfunctional computers, other electronic equipment or electric appliances. It is anticipated that some of the operational electronic/electrical equipment will continue to be used	*Waste electric and electronic equipment:* Waste electric and electronic equipment may be generated by the end of the closure phase, as dysfunctional computers, other electronic equipment or electric appliances. All operational equipment will be donated.

Waste Category	Waste Subcategories	Construction Phase	Operations Phase	Closure Phase
			during the closure phase and some will be donated.	
		End-of life vehicles: During the construction phase, this waste stream will exist only for damaged vehicles with repair costs exceeding probable resale value.	*End-of life vehicles:* During the operation phase, RMGC and contractor vehicle fleets are expected to be rotated (sold to new users) before their service life is over. Hence, this waste stream will exist only for damaged vehicles with repair costs exceeding probable resale value.	*End-of life vehicles:* During the closure phase, RMGC and contractor vehicle fleets are expected to be rotated (sold to new users) before their service life is over. Hence this waste stream will exist only damaged vehicles with repair costs exceeding probable resale value.
		Used tyres: Used tyres will be generated from the RMGC and contractor vehicle fleets deployed during the construction phase.	*Used tyres:* Used tyres in a wide range of sizes will be generated during operations from RMGC and contractor fleets of haulage trucks, loaders, graders and other vehicles and mobile equipment.	*Used tyres:* Used tyres will remain a waste stream from the fleet of vehicles and other mobile equipment used in closure and rehabilitation activities.
		Used oil filters: Used oil filters will be generated from RMGC and contractor vehicle fleets deployed during the construction phase.	*Used oil filters:* Used oil filters will be generated from RMGC and contractor vehicle fleets deployed during the operation phase.	*Used oil filters:* Used oil filters will be generated from RMGC and contractor vehicle fleets deployed during the closure phase.
		Waste aerosol containers: Small quantities of waste aerosol containers will be generated from the construction and maintenance of facilities.	*Waste aerosol containers:* Small quantities of waste aerosol containers will be generated from the maintenance of facilities.	*Waste aerosol containers*: Small quantities of waste aerosol containers will be generated from the maintenance of a limited number of facilities still in function during the closure phase.
		Not applicable	*Active carbon from processing plant:* Carbon fines from carbon reactivation process will be not reusable in the elution process and will have to be treated as waste.	*Not applicable*
	Special ferrous and non-ferrous metallic waste	*Not applicable*	*Metallic Waste* The processing plant is expected to generate mill liners as a result of repairing activities. The plant site is expected to generate additional scrap metal in association with vehicle /equipment maintenance activities. Also mining operations are expected to generate metallic waste like cables and drilling equipment.	*Not applicable*

Waste Category	Waste Subcategories	Construction Phase	Operations Phase	Closure Phase
	Construction and demolition waste	*Mixed construction and demolition waste:* Mixed inert and non-hazardous construction and demolition waste such as building stone or brick, concrete, ceramic tiles, and glass, will be generated from the demolition of existing facilities as well as the construction of new facilities. Although construction and demolition waste will be generated from the demolition of the existing houses, as necessary for the development of the new RMGC Project, this will be classified as production waste. Construction waste (mainly metallic waste) will be also generated in the construction phase.	*Not applicable*	*Mixed construction and demolition waste:* During closure, a small workforce will remain at the mine to support facility decommissioning and other closure activities. Buildings and other structures will be dismantled and removed from the site, if they are not compatible with the designated land use. All waste with inert and non-hazardous waste characteristics (brick, concrete, glass, reinforced concrete, simple concrete, masonry) will be treated as demolition waste. Machinery, equipment, storage tanks, metallic pipes and metal structure will also be removed from the site. Beneficial reuse within the region is the preferred option for all such items; therefore, waste generation will only occur in the event no beneficial reuse can be identified.
Medical Waste	*Hazardous and non-hazardous medical waste*	RMGC first aid stations and medical aid clinic will generate medical (and potentially infectious) waste.	RMGC first aid stations and medical aid clinic will generate medical (and potentially infectious) waste.	Medical and infectious wastes will continue to be generated in small volumes as long as first aid stations and the RMGC medical clinic remain operational.

3.5 Production Waste Management

Production waste is defined in the *National Plan for Waste Management* in compliance with the GD no. 856/2002, *Waste management* [lxxvii] provisions as the totality of wastes generated from different activities, except extractive industry, construction and demolition waste, medical waste and municipal and similar waste.

For this specific Project, the demolition and construction waste will be included in the production waste, as all the demolition and construction works will be performed by RMGC within the Project area, to clear the area, prior to the construction, operation and decommissioning of the industrial facilities. All those activities are under the responsibility of the RMGC, which has to take also the responsibility of all generated waste management.

Usually the production waste includes hazardous and non-hazardous waste. In the framework of this Project, the production waste could also represent inert waste.

3.5.1 Hazardous Production Waste

Hazardous production waste is defined as any dangerous or toxic waste covered by GD no. 856/2002, *Waste Administration.* Wastes considered having hazardous properties addressed by Governmental Emergency Ordinance (GEO) no. 78/2000 amended and approved by Law no. 426/2001, Annex I E. Such wastes may be explosive, reactive, corrosive, oxidising, flammable/very flammable, toxic/ecotoxic, infectious, cancerous, mutagenic, and/or teratogenic.

The hazardous waste definition has been updated in the GD no. 349/2005, *Waste Landfill*[lxxviii] - hazardous waste is defined in the Annexes 1C, 1D and 1E of the GEO no. 78/2000 amended and approved by Law no. 426/2001.

The hazardous waste predicted to be generated and managed by RMGC as noted in the *Waste Management Plan,* during the lifetime of this Project will consist of waste streams presented below.

3.5.1.1 Used Oils

The management of used oils shall comply with *Directive 75/439/EEC, on the disposal of waste oils*[lxxix]*,* transposed in Romania by Government Decision no. 662/2001, *on used oils management*[lxxx] and amended by Government Decision no. 441/2002 and GD no. 1159/2003.

Used transmission, motor, hydraulic and lubricating oils and greases will be generated in all three phases of the project as part of the maintenance and repairing activities for both vehicles and mining equipment fleet.

Used transmission, motor, hydraulic and lubricating oils and greases will be separately collected by categories (as are defined in Government Decision no. 1159/2003, Annex 1), stored in drums and transported off-site by a licensed waste disposal company to a recycling and/or incineration facility. Motor and transmission oil will be purchased from appropriate sources which will also collect the used oil and send it for recovery. Based on the specific legislation and the National Plan for Waste Management the used oils recovery (material or energy recovery) could be achieved by the following options:

- regeneration – the main specialised companies for this activity;
- use as fuel – in off-site boilers or generators;
- co-incineration – in cement kilns.

The material recovery of the used oils could be performed in any authorised companies engaged in used oil collection and processing. Where feasible, efforts will be made to recycle petroleum products for energy recovery purposes in off-site boilers or generators.

The co-incineration of the used oils and used grease is now feasible in Romania, as amongst the cement plants that have been authorised for these types of waste treatment, two of them are located in Alesd (Bihor county) and Hoghiz (Brasov county) at reasonable distances from the Site.

Shipping drums that are not re-usable or returnable will be drained and used to store crushed and drained spent oil filters and oily rags.

3.5.1.2 Lead (Acid) Batteries and Accumulators

All spent lead acid batteries from vehicles will be sold to an approved recycler, as permitted by EU Council Directive 91/157/EEC, *Batteries and Transformers Containing Certain Dangerous Substances*[lxxxi] transposed in GD no. 1057/2001.[lxxxii]

Spent batteries will be accumulated on pallets in a separate area of the transfer station on an impermeable, bermed surface, pending removal by the recycler. Based on the specific legislation and the National Plan for Waste Management the lead batteries and transformers for vehicles will be recycled either by batteries producers/importers or by authorised companies. Current planning is based on the approach that undrained batteries are accepted for recycling.

3.5.1.3 Non-Lead Acid Batteries

The applicable legislation for these types of wastes is also EU Council Directive 91/157/EEC, *Batteries and Transformers Containing Certain Dangerous Substances*[lxxxiii] transposed in GD no. 1057/2001, also applicable to the lead accumulators.

Standard dry manganese batteries used in portable torches and electrical/electronic devices will be disposed of as municipal waste; batteries with similar functions but which are considered potentially hazardous due to their heavy metal content (e.g. nickel-cadmium or spent “rechargeable” batteries) will be segregated, accumulated in a plastic drum, and routed to the Temporary Hazardous Waste Storage Facility pending identification of and shipment to a permitted off-site hazardous waste disposal facility. Based on the Implementation Plan on Waste Incineration, an incineration facility for hazardous waste should be built in 2009.

There is not yet organised a collection and disposal of system for these types of batteries/transformers in Romania. Neither the NPWM nor the RPWM has provisions/solutions for the disposal of hazardous batteries or accumulators.

3.5.1.4 Hazardous Demolition Waste

Hazardous Demolition Waste Generated during Pre-Construction Phase

It should be noted that asbestos waste is now considered to be a hazardous waste under the latest amendments to EU *Landfill Directive*[lxxxiv], and will be managed as such. The Romanian legislation applicable to the asbestos-bearing materials is the Government Decision no. 124/2003, *Pollution Prevention, Reduction and Control of the Environment with Asbestos.*[lxxxv]

Although asbestos or asbestos-bearing materials will not be permitted to be purchased or otherwise brought onto the project site, asbestos tiles, sheathing, and insulation board may be encountered in the demolition of buildings during the pre-construction phase. Prior to start-up of demolition activities, all affected employees or contractors will receive appropriate training on the special handling requirements and disposal requirements for asbestos, as well as training on the required proper respiratory protection, as described by the RMGC *Occupational Health and Safety Plan*. Asbestos demolition waste will be subject to the requirements of the *Waste Management Plan* and its supporting procedures; it may be mechanically consolidated under a light water spray, as necessary, then double-bagged in heavy-gauge plastic bags, and placed in compatible waste drums for storage at the Roşia Montană Project Temporary Hazardous Waste Storage Facility.

As described earlier, once an appropriately permitted hazardous waste landfill opens that is permitted to accept asbestos waste, the asbestos waste generated as a result of demolition will be transferred there.

Hazardous Demolition Waste Generated during Decommissioning and Closure Phase

During the decommissioning and closure phase of the Project, demolition activities will result in the generation of hazardous demolition waste. Typical hazardous demolition waste streams that can be expected include: paint residue, spent solvents, and residual reagent.

Major equipment items and ancillary equipment will be sorted by function, placed on a bermed concrete pad, washed with detergents and/or solvents, and assessed for wear or damage. All drained used oil or lubricants, washwater, and spent solvents will be captured, segregated, and accumulated in tanks (double-walled or provided with bermed concrete secondary containments) for proper disposal. Depending on their disassembled condition, all decommissioned equipment items will be sold for beneficial reuse or for their scrap or recycling value. Areas where equipment and tanks have been removed will be assessed for environmental contamination including sampling of sub-soils where indicated.

As described above, no asbestos insulation will have been permitted in the construction of the process plant or its ancillary facilities.

During decommissioning and closure, all cyanide process tanks and piping systems will be triple flushed with water to remove residual cyanide, and the effluent routed to the detoxification circuit for reduction of residual cyanide concentrations to below EU standards for cyanide in tailings. Detoxified washwater will then be released to the tailings pipeline for deposition in the TMF. The decommissioned process plant tanks and piping systems will then be cut up and recycled as noted under the "scrap metal" in Table 3-25.

Further details concerning the decommissioning of the Process Plant are provided in the *Mine Rehabilitation and Closure Management Plan*.

3.5.1.5 Potentially Contaminated Soil

As the vehicles and mining equipment will be refuelling at the fuel station, which will be provided with concrete paved area, the potential spillage of fuel will be collected using specific absorbing materials.

The oils change and the current repairing activities will be performed within the maintenance and repairing workshop, which will be provided with special devices for used oil collection and absorbing material for accidental spillage.

The protective measures above-mentioned will prevent the soil contamination with petroleum products in normal operation conditions.

In abnormal conditions, when accidental spillage of petroleum products (oil, fuel) could occur, the soil could be contaminated. In this situation, the spilled products will be collected using absorbing materials and in case that the soil will be affected, the contaminated soil will be removed and stored in metallic drums for a proper disposal.

The contamination level of the soil will be assessed against the intervention values for less-sensitive areas in the MO no. 756/1997 on environmental pollution assessment. [lxxxvi]

3.5.1.6 Detoxified Cyanide Spill Cleanup

As noted in the *Cyanide Management Plan*, unloading, storage, mixing, and use of cyanide in the mineral extraction process will be conducted within full containment. The plant design will require individual containment areas to be sized to accept 110% of the volume of potentially reporting material. All spills within the containment area are amenable to being returned directly to the cyanide leaching process, and no residual spill material will be generated in normal operations that will require management or disposal as a waste. Any spills of process solution will be captured with portable suction pumps and returned to appropriate locations in the process (i.e., areas that will not contribute to a process upset). Containment areas associated with cleaned-up spills will be washed into sumps within the containment, and the collected effluent pumped back to the process. Because any potential spills are captured and returned directly to the cyanide leaching process and no residual spill material will be generated during normal operations, this potential waste stream will not require disposal as a waste.

3.5.2 Non-Hazardous Production Waste

Non-hazardous production waste generated in construction, mining operations, or decommissioning and closure, will, in general, either be recycled by authorised companies or disposed of off-site as municipal waste by landfilling or incineration/co-incineration.

The main types of non-hazardous waste that will be generated during the lifetime of the project are presented below.

3.5.2.1 Production Packaging Waste

There is no specific legislation related to the production packaging waste in Romania. In this circumstance, the best management practices will be applied.

Empty containers generated as a result of production activities will be managed in a different manner than the packaging waste classified as municipal packaging waste. Containers will be drained and tripled-rinsed to ensure that residual product is not disposed of with the production packaging waste. To the extent possible, returnable shipping container options will be negotiated with major consumable suppliers in order to minimise the generation of packaging waste. Types of packaging waste for which no beneficial use or recycling options can be identified will be handled as municipal waste, except that containers that have contacted hazardous substances will be managed as hazardous wastes.

Special disposal considerations will apply to empty containers, as follows:

- empty used containers awaiting transport or reuse will not be accumulated or stored in a manner that allows discharge of any contents or the collection of precipitation;
- empty small used containers (less than 75 l) will be crushed and disposed of as municipal waste;
- empty medium used containers (75 l to less than 380 l) will be sent back to the original product vendor when possible. If this is not possible, such containers will be reused or recycled, or will be disposed of as municipal waste; and
- empty large used containers (380 l or more) will be sent back to the product vendor for reuse. Empty large used containers which are owned by the site and have reached the end of their useful life will be scrapped and recycled in the same manner as other used process equipment.

For reasons of safety, security, and liability, empty used containers will not be given to, sold to, or otherwise distributed to the public or to employees for personal use.

3.5.2.2 Waste Electric and Electronic Equipment (WEEE)

Wherever possible, obsolete electronic or electrical equipment will be donated to an appropriate charity or local educational institution. Dysfunctional equipment will be sold to an electronic/electrical equipment scrap dealer or recycler, as available, complying with *Directive 2002/96/EC on waste electrical and electronic equipment*[lxxxvii], which has been transposed in Romanian legislation by Government Decision no. 448/2005[lxxxviii]. The waste electrical and electronic equipment will be stored in a specially designated area of the Temporary Hazardous Waste Storage Facility.RMGC will contract with an appropriately certified waste electric and electronic equipment recovery and disposal company who will take responsibility for the proper disposal of this waste stream.

The local public authority has to provide a location for the WEEE collection. The current closest location of such a collection centre is within Cugireana S.A. Company, located in Cugir, County of Alba.

3.5.2.3 End-of-Life Vehicles

RMGC and contractor vehicle fleets are expected to be rotated (i.e. sold as used vehicles to new owners) before their useful service life is over. As a consequence, an end-of-life vehicle waste stream will be created only if accidents occur that result in damage that exceeds the repair cost of the affected vehicles. Such vehicles will be sold as scrap metal to a licensed dealer, for eventual recycling, and promptly removed from the Project site in order to comply with *Directive 2000/53/EC on end-of-life vehicles,* which has been transposed in Romanian legislation by Government Decision no. 246/2004[lxxxix]. End-of-life vehicles may not be disposed of as municipal waste.

3.5.2.4 Used Tyres

Used tyres will not be disposed of in any landfill except when used as engineering material for embankment stabilisation or for other erosion control or structural purposes at the landfill. Tyres may also be used for other embankment stabilisation or erosion control measure across the site. For RMGC and contractor fleets, tyre-purchasing priority will be given to tyre vendors with a take-back and re-tread program. Alternative means of disposal that will be sought include co-incineration with energy recovery in cement kilns or other types of industrial process plants, in accordance with Government Decision no. 170/2004, *used tyres*.[xc] Prior to delivery of used tyres for co-incineration, RMGC will ensure that cement kilns or other types of industrial process plants used for energy recovery comply with legally accepted environmental management practices and with legal provisions in of *Directive 2000/76/EC, Waste Incineration*[xci], which has been transposed in Romanian legislation by *Government Decision no. 128/2002, Waste incineration amended by Governemnt Decision no. 268/2005.*[xcii] Used tyres may not be disposed of as municipal waste.

3.5.2.5 Used Oil Filters

There is no specific regulation related to used oil filters management in Romania. Based on the international best practices, the used oil filters will be hot-drained, crushed, and stored in drums pending the proper disposal.

Used oil filters generated from RMGC and contractor vehicle fleets will sold as scrap metal to an appropriately licensed dealer. Although the hot-drained used oil filters represent non-hazardous waste, they will be managed as hazardous waste and collected in the Temporary Hazardous Waste Storage Facility until arrangements are made for the licensed dealer to take control of the used oil filters. Used oil filters may not be disposed of as a municipal waste.

3.5.2.6 Waste Aerosol Containers

Since under Romanian regulations aerosol containers, regardless of contents, are considered to be hazardous waste, RMGC will implement a purchasing policy that specifically prohibits purchase of paint, lubricants, cleansers, and other consumable materials in aerosol form, unless such materials have a critical maintenance, safety, or operational application and no reasonable alternative is available. Where materials in aerosol containers must be purchased, spent containers will be safely punctured and crushed (using shielded equipment designed for such purposes), accumulated as non-hazardous recyclable metallic waste, and routed to the authorised company for metal recycling.

3.5.2.7 Activated Carbon Residues

Carbon fines will be generated after the screening of the reactivated carbon and will not be used anymore in the elution process. Therefore, it has to be treated as waste.

Due to the fact that the carbon fines will result after the carbon thermal reactivation, this waste will be not hazardous. The best international practice is to dispose of the carbon in the TMF.

3.5.3 Construction and Demolition Waste

The construction and demolition waste will be generated during the pre-construction/ construction phase when the industrial facilities and private houses and premises in the Project development area will be demolished, as well as during the closure phase when the majority of facilities with no further use will be disassembled and decommissioned.

3.5.3.1 Demolition and construction waste generated in the pre-construction/construction phase

RMGC compensation policy provides that former landowners can recover all reusable construction materials (metal, woodwork, electric wires, roof metal sheeting or tiles, etc.). This will lead to diminishing the amounts of demolition waste generated and to a better segregation prior to land-filling, with significant reduction of the hazardous character of such waste in landfill condition.

In the case former landowners will collect and ship offsite a part of the reusable materials, the rest will be collected and segregated in order to recover all reusable waste. Such waste will either be disposed of by authorised contractors or will be made available to local inhabitants, in a well delimited location with controlled access under supervision by RMGC.

In the event that demolition activities will results in hazardous wastes – such as oil, paint or solvent products – these will be collected separately and will managed together with other hazardous waste generated on site.

Potential generation of asbestos-bearing waste will require special management procedures, as described in Section 3.5.1.4**.**

Non-hazardous waste that cannot be reused by former landowners or by third parties (RMGC or other local inhabitants) will consist mainly of gravel waste from foundations, concrete, bricks, plaster. Landfilling of such waste should be made in consideration of environmental and human health protection, and may be achieved by developing and operating an onsite construction and demolition landfill.

The waste generated during the *construction phase* of the main Roşia Montană Project facilities will consist mainly of:

- excavated topsoil and subsoil – which will be stored in a controlled manner, to allow their use for rehabilitation of areas with decommissioned industrial facilities;
- metal and wood waste – which are reusable through authorised operators;
- cardboard and plastic packaging waste – which are reusable through authorised operators;
- paint and solvent residues – small quantities, managed in a similar manner with other hazardous waste generated on site.
- concrete batch remainders or other non-contaminated construction waste – which are disposable by landfilling in the proposed construction and demolition waste deposit.

3.5.3.2 Demolition waste generated during the closure phase

Due to specific character of activities to be carried out within the Roşia Montană Project area, the waste generated during the closure phase will come mainly from decommissioning of processing plant equipment and ancillary facilities.

The management of raw materials necessary for the processing plant will ensure that the stock of available reagents will be reduced and eliminated by the time of plant closure.

Transport and handling of hazardous chemical substances within the processing plant will be carried out exclusively by pipes and metallic tanks. Thus, metallic piping and storage tanks will be flushed and detoxified to acceptable limits, prior to disassembly and recycling as scrap metal.

The technology for decommissioning of such equipment has specific provisions concerning accidental spill of toxic materials. Therefore, the disassembly of installations will be carried out according to a Mining Closure Plan (IPROMIN, 2005) which also includes the main technological phases and the main types and quantities of waste generated by the decommissioning of major processing equipment.

The waste generated by the decommissioning of processing equipment and demolition of related facilities will include industrial waste (tanks, basins, pumps, sieves etc.) which will allow direct beneficial reuse, as well as the following waste categories:

- waste from the site stripping operations;
- steel concrete;
- simple concrete;
- metallic structures;
- masonry, coatings;
- doors and windows;
- plaster; and
- metallic piping of various diameters.

All reusable waste – especially scrap metal - will be recovered by authorised operators. Doors and windows will be disposed of depending on their condition at the time of decommissioning, either by selling as such or by disassembly and recovery of component materials. It is possible for disassembly operations to result in waste which may be disposed of to the construction and demolition landfill.

Due to their considerable size, steel and plain concrete structures will require on site processing prior to disposal. Concrete rubble as a result of demolition will be transported to the TMF; this deposition option is related with the positive effect of influencing the milieu of the tailings to the alkaline direction, as concrete is a known alkaline product and will enhance control of surface water pH values.

Steel concrete will be also crushed, but by different technology, to allow recovery of metal reinforcement. Metallic waste will be sold as scrap metal to an authorised operator, whereas crushed material with no foreseeable local use (e.g. road bed filling) will be disposed of in the TMF, in order to enhance the buffer capacity of the tailings and therefore further prevent acidification and release of heavy metals.

The Construction and Demolition (C&D) Waste Landfill will be inspected on a weekly basis to ensure the following:

- only C&D wastes are placed in the cells;
- cells are compacted and covered with soil on at least a weekly basis;
- security measures are in place to prevent unauthorised entry, and
- that these measures are sufficient to prevent scattering by wind or precipitation.

3.6 Municipal And Similar Waste Management

Municipal waste is defined in the *National Plan for Waste Management* as non-hazardous waste from households, as well as other waste, which, because of its nature or composition, is similar to waste from households. For the Roşia Montană Project, this is interpreted to apply primarily to:

- non-hazardous, industrial or commercial waste, similar to household waste;
- biodegradable waste;
- packaging waste (excluding production packaging waste); and
- sewage sludge from the Domestic Wastewater Treatment Plant.

Efforts will be made, where feasible, to re-use and recycle waste material in order to minimise the amount of municipal waste created during construction, operation, and closure. Unless these wastes are recycled, or meet the criteria for inert and non-hazardous C&D waste characteristics as defined in Section 3.5.3, all municipal and similar wastes will, in the near term, be collected and transported by truck to the Abrud Waste Transfer Station.

3.6.1 General Household Type Waste

Garbage, food waste, sanitary waste, and other general refuse putrescible wastes will be stored in a safe and sanitary manner pending disposal, in compliance with applicable practices and regulations that have been developed to prevent exposure to employees, contractors, or visitors, and the propagation or harbourage of disease, attraction of vector species, scattering by wind or precipitation, and/or the creation of nuisances. Municipal waste containers will be covered and located around the plant site for accumulation prior to collection at the waste transfer station. Containers will be collected and brought to an appropriate transfer station site on at least a weekly basis.

Although in the Government Emergency Ordinance no. 78/2000, approved by Law no. 426/2001 Waste Regime[xciii] the organic biodegradable waste disposed into a municipal landfill should be diminished, due to the fact that until now there are no composting facilities available. In addition, this type of waste is not separately collected. As soon as a composting facility will be in operation, RMGC will proceed with the separate collection of organic biodegradable waste.

3.6.2 Packaging Wastes (Excluding Production Packaging Wastes)

Packaging wastes (excluding production packaging wastes) may contain paper or cardboard, plastic, metal, or glass, which will be segregated, as necessary, to meet current Roşia Montană Project recycling and reuse objectives as identified in the Waste Stream Inventory described in the *Waste Management Plan* and to comply with the provisions of GD no. 621/2005, *regarding packaging and packaging waste management*.[xciv]

Empty containers generated as a result of production activities will be managed as a production packaging waste.

3.6.3 Sewage Sludge from Domestic Wastewater Treatment Plant

A Domestic Wastewater Treatment Plant will be established to treat effluent from showers, toilets, sinks, and washing machines in the administrative areas of the Project.

In order to support waste minimisation efforts, Domestic Waste Water Treatment Plant sewage sludge may be used as a soil amendment or fertiliser in agriculture provided it is sampled and analysed on a regular basis for heavy metal content and is used in accordance with all requirements in Directive 86/278/EEC *on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture*[xcv] which has been transposed into Romanian Law as *Ministerial Order (MO) of Minister of Environment and Water Management no. 344/2004 and of Minister of Agriculture, Forests and Rural Development no. 708/2004*.[xcvi] RMGC will investigate the possibility of making the sludge available to local farmers, if testing indicates that such use is environmentally acceptable. The sewage sludge could also be used for land rehabilitation in areas affected by mining activities owned both by Roşiamin S.A. – during the construction phase and operation phase until closure activities will start and then by RMGC until the decommissioning of the Domestic Wastewater Treatment Plant. Prior to bio-solids agriculture application or usage for land rehabilitation, the chemical characteristics of the soil (which will be amended with bio-solids) will be tested to ensure the bio-solids sludge is compatible.

If the Domestic Wastewater Treatment Plant sludge will contain heavy metals and it is not usable for land rehabilitation or agriculture application, it will be deposited in the TMF especially during the closure phase (disposal in the upper layer of tailings) which would have the additional advantage of providing organic substance which leads to reducing conditions due to biological oxygen-consumption. This contributes to the prevention of acidification of the tailings.

3.7 Medical Waste

Medical waste from RMGC first aid facilities and medical clinics will be segregated and disposed of in accordance with the requirements of the *Waste Management Plan*. Medical waste will be properly handled in accordance with applicable procedures from the *Occupational Health and Safety Plan*. In addition, RMGC will maintain communications with both the Ministry of Environment and Water Management and the Ministry of Health to identify proper authorised facilities for this type of waste. The recommended disposal technologies in the National Plan for Waste Management consist in incineration or sterilisation and then land-filling.

The ECOBURN S.R.L. in Cluj Napoca is an example of a certified medical waste incinerator operation that could be contracted for this service.

3.8 Summary of Waste Amounts and Classifications

In this section is presented the list the wastes which have to be managed during the entire project life and provide estimates of the amounts for the three project phases:

- Construction,
- Operations,
- Closure.

The main information sources for the basic data needed for the waste quantities generated are the following:

- Construction phase – Construction Execution Plan and Work Methods Report, SNC Lavalin Engineering and Constructors, 2003, Project Estimation Costs, Washington Group 2005 and ICPM Petroşani, 2006:
  - Number of employees – 300 permanent staff and 1200 permanent staff and contractors during the first year and 300 permanent staff and 2200 permanent staff and contractors the second year;
  - Number of mining equipment vehicles – 23;
- Operation phase – Feasibility Study, IPROMIN, 2005, Project Estimation Costs, Washington Group 2005 and IMC Report, March 2006:
  - Number of employees – 621 in the first year and 394 in the last year, with an average over the 17 years of 560;
  - Number of mining equipment vehicles – average annual number 36;
- Closure phase – Closure Plan, IPROMIN, 2005:
  - Number of employees – 150 during active closure (first two years) and 25 during the following three years;
  - Number of mining equipment vehicles – 43 during active closure (first two years) and 10 during the following three years.

The basis for the waste quantities generated during the lifetime of the project is presented in Table 3-22.

Table 3-22. Basic Data for Waste Quantities Generated by the Project

Phase	Number of Employees (full time/ contractors)	Fleet vehicles for employees' transport* (full time/contractors)	Mining equipment vehicles
Construction	300/1700	30/170	23
Operation	560	56	36
Closure	150 – during the active' closure (first two year) 25 – during the following three years	30 – during the active closure (first two year) 5 – during the following three years	43 – during the active closure (first two year) 10 – during the following three years

* based on 1 fleet vehicle for 10 employees during construction and operation phases and 1 fleet vehicle for 5 employees for the closure phase

In addition, the source of number of buildings/structures which will be demolished during for the construcation phase is the RMGC *Resettlement and Relocation Action Plan* (Stantec and Frédéric Giovanetti, March 2006).

Based on that plan the number of households that have to be demolished are:

- Number of households (houses and ancillary facilities) already demolished: 115:
- Number of households (houses and ancillary facilities) to be demolished: 540;
- Number of blocks to be demolished: 1 storey block (1 piece), two storey block (7 pieces), three storey blocks (1 piece), four storey block (1 piece).

A demolition permit has been granted to RMGC for the demolition of the first 115 households. The non/recyclable demolition wastes were disposed at the Valea Verde waste rock dump and Manesti Mine Gallery. Based on the demolition waste resulted from those buildings demolition a quantity of about 50 t/household was estimated.

The estimated demolition waste in case of multi-storey blocks is estimated of about 30 t/apartment.

Table 3-23 through Table 3-25 list the wastes which have to be managed during the entire project life and provides estimates of the amounts for the project phases

- Construction,
- Operations,
- Closure.

Table 3-23. Waste Generation, Management and Disposition – Construction Phase (Anticipated Duration: 2 Years)

Waste Name [24]	Waste Category [25]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code *	Code on main hazardous feature [26]	Waste management – amount estimated to be generated annually			Disposal facility
						Utilisation [27] (Reused/ Recycled)	Elimination [28] (Disposed)	Closing stock [29] (Stored)	
Production waste									
Mixed inert and non-hazardous demolition waste[30]	Production waste	30,840 tonnes[31]	S	17 09 04	N/A		30,840 tonnes		Construction and Demolition Waste Landfill
Mixed non-hazardous potential bio-degradabile demolition waste	Production waste	1,200 tonnes[32]	S	17 09 04	N/A		1,200 tonnes		Municipal Waste Landfill via the Abrud Waste Transfer Station
Scrap metal[33]	Production waste	600 tonnes	S	17 04 05	N/A	600 tonnes			Recycled via authorised company

[24] In accordance with the List comprising waste, provided in Annex no. 2 of Government Decision no. 856/2002. The symbol * designates a hazardous waste. Statistic classification of waste is not transposed into Romanian legislation.
[25] Categories and subcategories based on those established by the National Plan for Waste Management, Government of Romania, 2004.
[26] In accordance with Annex 1E of Law 426/2001, Characteristics of Wastes that make them Dangerous.
[27] Waste is used, reused or recycled both onsite and offsite; see "Disposal facility" column regarding disposition options (e.g. land rehabilitation, agriculture application, metal and other material recovery etc.).
[28] Waste is disposed of both on-site and offsite facilities (e.g. on-site disposal facility – Waste rock stockpiles, Construction and Demolition Waste Landfill, municipal landfill, incineration and co-incineration) see "Disposal facility " column regarding disposition options.
[29] Waste is stored onsite (e.g. Temporary Hazardous Waste Storage Facility); see "Disposal facility" column regarding disposition options.
[30] Does not include scrap metal as a result of structure demolition.
[31] Quantity of waste generated based on assumption of 540 households and 128 apartments to be demolished. Assumes that each household will have 50 tonnes of demolition waste and each apartment will have 30 t of demolition waste.
[32] Quantity of waste generated based on assumption of 540 households and 128 apartments to be demolished. Assumes that each household will have 50 tonnes of potential degradable demolition waste and each apartment will have 30 t of potential degradable demolition waste.
[33] Quantity of waste generated from structure demolition and from construction of new facilities-assumes 2% of demolished structures are metal.

Waste Name [24]	Waste Category [25]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code *	Code on main hazardous feature [26]	Waste management – amount estimated to be generated annually			Disposal facility
Asbestos demolition waste	Production waste	54 tonnes[34]	S	17 06 05*	H6			54 tonnes	Encapsulated and stored in Temporary Hazardous Waste Storage Facility until properly permitted hazardous waste landfill is opened which accepts asbestos waste
Contaminated soil	Production waste	0.100 tonne[35]	S	17 05 03*	H5			0.100 tonne	Temporary Hazardous Waste Storage Facility and co-incineration/incineration in an authorised co-incineration/incineration facility
Empty Containers[36]	Production waste	0.500 tonne	S	15 01 04	N/A	0.500 tonne	See note[37]		Returned to vendor for reuse/recycling or Municipal Waste Landfill via the Abrud Waste Transfer Station
Waste aerosol containers	Production waste	0.050 tonne	S	15 01 04	N/A	0.050 tonne			Recycled via authorised company
Used hydraulic oil	Production waste	297,840 litres[38] (268,056 tonnes)	L	13 01 10*	H6	297,840 litres (268,056 tonnes)			Regenerated, used as fuel or co-incineration/incineration in an authorised co-

[34] Quantity of waste generated based on assumption of 540 structures (households) to be demolished. It is also assumed that the blocks do not have asbestos-containing material. Assumes that each structure will have 0.1 tonne asbestos demolition waste.
[35] Quantity of contaminated soil presented is an estimate of the soils contaminated as a result of accidental oil or fuelling spills. Actual quantities generated will depend on the actual spill clean-up scenario or demolition associated with historically contaminated soil.
[36] Assumes no hazardous material residues are present.
[37] Empty containers will be returned to vendor where reuse/recycling will be prioritised; however, if reuse/recycling option is not feasible, the empty containers will be disposed of in a municipal landfill via the Abrud Transfer Station.
[38] Construction Execution Plan and Work Methods Report, SNC Lavalin Engineering and Constructors, 2003

Waste Name [24]	Waste Category [25]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code *	Code on main hazardous feature [26]	Waste management – amount estimated to be generated annually			Disposal facility
									incineration/incineration facility
Used lubricating oil	Production waste	595,680 litres[39] (536,112 tonnes)	L	13 02 05* 13 02 08*	H6	595,680 litres (536,112 tonnes)			Regenerated, used as fuel or co-incineration/incineration in an authorised co-incineration/incineration facility
Used grease	Production waste	148.920 tonnes[40]	SS	13 02 05* 13 02 08*	H6		148.920 tonnes		Co-incinerated or incinerated in an authorised co-incineration /incineration facility
Used oil filters[41]	Production waste	2,938 tonne[42]	S	16 01 07(*)	N/A	2,958 tonne			Recycled via authorised company
Paint residue	Production waste	0.223 tonne[43]	SS	08 01 11*	H5		0.223 tonne		Temporary Hazardous Waste Storage Facility and co-incineration/incineration in an authorised co-incineration/incineration facility
Solvent residue	Production waste	0.446 tonne[44]	L	08 01 17*	H3A		0.446 tonne		Temporary Hazardous Waste Storage Facility and co-incineration/incineration in an authorised co-

[39] Construction Execution Plan and Work Methods Report, SNC Lavalin Engineering and Constructors, 2003
[40] Construction Execution Plan and Work Methods Report, SNC Lavalin Engineering and Constructors, 2003
[41] Used oil filters assumes that the filters have been hot-drained and negligible oil residue is present.
[42] For the quantity of used oil filters generated, this number assumes that oil filters are changed every three months on fleet vehicles and every month on mining equipment vehicles on average; each oil filter is estimated to weigh 0.5 kg.
[43] Amount of waste generated assumes 1 kilogram of residual paint per each fleet and mining equipment vehicle.
[44] Amount of waste generated assumes 2 kilograms of residual solvent per each fleet and mining equipment vehicle.

Waste Name [24]	Waste Category [25]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code *	Code on main hazardous feature [26]	Waste management – amount estimated to be generated annually			Disposal facility
									incineration/incineration facility
Used Tyres	Production waste	190,000 tonnes[45]	S	16 01 03	N/A	190,000 tonnes	See note		Used for erosion control purposes, off-site recycling or co-incineration/incineration in an authorised co-incineration/incineration facility
Lead acid batteries	Production waste	4,970 tonnes[46]	S	16 06 01*	H8	4,,970 tonnes			Recycled via authorised company
Batteries (nickel-cadmium/other spent rechargeable)	Production waste	0.060 tonne[47]	S	16 06 02* 16 06 04	H5/H6			0.060 tonne	Temporary Hazardous Waste Storage Facility and incineration in an authorised incineration facility
Batteries (dry manganese)	Production waste	0.240 tonne[48]	S	16 06 05	N/A		0.240 tonne		Municipal Waste Landfill via the Abrud Waste Transfer Station
Scrap vehicles	Production waste	0.500 tonne[49]	S	16 01 06	N/A	0.500 tonne			Recycled via authorised company
Paper/cardboard packaging	Production waste	1 tonne	S	15 01 01	N/A	1 tonne			Recycled via authorised company
Plastic packaging	Production	0.050 tonne	S	15 01 02	N/A	0.050 tonne	See note[50]		Reused/recycled. If no

[45] Assumes complete tyre change-out for fleet and mine equipment vehicles is every 2 years. It is assumed that on average, fleet vehicle tyres weigh 15 kg and mining equipment tyres weigh 4000 kg. For construction, the waste generation is the equivalent of 240 fleet tyres each year and 46 mining equipment tyres per year.
[46] Amount of waste generated assumes that a fleet vehicle battery is changed every 1.5 years and weighs approximately 20 kg and a mining equipment battery is changed every 1.25 years and weighs approximately 80 kg.
[47] Waste hazardous batteries (nickel cadmium/other rechargeable) generation at 0.2 kg/employee/year.
[48] Waste non-hazardous batteries (dry manganese/other non-lead acid) generation at 0.8 kg/employee/year.
[49] During the construction phase, this waste stream will exist only for those vehicles subject to accidents whose repair value exceeds the vehicle’s probable resale value.

Waste Name [24]	Waste Category [25]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code *	Code on main hazardous feature [26]	Waste management – amount estimated to be generated annually			Disposal facility
	waste								reuse/recycling option found, then Municipal Waste Landfill via the Abrud Transfer Station
Wood packaging	Production waste	3 tonnes	S	15 01 03	N/A	3 tonnes	See note[51]		Reused/recycled. If no reuse/recycling option found, then Municipal Waste Landfill via the Abrud Transfer Station
Composite material packaging	Production waste	0.100 tonne	S	15 01 05	N/A		0.100 tonne		Municipal Waste Landfill via Abrud Transfer Station.
Mixed packaging	Production waste	0.100 tonne	S	15 01 06	N/A		0.100 tonne		Municipal Waste Landfill via Abrud Transfer Station.
Waste electrical and electronic equipment	Production waste	0.200 tonne[52]	S	16 02 15* 16 02 16	H5/H6	0.200 tonne			Operational equipment will go to local charity or other beneficial use; non-functional equipment will be stored in the Temporary Hazardous Waste Storage Facility and be sold to a properly authorised company
Municipal and Similar Waste									
Paper/cardboard	Municipal	0.500 tonne	S	20 01 01	N/A	0.500 tonne			Recycled via authorised

[50] Recycling of packaging will be given priority however, if no recycling options are feasible packaging will be disposed of in a municipal landfill via Abrud Waste Transfer Station.
[51] Recycling of packaging will be given priority however, if no recycling options are feasible packaging will be disposed of in a municipal landfill via Abrud Waste Transfer Station.
[52] During the construction phase, this waste stream will exist only for non-functional electronic/electrical equipment; it is anticipated that all operational electronic/electrical equipment will continue to be used during the operation and closure phases. Amount of waste generated during the construction phase assumes ten 20 kg non-functional units (computer or other device) will be replaced.

Waste Name [24]	Waste Category [25]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code *	Code on main hazardous feature [26]	Waste management – amount estimated to be generated annually			Disposal facility
	and similar waste								company
Metal packaging	Municipal and similar waste	6,000 tonnes[53]	S	20 01 40	N/A	6,000 tonne			Recycled via authorised company
Glass packaging	Municipal and similar waste	24,400 tonnes[54]	S	20 01 02	N/A	24,400 tonnes			Recycled via authorised company
Plastic packaging	Municipal or similar waste	24,400 tonnes[55]	S	20 01 39	N/A	24,400 tonnes			Recycled via authorised company
Food waste (scraps)	Municipal and similar waste	200,750 tonnes[56]	S	20 01 08	N/A		200,750 tonnes		Municipal Waste Landfill via the Abrud Waste Transfer Station
Domestic Wastewater Treatment Plant sludge	Municipal and similar waste	14,600 tonnes[57] (dry substance)	SS	19 08 05	N/A	14,600 tonnes (dry substance)	See note[58]		Agricultural application, land rehabilitation or co-incinerated in an authorised facility
Medical Waste									
Medical waste	Waste generated by medical	0.500 tonne[59]	S	18 01 03* 18 01 04 18 01 09	H9		0.500 tonne		Collected in special containers at Temporary Hazardous Waste

[53] Metal packaging generation is estimated at 0.25 kg/employee including contractors' employees/month.
[54] Glass packaging generation is estimated at 1 kg/employee including contractors' employees/month.
[55] Plastic packaging generation is estimated at 1 kg/employee including contractors' employees/month.
[56] Food scrap generation is estimated at 0.275 kg/employee including contractors' employees /day.
[57] Amount of waste generated assumes 0.02 kg dry substance/employee including contractors' employees /day.
[58] Agricultural application or land rehabilitation uses will be sought however, if municipal sewage sludge is determined as ineligible for agricultural application or land rehabilitation purposes, the sludge will be co-incinerated in an authorised facility .
[59] Medical waste generation is estimated at 0.25 kg/employee including contractors' employees /year.

Waste Name [24]	Waste Category [25]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code *	Code on main hazardous feature [26]	Waste management – amount estimated to be generated annually			Disposal facility
	activities								Storage Facility for incineration in a properly authorised incinerator for medical waste.

Table 3-24. Waste Generation, Management and Disposition – Operations Phase (Anticipated Duration: 17 Years)

Waste Name [60]	Waste Category [61]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code*	Code on main hazardous feature [62]	Waste management – amount estimated to be generated annually			Disposal facility
						Utilisation [63] (Reused/ Recycled)	Elimination [64] (Disposed)	Closing stock [65] (Stored)	
Production Waste									
Scrap metal	Production waste	5 tonnes	S	17 04 05	N/A	5 tonnes			Recycled via authorised company
Fines of active carbon	Production Waste	390 tonnes[66]	S	01 03 06	N/A		390 tonnes		TMF
Residue of quicklime	Production waste	3.250 tonnes	S	01 03 99(*)	H8	3.250 tonnes			On-site recovery at the Wastewater Treatment Plant or off-site recovery, used for acid wastewater treatment
Empty containers[67]	Production waste	0.500 tonne	S	15 01 04	N/A	0.500 tonne	See note[68]		Returned to vendor for

[60] In accordance with the List comprising waste, provided in Annex no. 2 of GD no. 856/2002. The symbol * designates a hazardous waste. Statistic classification of waste is not transposed into Romanian legislation.
[61] Categories and subcategories based on those established by the National Plan for Waste Management, Government of Romania, 2004.
[62] In accordance with Annex 1E of Law 426/2001, Characteristics of Wastes that Make them Dangerous.
[63] Waste is used, re-used or recycled both on-site and off-site; see "Disposal facility" column regarding disposition options (e.g. land rehabilitation, agricuture application, metal or other material recovery etc.) see "Disposition" column regarding disposition options.
[64] Waste is used, re-used or recycled both on-site and off-site; see "Disposal facility" column regarding disposition options (e.g. land rehabilitation, agricuture application, metal or other material recovery etc.) see "Disposition" column regarding disposition options.
[65] Waste is disposed of in both onsite and off-site facilities (e..g. on-site disposal facility – Waste rock stockpiles, Construction and Demolition Waste Landfill, municipal landfill, incineration and co-incineration); see "Disposal facility" column regarding disposition options.
[66] Amount of waste generated assumes that the carbon consumption is 0.03 kg/t.(Feasibility Study, IPROMIN, 2005)
[67] Assumes no hazardous material residues are present.

Waste Name [60]	Waste Category [61]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code*	Code on main hazardous feature [62]	Waste management – amount estimated to be generated annually			Disposal facility
									reuse/recycled or Municipal Waste Landfill via Abrud Waste Transfer Station
Waste aerosol containers	Production waste	0.100 tonne	S	15 01 04	N/A	0.100 tonne			Recycled via authorised company
Contaminated soil[69]	Production waste	0.100 tonne[70]	S	17 05 03*	H5			0.100 tonne	Temporary Hazardous Waste Storage Facility and co-incinerated /incinerated in a properly authorised co-incineration/incineration facility
Used hydraulic oil	Production waste	29,250 litres[71] (26,325 tonnes)	L	13 01 10*	H6	29,250 litres (26,325 tonnes)			Regenerated, used as fuel or co-incinerated /incinerated in a properly authorised co-incineration/incineration facility
Used lubricating oil	Production waste	78,000 litres[72]	L	13 02 05* 13 02 08*	H6	78,000 litres (70,200			Regenerated, used as fuel or co-incinerated

[68] Empty containers will be returned to vendor where reuse/recycling will be prioritised; however, if reuse/recycling option is not feasible, the empty containers will be disposed of in a municipal landfill via the Abrud Transfer Station.
[69] Quantity of contaminated soil presented is an estimate of the soils contaminated as a result of accidental oil or fuelling spills.
[70] Even though the number of vehicles is smaller during the production phase than in the construction phase, the vehicles are older and more prone to defects, spills etc. Therefore, the amount of oil spills is assumed to be the same as during the construction phase.
[71] Amount of waste generated assumes that the used hydraulic oil is 0.00225 l/t.(Feasibility Study, IPROMIN, 2005)
[72] Amount of waste generated assumes that the used lubricating oil is 0.0060 l/t.(Feasibility Study, IPROMIN, 2005)

Waste Name [60]	Waste Category [61]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code*	Code on main hazardous feature [62]	Waste management – amount estimated to be generated annually			Disposal facility
		(70,200 tonnes)				tonnes)			/incinerated in a properly authorised co-incineration/incineration facility
Used grease	Production waste	4.680 tonnes[73]	SS	13 02 05* 13 02 08*	H6		4,680 tonnes		Co-incinerated /incinerated in a properly authorised co-incineration/incineration facility
Paint residue	Production waste	0.092 tonne[74]	SS	08 01 11*	H5		0.092 tonne		Co-incinerated /incinerated in a properly authorised co-incineration/incineration facility
Solvent residue	Production waste	0.184 tonne[75]	L	08 01 17*	H3A		0.184 tonne		Co-incinerated /incinerated in a properly authorised co-incineration/incineration facility
Used tyres	Production waste	289,680 tonnes[76]	S	16 01 03	N/A	289,680 tonnes			Used for erosion control purposes, off-site recycling or co-incinerated /incinerated in a properly authorised co-incineration/incineration facility

[73] Amount of waste generated assumes that the used grease is 0.00036 kg/t.(Feasibility Study, IPROMIN, 2005)
[74] Amount of waste generated assumes 1 kilogram of residual paint per each fleet and mining equipment vehicle.
[75] Amount of waste generated assumes 2 kilograms of residual solvent per each fleet and mining equipment vehicle.
[76] Assumes complete tyre change-out for fleet and mine equipment vehicles is every 2 years. It is assumed that on average, fleet vehicle tyres weigh 15 kg and mining equipment tyres weigh 4000 kg. For operation, the waste generation is the equivalent of 112 fleet tyres each year and 72 mining equipment tires per year.

Waste Name [60]	Waste Category [61]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code*	Code on main hazardous feature [62]	Waste management – amount estimated to be generated annually			Disposal facility
Used oil filters[77]	Production waste	0.328 tonne[78]	S	16 01 07	N/A	0.328 tonne			Recycled via authorised company
Lead acid batteries	Production waste	23,500 tonnes[79]	S	16 06 01*	H8	3,500 tonnes			Recycled via authorised company
Batteries (nickel-cadmium/other spent rechargeable)	Production waste	0.112 tonne[80]	S	16 06 02* 16 06 04	H5/H6		See note	0.112 tonne	Temporary Hazardous Waste Storage Facility and co-incinerated /incinerated in a properly authorised co-incineration/incineration facility
Batteries (dry manganese)	Production waste	0.448 tonne[81]	S	16 06 05	N/A		0.448 tonne		Municipal Waste Landfill via the Abrud Waste Transfer Station
Scrap vehicles[82]	Production waste	3 tonnes	S	16 01 06	N/A	3 tonnes			Recycled via authorised company
Mill liners	Production waste	5 sets (2.5 tonnes)	S	16 01 17 (ferrous) or 16 01 18 (non-ferrous)	N/A	5 sets (2.5 tonnes)			Liners that will be not repaired and reused will be recycled via authorised company

[77] Used oil filters assumes that the filters have been hot-drained and negligible oil residue is present.
[78] For the quantity of used oil filters generated, this number assumes that oil filters are changed every three months on fleet vehicles and every month on mining equipment vehicles on average; each oil filter is estimated to weigh 0.5 kg.
[79] Amount of waste generated assumes that a fleet vehicle battery is changed every 1.5 years and weighs approximately 20 kg and a mining equipment battery is changed every 1.25 years and weighs approximately 80 kg.
[80] Waste hazardous batteries (nickel cadmium/other rechargeable) generation at 0.2 kg/employee/year.
[81] Waste non-hazardous batteries (dry manganese/other non-lead acid) generation at 0.8 kg/employee/year.
[82] RMGC and contractor vehicle fleets in the operations phase of mine life are expected to be rotated (sold to new users) before their useful service life is over, hence this waste stream will exist only for those vehicles subject to accidents whose repair value exceeds the vehicle's probable resale value.

Waste Name [60]	Waste Category [61]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code*	Code on main hazardous feature [62]	Waste management – amount estimated to be generated annually			Disposal facility
Paper/cardboard packaging	Production waste	1 tonne	S	15 01 01	N/A	1 tonne			Recycled via authorised company
Plastic packaging	Production waste	0.050 tone	S	15 01 02	N/A	0.050 tonne	See note[83]		Recycled via authorised company
Wood packaging	Production waste	0.500 tonne	S	15 01 03	N/A	0.500 tonne	See note[84]		Recycled via authorised company
Composite material packaging	Production waste	0.050 tonne	S	15 01 05	N/A		0.050 tonne		Municipal Waste Landfill via the Abrud Waste Transfer Station or Recycled
Mixed packaging	Production waste	0.050 tonne	S	15 01 06	N/A		0.050 tonne		Municipal Waste Landfill via the Abrud Waste Transfer Station or Recycled
Waste electric and electronic equipment	Production waste	2,200 tonnes[85]	S	16 02 15* 16 02 16	H5/H6	2,200 tonnes			Operational equipment will go to local charity or other beneficial use; non-functional equipment will be stored in the Temporary Hazardous Waste Storage Facility and be sold to a properly authorised company
Municipal and Similar Waste									

[83] Recycling of packaging will be given priority however, if no recycling options are feasible packaging will be disposed of in a municipal landfill via Abrud Waste Transfer Station.

[84] Recycling of packaging will be given priority however, if no recycling options are feasible packaging will be disposed of in a municipal landfill via Abrud Waste Transfer Station.

[85] Amount of waste generated assumes that 25 percent of the 560 employees during operations will have a computer; 30 of these computers will continued to be used during the closure phase and the other 110 computers will be donated. Each unit is assumed to weight 20 kg.

Waste Name [60]	Waste Category [61]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code*	Code on main hazardous feature [62]	Waste management – amount estimated to be generated annually			Disposal facility
Paper/cardboard	Municipal and similar waste	0.500 tonne	S	20 01 01	N/A	0.500 tonne			Recycled via authorised company
Metal packaging	Municipal and similar waste	1.680 tonne[86]	S	20 01 40	N/A	1.680 tonne			Recycled via authorised company
Glass packaging	Municipal and similar waste	6.720 tonnes[87]	S	20 01 02	N/A	6.720 tonnes			Recycled via authorised company
Plastic packaging	Municipal and similar waste	6.720 tonnes[88]	S	20 01 39	N/A	6.720 tonnes			Recycled via authorised company
Food waste (scraps)	Municipal and similar waste	56.210 tonnes[89]	S	20 01 08	N/A		56.210 tonnes		Municipal Waste Landfill via the Abrud Waste Transfer Station
Domestic sewage treatment plant sludge	Municipal and similar waste	4.080 tonnes[90] (dry substance)	SS	19 08 05	N/A	4.080 tonnes (dry substance)	See note[91]		Land rehabilitation/agriculture application or co-incinerated in an authorised facility
Medical Waste									
Medical waste	Waste generated by medical activities	0.140 tonne[92]	S	18 01 03* 18 01 04 18 01 09	H9		0.140 tonne		Collected in special containers at Temporary Hazardous Waste Storage Facility and incineration in a properly authorised

[86] Metal packaging generation is estimated at 0.25 kg/employee/month.
[87] Glass packaging generation is estimated at 1 kg/employee/month.
[88] Plastic packaging generation is estimated at 1 kg/employee/month.
[89] Food scrap generation is estimated at 0.275 kg/employee/day.
[90] Amount of waste generated assumes 0.02 kg dry substance/employee/day.
[91] Agricultural application or land rehabilitation uses will be sought however, if municipal sewage sludge is determined as ineligible for agricultural application or land rehabilitation purposes, the sludge will be co-incinerated in an authorised facility ..
[92] Medical waste generation is estimated at 0.25 kg/employee/year.

Waste Name [60]	Waste Category [61]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code*	Code on main hazardous feature [62]	Waste management – amount estimated to be generated annually			Disposal facility
									incinerator for medical waste

Table 3-25. Waste Generation, Management and Disposition – Closure Phase

Waste Name [93]	Waste Category [94]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code *	Code on main hazardous feature [95]	Waste management – amount estimated to be generated annually			Disposal facility
						Utilisation [96] (Reused/ Recycled)	Elimination [97] (Disposed)	Closing stock [98] (Stored)	
Production Waste									
Material resulting from the site stripping	Production waste	3,562 m^3 (5,343 tonnes) - active closure; 0 tonne - final yrs[99]	S	17 05 04	N/A		3,562 m^3 (5,343 tonnes) - active closure; 0 tonne - final yrs		Construction and Demolition Waste Landfill
Reinforced concrete	Production waste	8,922 m^3 (17,843 tonnes) - active closure; 0	S	17 01 07 17 04 05	N/A	3,569 tonnes- active closure; 0 tonne - final	8,922 m^3 (14,2743 tonnes [101]- active closure; 0		On-site processing Scrap metal – recycled via authorised company Concrete rubble – disposed off in Construction and

[93] In accordance with the List comprising waste, provided in Annex no. 2 of GD no. 856/2002. The symbol * designates a hazardous waste. Statistic classification of waste is not transposed into Romanian legislation.
[94] Categories and subcategories based on those established by the National Plan for Waste Management, Government of Romania, 2004.
[95] In accordance with Annex 1E of Law 426/2001, Characteristics of Wastes that make them Dangerous.
[96] Waste is used, re-used or recycled both on-site and off-site; see "Disposal facility" column regarding disposition options (e.g. land rehabilitation, agricuture application, metal or other material recovery etc.) see "Disposition" column regarding disposition options.
[97] Waste is used, re-used or recycled both on-site and off-site; see "Disposal facility" column regarding disposition options (e.g. land rehabilitation, agricuture application, metal or other material recovery etc.) see "Disposition" column regarding disposition options.
[98] Waste is disposed of in both on-siteand off-site facilities (e.g. on-site disdosal facility – Waste rock stockpiles, Construction and Demolition Waste Landfill, Municipal Landfill, incineration and co-incineration); see "Disposal facility" column regarding disposition options.
[99] Based on the estimations in the Mine Closure Plan, IPROMIN 2005

Waste Name [93]	Waste Category [94]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code *	Code on main hazardous feature [95]	Waste management – amount estimated to be generated annually			Disposal facility
		tonne - final yrs[100]				yrs	tonne - final yrs		Demolition Waste Landfill or TMF
Simple concrete	Production waste	489 m^3 (987 tonnes) - “active” closure; 0 tonne- final yrs[102]	S	17 09 04	N/A		489 m^3 (987 tonnes) - “active” closure; 0 tonne- final yrs		On-site processing Concrete rubble – disposed off in Construction and Demolition Waste Landfill or TMF
Metal structures	Production waste	2,665 tonnes - “active” closure; 0 tonne - final yrs[103]	S	17 04 05	N/A	2,665 tonnes - “active” closure; 0 tonne - final yrs			Recycled via authorised company
Masonry	Production waste	1,104 m^2 - 4.433 tonnes - “active” closure; 0 tonne- final yrs[104]	S	17 09 04	N/A		1,104 m^2 - 4.433 tonnes - “active” closure; 0 tonne - final yrs		Construction and Demolition Waste Landfill
Plaster	Production waste	3,922 m^2 - 15.110 tonnes - “active” closure; 0	S	17 09 04	N/A		3,922 m^2 - 15.110 tonnes - “active” closure; 0		Construction and Demolition Waste Landfill

[100] Based on the estimations in the Mine Closure Plan, IPROMIN 2005
[101] Assumes that reinforced metal represents 20 % of total reinforced concrete mass.
[102] Based on the estimations in the Mine Closure Plan, IPROMIN 2005
[103] Based on the estimations in the Mine Closure Plan, IPROMIN 2005
[104] Based on the estimations in the Mine Closure Plan, IPROMIN 2005

Waste Name [93]	Waste Category [94]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code *	Code on main hazardous feature [95]	Waste management – amount estimated to be generated annually			Disposal facility
		tonne - final yrs[105]					tonne - final yrs		
Doors and windows	Production waste	46 pieces - “active” closure; 0 pieces - final yrs[106]	S	17 02 01 17 02 02 17 02 03	N/A	46 pieces - “active” closure; 0 pieces - final yrs			Reuse by local residents or on-site processed for material recycling vi authorised companies
Residue of quicklime	Production waste	11 tonnes	S	01 03 99(*)	H8			11 tonnes	On-site recovery at the Wastewater Treatment Plant or off-site recovery; used for acid wastewater treatment
Contaminated soil[107]	Production waste	0.1 tonne[108]	S	17 05 03*	H5		0.1 tonne		Co-incinerated/ incinerated in a properly authorised co-incineration/inicineration facility
Used hydraulic oil	Production waste	99,280 litres[109] (89,352 tonnes)	L	13 01 10*	H6	99,280 litres (89,352 tonnes)			Regenerated, used as fuel or co-incinerated/incinerated in a properly authorised co-incineration/ incineration facility
Used lubricating oil	Production waste	198,560 litres[110] (178,704 tonnes)	L	13 02 05* 13 02 08*	H6	198,560 litres (178,704 tonnes)			Regenerated, used as fuel or co-incinerated/incinerated in a properly authorised co-incineration/ incineration facility
Used grease	Production	49,640	SS	13 02 05*	H6		49,640		Co-incinerated /incinerated in

[105] Based on the estimations in the Mine Closure Plan, IPROMIN 2005
[106] Based on the estimations in the Mine Closure Plan, IPROMIN 2005
[107] Quantity of contaminated soil presented is an estimate of the soils contaminated as a result of accidental oil or fuelling spills.
[108] Even though the number of vehicles is smaller during the closure phase than in the construction phase, the vehicles are older and more prone to defects, spills etc. Therefore, the amount of oil spills is assumed to be the same as during the construction phase.
[109] Amount of waste generated assumes that the used hydraulic oil is scaled from the number of equipment...
[110] Amount of waste generated assumes that the used lubricating oil is scaled from the number of equipment

Waste Name [93]	Waste Category [94]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code *	Code on main hazardous feature [95]	Waste management – amount estimated to be generated annually			Disposal facility
	waste	tonnes[111]		13 02 08*			tonnes		a properly authorised co-incineration/incineration facility
Paint residue	Production waste	0.063 tonne - "active closure"; 0.015 tonne -final yrs[112]	SS	08 01 11*	H5		0.063 tonne - "active" closure; 0.015 tonne - final yrs nne		Co-incinerated /incinerated in a properly authorised co-incineration/incineration facility
Solvent residue	Production waste	0.126 tonne - "active closure"; 0.030 kg - final yrs[113]	L	08 01 17*	H3A		0.126 tonne - "active" closure; 0.030 tonne - final yrs		Co-incinerated /incinerated in a properly authorised co-incineration/incineration facility
Waste aerosol containers	Production waste	0.025 tonne	S	17 06 03(*)	N/A	0.025 tonne			Recycled via authorised company
Used tyres	Production waste	344,900 tonnes - "active" closure and 80,150 tonnes – final yrs[114]	S	16 01 03	N/A	344,900 tonnes - "active" closure; 80,150 tonnes - final yrs	See note		Used for erosion control purposes, off-site recycling or Co-incinerated /incinerated in a properly authorised co-incineration/incineration facility
Used oil filters[115]	Production	0.318 tonne	S	16 01 07*	N/A	0.318 tonn -			Recycled via authorised

[111] Amount of waste generated assumes that the used grease is scaled from the number of equipment
[112] Amount of waste generated assumes 1 kilogram of residual paint per each fleet and mining equipment vehicle.
[113] Amount of waste generated assumes 2 kilograms of residual solvent per each fleet and mining equipment vehicle.
[114] Assumes complete tyre change-out for fleet and mine equipment vehicles is every 2 years. It is assumed that on average, fleet vehicle tyres weigh 15 kg and mining equipment tyres weigh 4000 kg. For construction, the waste generation is the equivalent of 60 fleet tyres each year in active closure and respectively 10 fleet tyres each year during final years and 86 mining equipment tires per year in active closure and respectively 20 fleet tyres each year during final years.
[115] Used oil filters assumes that the filters have been hot-drained and negligible oil residue is present.

Waste Name [93]	Waste Category [94]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code *	Code on main hazardous feature [95]	Waste management – amount estimated to be generated annually			Disposal facility
	waste	- “active” closure; 0.070 tonne - final yrs[116]				“active” closure; 0.070 tonne - final yrs			company
Lead acid batteries	Production waste	3,344 tonne - “active” closure; 0.707 tonne - final yrs[117]	S	16 06 01*	H8	3,344 tonne - “active” closure; 0.707 tonne - final yrs			Recycled via authorized company
Batteries (nickel-cadmium/other spent rechargeable)	Production waste	0.030 tonnes - “active” closure; 0.005 tonne - final yrs[118]	S	16 06 02* 16 06 04	H5		0.030 tonnes - “active” closure; 0.005 tonne - final yrs		Collected in special containers at Temporary Hazardous Waste Storage Facility and incinerated/co-incinerated in a properly authorised facility
Batteries (dry manganese)	Production waste	0.120 tonnes - “active” closure; 0.020 tonne - final yrs[119]	S	16 06 05	N/A		0.120 tonnes - “active” closure; 0.020 tonne - final yrs		Municipal Waste Landfill via the Abrud Waste Transfer Station
Scrap vehicles[120]	Production waste	0.200 tonne	S	16 01 06	N/A	0.200 tonnes			Recycled via authorized company
Paper/cardboard	Production	0.250 tonne	S	15 01 01	N/A	0.250 tonne	See note[121]		Recycled via authorized

[116] For the quantity of used oil filters generated, this number assumes that oil filters are changed every three months on fleet vehicles and every month on mining equipment vehicles on average; each oil filter is estimated to weigh 0.5 kg.
[117] Amount of waste generated assumes that a fleet vehicle battery is changed every 1.5 years and weighs approximately 20 kg and a mining equipment battery is changed every 1.25 years and weighs approximately 80 kg.
[118] Waste hazardous batteries (nickel cadmium/other rechargeable) generation at 0.2 kg/employee/year.
[119] Waste non-hazardous batteries (dry manganese/other non-lead acid) generation at 0.8 kg/employee/year.
[120] RMGC and contractor vehicle fleets in the operations phase of mine life are expected to be rotated (sold to new users) before their useful service life is over, hence this waste stream will exist only for those vehicles subject to accidents whose repair value exceeds the vehicle’s probable resale value.

Waste Name [93]	Waste Category [94]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code *	Code on main hazardous feature [95]	Waste management – amount estimated to be generated annually			Disposal facility
packaging	waste								company
Plastic packaging	Production waste	0.010 tonne	S	15 01 02	N/A	0.010 tonne	See note[122]		Recycled or Municipal Waste Landfill via the Abrud Waste Transfer Station
Composite material packaging	Production waste	0.005 tonne	S	15 01 05	N/A		0.005 tonne		Municipal Waste Landfill via the Abrud Waste Transfer Station or Recycled
Mixed packaging	Production waste	0.005 tonne	S	15 01 06	N/A		0.005 tonne		Municipal Waste Landfill via the Abrud Waste Transfer Station or Recycled
Waste electrical and electronic equipment	Production waste	0.600 tonne[123]	S	20 01 35* 20 01 36	H5	0.600 tonne			Operational equipment will go to local charity or other beneficial use; non-operational equipment will attempt to sell to electronic scrap dealer or, as last resort, will be consolidated into drums as hazardous waste.
Municipal and Similar Waste									
Paper/cardboard	Municipal and similar waste	0.100 tonne	S	20 01 01	N/A	0.100 tonne			Recycled via authorised company
Metal packaging	Municipal and similar waste	0.450 tonnes - “active” closure;	S	20 01 40	N/A	0.450 tonnes - “active” closure; 0.075 tonne -			Recycled via authorosed company

121 Recycling of packaging will be given priority however, if no recycling options are feasible packaging will be disposed of in a municipal landfill via Abrud Waste Transfer Station.
122 Recycling of packaging will be given priority however, if no recycling options are feasible packaging will be disposed of in a municipal landfill via Abrud Waste Transfer Station.
123 Amount of waste generated assumes that 30 employees during closure will have a computer; at end of the closure phase all 30 computers will be donated. Each unit is assumed to weight 20 kg.

Waste Name [93]	Waste Category [94]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code *	Code on main hazardous feature [95]	Waste management – amount estimated to be generated annually			Disposal facility
		0.075 tonne - final yrs[124]				final yrs			
Glass packaging	Municipal and similar waste	1,800 tonnes - “active” closure; 0.300 tonne - final yrs[125]	S	20 01 02	N/A	1,800 tonnes - “active” closure; 0.300 tonne - final yrs			Recycled via authorised company
Plastic packaging	Municipal and similar waste	1,800 tonnes - “active” closure; 0.300 tonne - final yrs[126]	S	20 01 39	N/A	1,800 tonnes - “active” closure; 0.300 tonne - final yrs			Recycled via authorised company
Food waste (scraps)	Municipal and similar waste	15,056 tonnes - “active” closure; 2,509 tonnes - final yrs[127]	S	20 01 08	N/A		15,,056 tonnes - “active” closure; 1,300 tonnes - final yrs		Municipal Waste Landfill via the Abrud Waste Transfer Station
Domestic Wastewater Treatment Plant sludge	Municipal and similar waste	1,095 tonnes dry substance - “active” closure; 0.183 tonne dry substance - final yrs[128]	SS	19 08 05	N/A	1,095 tonnes dry substance - “active” closure; 0.183 tonne dry substance - final yrs	See note[129]		Land rehabilitation/agriculture application or co-incinerated into an authorised facility

[124] Metal packaging generation is estimated at 0.25 kg/employee/month.
[125] Glass packaging generation is estimated at 1 kg/employee/month.
[126] Plastic packaging generation is estimated at 1 kg/employee/month.
[127] Food scrap generation is estimated at 0.275 kg/employee/day.
[128] Amount of waste generated assumes 0.02 kg dry substance/employee/day.

Waste Name [93]	Waste Category [94]	Amount estimated to be generated annually	Physical status (Solid-S Liquid-L, Semisolid-SS)	Waste Code *	Code on main hazardous feature [95]	Waste management – amount estimated to be generated annually			Disposal facility
Medical Waste									
Medical waste	Waste generated by medical activities	0.038 tonnes - “active” closure; 0.007 tonne - final yrs[130]	S	18 01 03* 18 01 04 18 01 09	H9		0.038 tonnes - “active” closure; 0.007 tonne - final yrs		Collected in special containers at Temporary Hazardous Waste Storage Facility and incineration in a properly authorised incinerator for medical waste

[129] Agricultural application or land rehabilitation uses will be sought however, if municipal sewage sludge is determined as ineligible for agricultural application or land rehabilitation purposes, the sludge will be co-incinerated in an authorised facility .
[130] Medical waste generation is estimated at 0.25 kg/employee/year.

3.9 Monitoring

The knowledge regarding the composition and the characteristics of the generated wastes is an implicit requirement of the legislation in the field. The wastes subject to this provision are:

- Hazardous wastes generated on the site (especially those containing hydrocarbons);
- Inert and non-hazardous wastes that require additional handling or disposal consideration.

The methods to be used for the characterisation of these wastes are those presented in the Order of the Minister of the Environment and Water Management no. 95/2005 for establishing the acceptance criteria and the preliminary procedures for acceptance of waste for landfill and the national list of waste accepted to each class of waste landfill.

For the municipal wastes, the current regulations do not require tests in order to determine the composition or the physical-chemical characteristics

The organic sludge resulting from the urban waste-water treatment, will undergo periodically determinations on the micro-pollutants content, in order to establish the agricultural use potential.

The Government Decision no. 1159/02.10.2003 for the modification of Government Decision no. 662/2001 regarding the used oils management establishes specific measures on collection by category of the used oils. It is also required the filling in of a declaration for each used oil batch on the absence of its contamination. Without being a separate request, this will lead to the necessity of periodical laboratory determinations regarding the characteristics of the used oils.

Anyway, in the current practice, for the incineration or co-incineration of the hazardous wastes, it is necessary to present a characterisation fiche to the transporting operator and to the recovery or disposal operator.

All the laboratory determinations shall be performed in certified laboratories.

3.10 Record-keeping

3.10.1 General requirements

Waste facility inspection records, training records, and all other records generated as a result of the implementation of this plan will be forwarded for filing and retention in accordance with Section 5.3 of the *Roşia Montană Project Environmental and Social Management Plan* and MP-12, "Management of Environmental and Social Management System Records."

3.10.2 Waste Generator Recordkeeping and Reporting Requirements

The Waste Management Co-ordinator is responsible for keeping records of all waste administration. This includes a record of all shipping documents or invoices from waste contractors for any waste transported off-site, with the final destination and fate of the waste clearly identified.

Records of the types and quantities of all waste generation must be kept and the logs in Attachment III, Evidence of Wastes Administration, filled out on a monthly basis. (Source: Annex 1 of Government Decision No. 856/2002, *Wastes Administration*).

Separate records and periodic reports to the competent authorities will be kept for used oils – based on the requirements of the Government Decision no. 1159 /2003 amending the Government Decision no. 661/2001, Used Oils Management.

Waste administration information must be reported to the County Environmental Protection Agency (EPA) on an annual basis. Contact details are as follows:

EPA Alba

Str. Lalelelor nr. 7A

2500 Alba-Iulia

judetul Alba

Phone:	0258/813.248
	0258/813.290
Fax:	0258/816.834
	0258/813.248
E-mail:	apmalba@apulum.ro

Specific six-digit codes for each type of waste are provided in Government Decision No. 856, Annex II.

3.11 List of Exhibits (Non-extractive waste)

4 References

4.1 EU Regulations

Waste Framework Directive (75/442/EEC) amended by Council Directive 91/156/EEC

Hazardous Waste Directive (91/689/EEC)

Hazardous Waste List (2000/532/EC)

Council Regulation on the supervision and control of shipments of waste within, into and out of the

European Community (259/93/EEC)

Disposal of Waste Oils Directive (75/439/EEC) amended by Directives 87/101/EEC and 91/692/EEC

Batteries and Transformers Containing Certain Dangerous Substances Directive (91/157/EEC), as amended by 93/86/EC and 91/157/EEC

Landfill Directive (1999/31/EC), amended by Council Decision of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills (2003/33/EC)

Waste Incineration Directive (2000/76/EC)

Packaging and Packaging Waste Directive (94/62/EC)

Disposal of Polychlorinated Biphenyls and Polychlorinated Triphenyls Directive (96/59/EC)

Directive of the European Parliament and of the Council on the management of waste from the extractive industries [COM (2003) 0319]

4.2 Romanian Regulations

Government Decision No. 173/2000, *Regulations on the Administration and Control of Polychlorinated Biphenyls and Similar Compounds,* amended by Government Decision No. 291/2005

Government Emergency Ordinance No. 78/2000, as amended and approved by Law 426, June 18, 2001, *Waste Management*

Law No. 326/2001; *Public Service Utilities*, amended by Government Emergency Ordinance No. 9/2002, No. 5/2003 and 65/2003

Government Decision No. 662/2001, *Used Oil Management*, amended by Government Decision No. 441/2002 and No. 1159/2003

Government Decision No. 87/2001, *Municipal Sanitation Public Services*, amended by Law No. 139/2002, Government Decision No. 35/2003 and No. 34/2004 and Law No. 131/2004

Government Decision No. 1057/2001, *Batteries and Transformers Containing Certain Dangerous Substances*

Government Decision No. 128/2002, *Waste Incineration*, amended by Government Decision No. 268/2005

Government Decision No. 349/2005, *Landfill of Waste*

Order of the Ministry of Waters and Environmental Protection No. 757/2004, *Approval of the Technical Norm regarding the landfill of waste – the building, the exploitation, the monitoring and the closing up of the landfill of waste*

Government Emergency Ordinance No. 152/2005, *Integrated Pollution Prevention and Control*

Government Decision No. 621/2005, *Management of Packaging and Packaging Waste*

Government Decision No. 856/2002, *Waste management and List of Waste Including Hazardous Waste*

Government Decision No. 1357/2002, *Establishing Public Authorities Responsible for Control and Supervision of Import, Export and Shipment of Waste*

Government Decision No. 124/2003, *Prevention, Reduction and Control of Environmental Pollution with Asbestos*

4.3 Internal References of RMGC[131]

Roşia Montană Project Environmental and Social Management System plans:

- *Roşia Montană Project Environmental and Social Management Plan*
- *Cyanide Management Plan*
- *Tailings Facility Management Plan*
- *Water Management and Erosion Control Plan*
- *Mine Rehabilitation and Closure Plan*
- *Emergency Preparedness and Spill Contingency Plan*
- *Environmental and Social Monitoring Plan*
- *Annual Mining Plan*

RMGC Standard Operating Procedures Manual

- EM-07, “Site Security”
- MP-02, “Identification of Legal and Regulatory Requirements”
- MP-03, “Environmental and Social Management System Training”
- MP-05, “Review, Approval, Controlled Distribution, and Update of Environmental and Social Management System Documents”
- MP-06, “Preparation of Standard Operating Procedures”
- MP-07, “Purchasing”
- MP-08, “Surveillance Audits of Third-Party Contractors”
- MP-12, “Management of Environmental and Social Management System Records
- WM-01, “Accumulation and Disposition of Used Oil, Grease, and Antifreeze”
- WM-02, “Accumulation and Disposition of Scrap Metal”
- WM-03, “Accumulation and Disposal of Used Batteries”
- WM-04, “Management of the Inert Waste Landfill”
- WM-05, “Management of the Temporary Hazardous Waste Storage Facility”
- WM-06, “Accumulation and Disposal of Asbestos Waste”
- WM-07, “Used Container Management

[131] Note: all documents listed are controlled documents per Section 4.5 of the *Roşia Montană Project Environmental and Social Management Plan*; current approved versions will be assumed to apply in all cases.

- WM-08, “Accumulation and Disposal of Used Tyres”

4.4 Other References

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