6. Monitoring

Cuprins

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1 General Requirements

In accordance with Ministerial Order (M.O.) 863, Annex 2, Part II,[a] this Chapter presents an overall plan or approach for the monitoring of the performance of the environmental components of the Roşia Montană Project. The monitoring program described in the following paragraphs applies to all phases of the Project (construction, operation, decommissioning, and closure). The methodology presented by this Chapter is extended to also apply to the systematic monitoring of social performance parameters.

1.1 Environmental and Social Monitoring Requirements

RMGC will establish a comprehensive programme for monitoring a wide range of environmental and social performance criteria, in order to ensure continued compliance with both voluntary and regulation-based environmental and social management requirements established for the Roşia Montană Project. This environmental and social monitoring programme will be based on the current surface water and groundwater monitoring programme (and supporting database) that was developed by RMGC early in the exploration and preconstruction phases of the Project. A detailed discussion of the existing programme is presented in Section 6.1.2.

The overall requirements of the environmental and social monitoring programme are documented in the Roşia Montană Project *Environmental and Social Monitoring Plan* (see **ESMS Plans, Plan P**). This plan is a management tool designed to assist RMGC in maintaining a current understanding of the full range of specific monitoring and reporting requirements applicable to each stage or phase of Project activity. The *Environmental and Social Monitoring Plan* will be systematically and periodically benchmarked against applicable legal and regulatory requirements, and is a key component of the continual improvement process established by the *Roşia Montană Project Environmental and Social Management Plan* (see **ESMS Plans, Plan A**, Section 5.1.1). Tables 4.1 and 4.2 of the *Environmental and Social Monitoring Plan* provides a comprehensive listing of minimum database field requirements that address the physical, chemical, and biological monitoring of all relevant environmental media, as well as the monitoring of regulatory agency contacts, external stakeholder or community issues, and workforce health and safety issues. For each of the database fields so established, the *Environmental and Social Monitoring Plan* identifies (to the extent known or anticipated) the following information:

- the general operational area being monitored;
- the documented source of the monitoring requirement;
- a summary of the actual monitoring requirement;
- references to the specific location of the required monitoring action;
- the frequency of the required monitoring action;
- references to the actual procedure or method for conducting the monitoring action;
- personnel responsibilities for performing the required monitoring action;
- reporting requirements associated with the monitoring action;
- the due date of the next monitoring event
- a summary of monitoring results, and
- additional comments, as appropriate for a given monitoring event.

Environmental and social monitoring needs will generally be greatest during the construction and operational phases of the Project, but will also extend into decommissioning and closure (i.e. environmental restoration and post-decommissioning activities). Table 6.1 summarises the information continued in Tables 4.1 and 4.2 of the *Environmental and Social Monitoring Plan,* and presents currently anticipated monitoring needs and inputs from all currently identified sources of environmental and social monitoring requirements are also listed. The primary sources of monitoring requirements include:

- the *Roşia Montană Project Environmental and Social Management Plan* (**ESMS Plans, Plan A);**
- the *Cyanide Management Plan* (**ESMS Plans, Plan G**);
- the *Tailings Facility Management Plan* (**ESMS Plans, Plan F);**
- the *Waste Management Plan* (**ESMS Plans, Plan B);**
- the *Biodiversity Conservation Plan* (**ESMS Plans, Plan H);**
- the *Air Quality Management Plan* (**ESMS Plans, Plan D);**
- the *Noise and Vibration Management Plan* (**ESMS Plans, Plan E);**
- the *Emergency Preparedness and Spill Contingency Plan* (**ESMS Plans, Plan I)**;
- the *Mine Rehabilitation and Closure Management Plan* (**ESMS Plans, Plan J**); and
- Other individual RMGC plans or their supporting procedures.

The monitoring inputs summarised in **Table 6.1** will be managed in a controlled database based on the current RMGC Environmental Database, as previously noted, in order to support the planning and timely execution of all monitoring actions.

It is anticipated that the RMGC Environmental Database will also serve as a readily accessible repository of historical data on stream flow, meteorology, hydrochemistry, groundwater levels, air quality levels, noise and vibration readings, and soil quality, as well as current inventories of wells, springs, seeps, and aquatic and terrestrial species.

Table 6-1. General Requirements for Environmental and Social Monitoring

Category of Monitoring	Operational Area	Source of Monitoring Requirement (primary reference)	Monitoring/Inspection Requirement
Environmental Performance Monitoring			
Physical Stability	Tailings Management Facility	*Tailings Facility Management Plan* Section 8.4	Routine facility inspections
	Process plant, cyanide leaching and cyanide detoxification circuits	*Cyanide Management Plan,* Section 8.6	Weather monitoring (includes temperature, precipitation, wind speed and direction, and relative humidity)
	Waste rock stockpiles	*Water Management and Erosion Control Plan*, Sections 3.4, 3.5, and 4.9	Monitoring of effectiveness of erosion control methods
	Water management system and facility/process plant construction areas	*Water Management and Erosion Control Plan*, Sections 3.4, 3.5, and 4.9	Monitoring of effectiveness of erosion control methods
	Ponds and other water management system earthworks	*Water Management and Erosion Control Plan*, Sections 3.4, 3.5, and 4.9	Monitoring of effectiveness of soil stabilisation and sediment control methods
	Site areas disturbed by earthworks, cutbanks, reclaimed areas	*Water Management and Erosion Control Plan*, Sections 3.4, 3.5, and 4.9	Monitoring of effectiveness of seeding and revegetation program
	Site areas disturbed by earthworks, cutbanks, reclaimed areas open to grazing	*Water Management and Erosion Control Plan*, Sections 3.4, 3.5, and 4.9	Monitoring of effectiveness of erosion controls associated with range management issues
Chemical Stability – Air Quality	Process plant, cyanide leaching and cyanide detoxification circuits	*Cyanide Management Plan, Section 8.6*	Weather monitoring (includes temperature, precipitation, wind speed and direction, and relative humidity)
	Process plant, cyanide leaching and cyanide detoxification circuits	*Air Quality Management Plan; Cyanide Management Plan,* Section 10.3	Continuous (alarmed) monitoring of ambient HCN
	Tailings Management Facility	*Tailings Facility Management Plan* Section 12.3; Section 5.3.1, *Environmental and Social Monitoring Plan*	Air particulate level monitoring
	Pit areas, haul roads,	*Air Quality Management*	Air particulate level

Category of Monitoring	Operational Area	Source of Monitoring Requirement (primary reference)	Monitoring/Inspection Requirement
	landfills, earthworks construction areas	*Plan*	monitoring/exhaust emissions monitoring
Chemical Stability – Surface Water Quality	Process plant cyanide leaching system and cyanide detoxification circuit	*Cyanide Management Plan,* Section 8.6	Monitoring of cyanide concentrations in detoxified tailings, prior to release to TMF
	Tailings Management Facility	*Tailings Facility Management Plan* Section 12.2	Surface water monitoring
	Wastewater Treatment Plant	*Water Management and Erosion Control Plan*, Section 3.5	Routine influent and effluent monitoring
	Corna and Rosia Valley downstream of project	*Water Management and Erosion Control Plan*, Section 3.5	Flow rates and water chemistry
	Domestic Wastewater Treatment plant	*Environmental and Social Monitoring Plan,* Section 5.3.2	Routine influent and effluent monitoring
	Domestic Wastewater Treatment Plant	Domestic Wastewater Treatment Plant vendor's Operations Manual	Routine monitoring of treatment plant operational performance, as defined by equipment vendor
Chemical Stability-Groundwater	Tailings Management Facility	*Tailings Facility Management Plan* Section 12.1	Groundwater monitoring
Chemical Stability-Solid media	Tailings Management Facility	*Tailings Facility Management Plan,* Section 7.1.2	Monitoring of tailings chemistry
	Waste rock stockpiles	*Mine Rehabilitation and Closure Plan,* Section 9	Monitoring of waste rock chemistry for potential segregation purposes
Chemical Stability-Solid media (continued)	Wastewater Treatment Plant	*Waste Management Plan, Section 12.0*	Monitoring of Wastewater Treatment Plant sludge chemistry (to determine applicability of hazardous/municipal waste categories for disposal)
Chemical Stability-Solid media	Domestic Wastewater Treatment Plant	*Waste Management Plan, Section 12.0*	Monitoring of Domestic Wastewater Treatment Plant sludge chemistry (to determine applicability of hazardous/municipal waste categories for disposal)

Category of Monitoring	Operational Area	Source of Monitoring Requirement (primary reference)	Monitoring/Inspection Requirement
Biological - Aquatic	Lakes, ponds, streams, seeps, rivers on or associated with the Roşia Montană Project site	*Biodiversity Management Plan,* Section 5.5	Monitoring of aquatic species
Biological - Terrestrial	Tailings Management Facility	*Tailings Facility Management Plan,* Section 8.4	Wildlife mortality monitoring
	Cyanide production facility	*Cyanide Management Plan*, Section 7.4	Wildlife mortality monitoring
	Roşia Montană Project site and adjacent land areas	*Biodiversity Management Plan,* Section 5.5	Monitoring of terrestrial species
Social Performance Monitoring			
Regulatory agency contacts	Entire Roşia Montană Project concession	*Environmental and Social Management Plan*, Sections 3.1, 5.1	Verification of compliance with governing regulations
	Entire Roşia Montană Project concession	*Environmental and Social Management Plan*, Sections 4.3, 5.4, and 6.0	Monitoring of RMGC responsiveness to regulatory inquiries, complaints, or requests for information
External stakeholder/ community issues	Cyanide Producer	*Cyanide Management Plan*, Section 4.0	Cyanide producer audit
	Cyanide Transporter	*Cyanide Management Plan*, Section 5.0	Cyanide transporter audit
	Entire Roşia Montană Project concession	*Waste Management Plan*, Section 12.0	Completion and updating of Waste Stream Inventory to keep current; reporting of progress towards waste minimisation targets
	Entire Roşia Montană Project concession	*Environmental and Social Management Plan*, Sections 4.3, 5.4, and 6.0	Monitoring RMGC responsiveness to stakeholder inquiries, complaints, or request for information
	Haul roads, blasting operations in pits, processing plant	*Noise and Vibration Management Plan,* Section 6.2.3 to 6.2.5	Ambient noise and vibration monitoring
Internal stakeholder/ workforce Health and Safety	Potable water treatment plant and potable water tank	*Water Management and Erosion Control Plan*, Section 3.2.9	Monitoring of quantity and quality of raw/treated water against current Romanian potable water quality standards

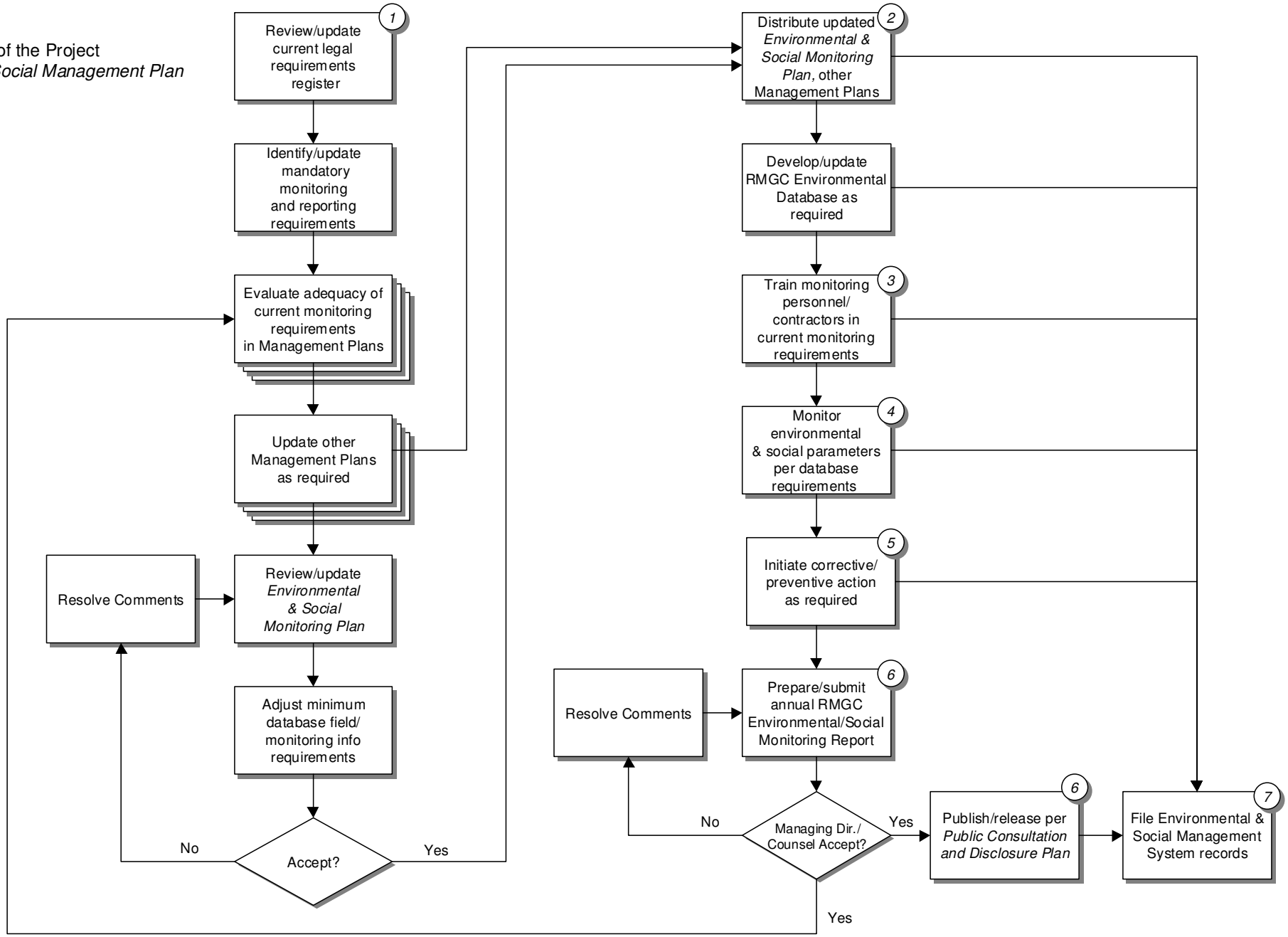
Category of Monitoring	Operational Area	Source of Monitoring Requirement (primary reference)	Monitoring/Inspection Requirement
	Tailings Management Facility	*Tailings Facility Management Plan* Section 10.2, applicable portions of the *Occupational Health and Safety Plan* and Roşia Montană Project *Emergency Preparedness and Spill Contingency Plan*	Routine Health and Safety Monitoring
	Cyanide off-loading and storage facility	*Cyanide Management Plan*, Section 6.4	Routine daily safety inspections
	Cyanide off-loading and storage facility	*Cyanide Management Plan*, Section 6.4	Cyanide off-loading and storage facility inspections
	Cyanide off-loading and storage facility	*Cyanide Management Plan*, Section 6.4	Perimeter fencing inspection, cyanide off-loading and storage facility
Internal stakeholder/ workforce Health and Safety (continued)	Process plant, cyanide leaching system and detoxification circuit	*Cyanide Management Plan*, Section 7.1	Cyanide production facility backup generator inspection
	Cyanide production facility, carbon-in-leach facility area	*Cyanide Management Plan*, Section 7.2	Pre-work safety inspections, carbon-in-leach facility area
	Process plant, cyanide leaching system and detoxification circuit	*Cyanide Management Plan*, Section 7.6	Routine daily safety inspections
	Process plant, cyanide leaching system and detoxification circuit	*Cyanide Management Plan*, Section 7.6	Inspections of tanks, piping, valves, and secondary containments
	Process plant	*Cyanide Management Plan*, Section 7.6	Perimeter fence inspection
	Process plant cyanide leaching system and cyanide detoxification circuit (SO_2/air treatment plant)	*Cyanide Management Plan,* Section 8.6	Routine safety inspections
	Process plant cyanide leaching system and cyanide detoxification circuit (SO_2/air treatment plant)	*Cyanide Management Plan,* Section 8.6	Inspections of tanks, piping, valves, secondary containments, other equipment

Category of Monitoring	Operational Area	Source of Monitoring Requirement (primary reference)	Monitoring/Inspection Requirement
	Emergency response equipment depots	*Emergency Preparedness and Spill Contingency Plan,* Section 15.1	Routine (weekly) and detailed (annual) inspections of emergency response equipment
Internal stakeholder/ workforce Health and Safety (continued)	Site-wide and building-specific alarm systems; community alarm system; communications centre	*Emergency Preparedness and Spill Contingency Plan,* Section 15.2 and 16.2; and applicable portions of the *Occupational Health and Safety Plan*	Weekly testing of site-wide alarms and annual testing of building-specific and area alarms; biennial testing of community alarms; monthly communications system testing
	Bulk storage tanks (less tanks addressed under *Cyanide Management Plan*)	*Emergency Preparedness and Spill Contingency Plan,* Section 15.3; and applicable portions of the *Occupational Health and Safety Plan*	Integrity/condition inspections
	Bulk storage tanks (less tanks addressed under *Cyanide Management Plan*)	*Emergency Preparedness and Spill Contingency Plan,* Section 15.3; and applicable portions of the *Occupational Health and Safety Plan*	Integrity/condition inspections
	Packaged reagent/chemical storage areas	*Emergency Preparedness and Spill Contingency Plan,* Section 15.4; and applicable portions of the RMGC *Occupational Health and Safety Plan*	Integrity/condition inspections
	Explosives magazine	*Emergency Preparedness and Spill Contingency Plan,* Section 15.7; and applicable portions of the RMGC *Occupational Health and Safety Plan*	Integrity/condition inspections

Category of Monitoring	Operational Area	Source of Monitoring Requirement (primary reference)	Monitoring/Inspection Requirement
	Explosives magazine	*Emergency Preparedness and Spill Contingency Plan,* Section 15.7; and applicable portions of the RMGC *Occupational Health and Safety Plan*	Integrity/condition inspections
Internal stakeholder/ workforce Health and Safety (continued)	Emergency response equipment depots	*Emergency Preparedness and Spill Contingency Plan,* Section 16.3	Emergency response equipment deployment drills
	Entire Roşia Montană Project site	*Emergency Preparedness and Spill Contingency Plan,* Section 16.4; and applicable portions of the RMGC *Occupational Health and Safety Plan*	Evacuation and fire drills

Figure 6-1: Environmental and Social Monitoring and Reporting Process

Notes:
1. See Section 3.2 of the Project *Environmental and Social Management Plan*
2. *ibid.,* Section 4.5
3. *ibid.,* Section 4.2
4. *ibid.,* Section 5.1
5. *ibid.,* Section 5.2
6. *ibid.,* Section 6.0
7. *ibid.,* Section 5.3



Database updates will be performed on a routine basis to ensure that the monitoring program remains accurate, comprehensive, and suitable for all stages or phases of Project activity. The overall process by which these updates are accomplished is summarised in **Figure 6.1**, and is described in detail in Section 4.2 of the *Environmental and Social Monitoring Plan* (**ESMS Plans, Appendix P**).

1.2 Special Considerations – Surface Water and Groundwater Monitoring Program

The management and mitigation of surface water and groundwater quality impacts, from historical sources as well as anticipated Project operations is among the most predominant environmental issues that must be addressed over the life of the Project. Towards that end, RMGC commissioned several studies of background conditions (see the "State of the Aquatic Environment Report and the other companion reports in the **Roşia Montană Project Baseline Reports**). RMGC also established a robust surface water and groundwater monitoring programme in the feasibility stage of the Project in order to further characterise the nature and extent of the historical contamination upstream and downstream from potential sources of contamination on the Project site, as well as background conditions in adjacent watersheds that will not be directly impacted by Project operations. The RMGC Environmental Database was originally developed to support surface and groundwater monitoring activities in the pre-construction phase, but, as discussed in Section 6.1.1, the database will be adapted and expanded to serve the full set of environmental and social monitoring needs set out in the *Environmental and Social Monitoring Plan* (**ESMS Plans, Plan P**).

This section identifies the water-related parameters which will be monitored during the life of the mine in order to:

- extend the baseline record and identify any trends in the background environment;
- monitor the environmental performance of the Project;
- verify the mitigation measures implemented to minimise negative impacts; and
- provide the basis for continuing review and improvement of environmental management systems.

The surface water and groundwater monitoring locations currently established for the preconstruction/construction phase of the Project are as shown in the map provided as **Exhibit 6.1.** These locations include permanently installed weirs, monitoring wells, and water supply wells, as well as sampling points in various springs and streams. Sampling locations were selected in order to properly characterise the existing water quality associated with historical mining sites in the Roşia Montană, Corna, and Abruzel valley drainages, as well as other specific locations in or near the Aries and Abrud River watercourses.

Management aspects of water-related monitoring are specified in Section 5.3 of the *Water Management and Erosion Control Plan*. These include quality control, regulatory compliance and reporting procedures.

1.2.1 Water quality monitoring

Parameters and methods

The monitoring parameters and analytical methods currently established for the chemical and physical analysis of surface and groundwater monitoring programme samples are presented in Table 6-2.

Table 6-2. Analytical parameters/methods for physical and chemical analysis

No.	Analytical Parameter	Analytical Method	MDLs
	Field Parameters		
	Redox potential	Information acquired via CONSORT P601 per manufacturer's instructions	N/A
	Conductivity	Information acquired via HACH SENSION 156 per manufacturer's instructions	N/A
	pH	Information acquired via HACH SENSION 156 per manufacturer's instructions	N/A
	Turbidity	Information acquired via SPEKOL spectrophotometer per manufacturer's instructions	0.1 NTU
	Temperature	Information acquired via HACH SENSION 156 per manufacturer's instructions	N/A
	Laboratory Parameters		
	Suspended particles	STAS 6953/81	0.5 mg/l
	Sodium	STAS 3223 – 1/91	5 µg/l
	Potassium	STAS 3223 – 2/91	15 µg/l
	Calcium	STAS 3662/90	3 µg/l
	Barium	APHA Standard Methods (1992), method 3113.B	1 µg/l
	Magnesium	SR ISO 7980/86	10 µg/l
	Antimony	APHA Standard Methods (1992), method 3114.B	0.05 µg/l
	Arsenic (total)	APHA Standard Methods (1992), method 3114.B	0.05 µg/l
	Arsenic (dissolved)	APHA Standard Methods (1992), method 3114.B	0.05 µg/l
	Chloride	STAS 3049/88	0.40 µg/l
	Sulphate	STAS 3069/87	0.40 µg/l
	Iron (total)	SR 13315/96	25 µg/l
	Iron (as Fe^{2+})	SR ISO6332/96	10 µg/l
	Manganese	APHA Standard Methods (1992), method 3113.B	1 µg/l
	Lead (total)	APHA Standard Methods (1992), method 3113.B	1 µg/l
	Lead (dissolved)	APHA Standard Methods (1992), method 3113.B	1 µg/l
	Copper Total)	APHA Standard Methods (1992), method 3113.B	1 µg/l
	Copper (dissolved)	APHA Standard Methods (1992), method 3113.B	1 µg/l
	Cadmium (total)	APHA Standard Methods (1992), method 3113.B	1 µg/l
	Cadmium (dissolved)	APHA Standard Methods (1992), method 3113.B	1 µg/l
	Zinc (total)	APHA Standard Methods (1992), method 3113.B	1 µg/l
	Zinc (dissolved)	APHA Standard Methods (1992), method 3113.B	1 µg/l
	Nickel (total)	APHA Standard Methods (1992), method 3113.B	1 µg/l
	Nickel (dissolved)	APHA Standard Methods (1992), method 3113.B	1 µg/l
	HCO_3/CO_3	SR ISO 9963 – 1	N/A
	Nitrate	STAS 3048 – 1/77	20 µg/l
	Fluoride	STAS 3048 – 2/77	50 µg/l
	Selenium	APHA Standard Methods (1992), method 3114.B	0.05 µg/l
	Cobalt	APHA Standard Methods (1992), method 3113.B	1 µg/l
	Cyanide (total)	STAS 10847/77	2.5 µg/l
	Mercury	STAS 8045-79	0.1 µg/l
	Molybdenum	APHA Standard Methods (1992), method 3113.B	1 µg/l
	Chromium (total)	SR ISO 9174/1	1 µg/l
	Chromium (hexavalent)	STAS 7884/91	10 µg/l
	Phenols	STAS R 7167/92	10 µg/l
	Phosphate	SR ISO 10304/99	10 µg/l
	Biological Oxygen Demand	STAS 6560/82	N/A
	Chemical Oxygen Demand	SR ISO 6060/96	N/A
	Silicon Oxide	STAS 9375/75	N/A
	Residue (dissolved salts) at 105°C	STAS 6953/81	0.5 µg/l

These parameters and methods will be periodically evaluated and adjusted or updated as appropriate, in conjunction with periodic evaluations and updates of the *Environmental and Social Monitoring Plan.* Analytical data are entered into the RMGC Environmental Database in a manner that permits identification and resolution of any transcriptions or other data reporting errors, as well as analyses of trends at any given sampling point or sets of sampling points.

In the case of mitigation and impact monitoring, exceedance of pre-set levels at crucial monitoring points will trigger a series of responses to identify the causes, nature and reaction required. These levels will be defined in the appropriate monitoring plans and will be subject to periodic review as required.

Monitoring programme rationale

The monitoring network comprises a combination of:

a) continued monitoring at locations of environmental significance to the project; and

b) monitoring at new locations related to the Project processes.

Water quality monitoring is required for various parameters depending on the water source. Parameter suites will be defined in the appropriate monitoring plans, and a provisional schedule is shown in Table 6.2.

Table 6-3. Parameter suites for water quality monitoring

Parameter	Baseline	Process	ARD	Domestic in	Domestic out
Bacteria*	x			x	x
Temperature	x				
pH	x		x	x	
Electrical Conductivity	x		x	x	x
Total Dissolved Solids	x		x		
Eh (Redox)	x				
Dissolved Oxygen	x				
Biochemical Oxygen Demand	x				x
Chemical Oxygen Demand	x				x
Turbidity	x			x	x
Suspended Solids	x			x	x
Alkalinity	x				
Ca	x	x	x		
Mg	x	x	x		
Na	x			x	
K	x				
F	x			x	
Cl	x			x	
Cl_2 (chlorine)				x	
SO_4	x	x	x	x	
HCO_3	x				
CO_3	x				
NO_3	x			x	
NO_2				x	
NH_4 - N	x	x		x	
PO_4	x				x

Parameter	Baseline	Process	ARD	Domestic in	Domestic out
Ag (dissolved)		x			
Al (dissolved)	x	x	x	x	
As (dissolved)	x	x	x		
Cd (dissolved)	x	x	x	x	
Cu (dissolved)	x	x	x	x	
Fe (total)	x	x	x	x	
Fe (dissolved)	x	x	x	x	
Ni (total)	x	x	x	x	
Ni (dissolved)	x	x	x		
Pb (dissolved)	x	x	x	x	
Zn (total)	x	x	x		
Zn (dissolved)	x	x	x	x	
Sb				x	
B				x	
Cr (total)	x		x	x	
Cr (hexavalent)	x			x	
Mn (total)	x	x	x	x	
Mn (dissolved)	x	x	x	x	
Co	x		x		
Hg	x	x	x	x	
Mo	x	x	x		
Se		x		x	
Phenols				x	x
Detergents				x	x
Pesticides				x	x
Polycyclic Aromatic Hydrocarbons (PAHs)				x	x
CN (Total)	x		x	x	
CN (Free)			x	x	
CN (Weak Acid Dissoluble - WAD)			x	x	
*Escherichia coli, Enterococci(Streptococci fecali), Pseudomonas aeruginosa					

For monitoring the quality of Project generated waters, parameter suites appropriate to the sources are recommended. Sampling locations and suites are as follows (and in Table 6.3.)

1) Treated Process Water – weekly monitoring of the process suite at:
   a) the discharge point to the TMF
   b) the decant pond
   c) the secondary containment pond
   d) the inflow to the passive treatment cells
   e) the outflow from the passive treatment cells

2) Treated Acid Rock Drainage - weekly monitoring of the ARD suite at:
   a) the point of discharge to Rosia Valley
   b) the point of discharge to Corna Valley
   c) the Cetate water catchment pond
   d) the Cetate mine pit

3) Domestic Water Supply – weekly monitoring of the 'domestic in' suite at:
   a) the treated domestic use water inlet

4) Domestic Wastewater Final Treated Effluent – monthly monitoring of the 'domestic out' suite at:
   a) the final treated domestic wastewater outlet

1.2.2 Groundwater monitoring

A line of three to five boreholes will be installed downstream of the SCD to confirm by monitoring that the TMF water is being contained by the seepage collection system. If TMF hydrochemcial parameters are ever detected in the monitoring wells above regulatory standards, groundwater recovery will become a component of the seepage collection system and seepage water from the recovery wells will be pumped back to the TMF reclaim pond for recycling in the process. Water from the boreholes should be sampled and analysed for the 'process suite' and groundwater levels taken on a monthly basis.

Monitoring locations, parameter suites and monitoring frequency for the different project phases are summarised in Table 6_4.

Table 6-4. Summary of monitoring locations, parameter suites and monitoring frequency

Location	Suite	Project Phase	Frequency
Surface Water Flow Monitoring Points			
Aries – Campeni		All	1
Abrudel – Abrud		All	1
AW01		All	Hourly
R085		All	Daily
RW01		All	Hourly
CW01		All	Hourly
Water Balance Node Positions		Whilst operational	Daily Total Flows
Surface Water Quality Monitoring Points			
S003	Baseline	All	Monthly
S004	Baseline	All	Monthly
S008	Baseline	All	Monthly
S009	Baseline	All	Monthly
S012	Baseline	All	Monthly
S013	Baseline	All	Monthly
S014	Baseline	All	Monthly
R085	Baseline	All 2	Monthly
Groundwater Monitoring Points			
Monitoring Boreholes Downstream of SCD	Process and Levels	3	Monthly
Process Water Monitoring Points			
Discharge Point to TMF	Process	Whilst operational	Weekly
Decant Pond	Process	Construction to Closure	Weekly
SCD Pond	Process	Construction to Post-Closure	Weekly
Treatment Cells Inflow	Process	Testing to Post-Closure	Weekly
Treated Acid Rock Drainage Monitoring Points			
Point of Discharge to Rosia Valley	ARD	Whilst operational	Weekly
Point of Discharge to Corna Valley	ARD	Whilst operational	Weekly
Cetate Water Catchment Pond	ARD	All	Weekly
Cetate Mine Pit	ARD	Late operational to Post-Closure	Weekly
Domestic Water Monitoring Points			
Treated Domestic Water Inflow Point	Domestic in	Whilst operational	Weekly
Final Treated Effluent Monitoring Point	Domestic out	Whilst operational	Monthly

Location	Suite	Project Phase	Frequency
1 Frequency as per government recordings 2 Until flooded by Cetate Pond 3 After detection of TMF substances in SCD			

For water quality monitoring in conjunction with surface water flows (see below), the baseline suite is recommended for monthly sampling and analysis. Sampling locations are at:

- the Aries intake to determine the intake quality and to monitor the Aries upstream of the Abrudel (S013)
- the Aries downstream of the Abrud confluence (S014). This sampling point could be moved closer to the Abrud confluence to give a better indication of the impact of the Abrud on the Aries and to be related more closely to the flow measurements at Campeni.
- the Rosia quality upstream (R085) and downstream (S009) of the discharge point. R085 can only be monitored until the Cetate Pond reaches the 714 adit.
- the Corna quality downstream of the discharge point (S004)
- the Abrud quality upstream of the Corna stream (S003) and the quality between Corna and Rosia streams (S008) and between Rosia stream and the River Aries (S012)

Meteorology and surface water flows monitoring

Surface water volumes and meteorological conditions are monitored, respectively, via the processes described in the RMGC *Stream Flow Measurement Process Operation Manual* and *Project Meteorological Station Operation Manual,* as noted in Section 5.1 of the *Roşia Montană Project Environmental and Social Management Pla*n (**ESMS Plans, Plan A**). Results are maintained in the RMGC Environmental Database.

Surface water monitoring points are the main existing locations for which continued monitoring is required. In particular monitoring is required for flows and water quality. Flow monitoring is required as shown in Table 6_5..

Table 6-5. Surface water flow monitoring locations

Item	Monitoring	Comment
Aries	Continued access to daily government monitoring data from Campeni	To assess impact of abstraction
Abrud	Continued access to daily government monitoring data from Abrud	
Abrud – upper catchment	AW01 – hourly	
Rosia – upstream of project	R085 – daily	
Rosia – downstream of project	RW01 – hourly	
Corna – downstream of project	CW01 – hourly	
Water Balance Node Positions	Daily total flows	Check process / water balance

To account for climate change (see 4.1.1.1 and Appendix 4.1B) and improvements in knowledge and predictive ability as data availability and modelling techniques improve, the project Water Management Plan will include a provision for continual review of climate change knowledge status so that any design or management implications can be identified as soon as possible and acted upon in a timely manner.

1.3 Special Considerations – Air Monitoring

1.3.1 Structure and spatial configuration of the Air Quality Monitoring Network

The structure of the air quality network is required on the one hand by purpose and objectives, and on the other hand, by the particular features of the area concerned.

The design of the air quality monitoring network must take into account several factors related to the Project:

- The very large area where the activities related to the Project will be carried out;
- The activities related to the Project will take place in various locations at smaller or greater distances from areas with sensitive receptor, and will be associated with various emission potential of atmospheric pollutant as well as with various temporal fluctuation of the emissions;
- The very complex topography of the Project area (hills/mountains of various heights, crossed by valleys with different orientations) which reflects in an absolute particular/local character and in a very large spatial variability of the parameters related to the ground and boundary air layers, where the pollutant emissions, transport and diffusion will take place;
- Several small towns and population centres border the Project site, particularly to the east, south and west;
- A number of historical structures exist in protected areas that may be sensitive to acidic conditions; and
- Various operations will change location throughout the life of the mine.

The government-operated Roşia Montană Meteorological Station has been upgraded to provide continuous, accurate weather data at an elevation of approximately 1000 metres, and is located to the north-east of the Project site. This station provides representative characterisation of the regional weather patterns in the area and is located at an elevation above the Project site. Historical data have shown the prevailing wind directions to be south-west and north-east, corresponding to the deep valley terrain features of the site. These data do not comply in detail with the requirements concerning the appraisal of the relation between cause and effect (i.e. the relation: emission – transmission – concentration level at receptors) for the air pollution generated by the sources related to the project.

Based on emissions inventory estimates and modelled impacts from the Project during construction and operations phases, the primary air pollutants of concern are particulate matter, metals, nitrogen oxides (NO_x), and carbon monoxide (CO). Particulate matter consists of both total suspended particulate (TSP) and particulate matter less than 10 microns in diameter (PM_{10}). Targeted metal concentrations will be determined from the TSP and PM_{10} samples. In addition, to safeguard certain historic areas and structures from degradation, particularly within the Roşia Montană protected areas, acid deposition monitoring (wet and dry) will be conducted.

Will be established around the Project site, generally corresponding to the four cardinal directions. One of these locations will also contain a meteorological station, and three of these locations will contain meteorological sensors in order to characterise the localised wind patterns and micrometeorology in Roşia and Corna Valleys. One additional meteorological station will be established near the ore processing plant. Wet and dry

atmospheric deposition monitoring will be performed within the protected area in the historical residential area of Roşia Montană.

Monitoring will commence prior to actual construction in order to confirm existing background air quality. Background monitoring will be conducted for approximately one quarter prior to the start of construction and will continue throughout the construction, operations, and closure phases of the Project. As mine operations evolve, as different areas are affected, and as monitoring data evaluations may indicate, monitoring sites may be relocated or the monitoring program otherwise modified in order to ensure that adequate and representative data are obtained.

1.3.2 Monitoring Site Locations

Considering the complex terrain, extensive foliage, and large area of the Project site, it is challenging to locate monitoring sites that will represent both regional air quality and specific Project impacts. Sitting considerations include proximity to population areas, ease of access, availability of power, and distance from localised influences such as roadways or other industrial operations. The map in Figure 4.1 from *Air Quality Management Plan* depicts the approximate locations of air quality, wet/dry deposition, and meteorological stations/sensors; initial locations will be established based on the predicted maximum extent of activities in the construction phase.

1.3.3 Monitoring Equipment Description

General specifications for the meteorological sensors, gaseous analysers, and particulate sampling equipment to be procured and installed for the Roşia Montană Project are described in the following paragraphs

1.3.3.1 Meteorological Instrumentation

Meteorological parameters that will be monitored include the following:

- Wind direction
- Wind speed
- Ambient temperature at 2 and 10 metres
- Temperature difference (2 to 10 metres)
- Wind direction fluctuation
- Barometric pressure
- Solar radiation
- Precipitation
- Relative humidity

Each meteorological monitoring system will be electrical and solar-powered. Recommended instrument specifications for the sensors are as follows:

Wind Direction

- Starting Threshold 0.33 m/s
- Delay Distance 1.2 m
- Damping Ratio 0.5 to 0.6
- Accuracy $\pm$ 3.6°
- Range 0-360° (540°)

Wind Speed

- Starting Threshold 0.33 m/s
- Response Distance 5.5 m
- Accuracy ± 0.11 m/s
- Range 0 – 50 m/s

Temperature

- Linearity ± 0.05° C
- Stability ± 0.05° C
- Accuracy ± 0.2° C
- Range -30 to +50° C

Sigma Theta

- Sampling Rate 1 Hz
- Sampling Period 15 minutes
- Accuracy ± 0.5 percent FS
- Range 0 - 100°

Barometric Pressure

- Accuracy +/- 1 mm

Solar Radiation

- Range 0-1500 watts/m^2

Precipitation

- Accuracy 0.025 cm increments

Relative Humidity

- Range 0-100%

1.3.3.2 Air Quality Instrumentation

General specifications for the air quality monitoring instrumentation are listed below:

Sampling device for TSP

Technical specification:

- Voltage: 220 – 240V
- Method used: gravimetric method
- Type of device: high volume sampler
- Operating temperature range: -15° C to +30° C

Number of devices: 1 (one)

Sampling device for PM_{10}

Technical specifications:

- Voltage: 220 – 240V
- Method used: gravimetric method EN 12341
- Type of device: high volume sampler (HVS) and super high volume sampler (WRAC)
- Reference method: gravimetric method EN 12341
- Operating temperature range: -15° C to +30° C

Number of devices: 4 (four) high volume samplers (HVS) to be installed in field and 1 (one) super high sampler (WRAC) to be used as calibration device.

Automatic sampling device for PM_{10}

- Voltage: 220 – 240V
- Method used: absorption of β radiation
- Operating temperature range: -15° C to +30° C

Number of devices: 1 (one)

Automatic analyser for NO – NO_x

The automatic analyser is needed for monitoring the level of nitrogen oxides in the ambient air.

Technical specifications:

- Voltage: 220 – 240V
- Measurement method: chemiluminiscence EN 14211
- Permapure dryer for drying the air in the ozone generator
- Data averaging time: 1 hour (hourly mean values)
- Reference method: chemiluminiscence EN 14211 or equivalent
- Output (NO, NO_2, NO_x) proportional to the values of the measurement for connecting to data acquisition system
- Operating temperature range: -15° C to +30° C

Number devices: 3 (three)

Automatic analyser for CO

The automatic analyser is needed for monitoring the level of CO in the ambient air.

Technical specifications:

- Voltage: 220 – 240 V
- Measurement method: non-dispersive infra red method (NDIR), EN 14626
- Data averaging time: 1 hour
- Reference method: non-dispersive infra red method (NDIR), EN 14626 or equivalent
- Output proportional to the values of the measurement for connecting to data acquisition system
- Operating temperature range: -15° C to +30° C

Number of devices: 2 (two)

Automatic sampler for wet and dry particle deposition

The sampler is used to measure acidic content of particles deposited in the vicinity of sensitive structures and artifacts of historic significance. The sampler will incorporate a rain sensor to activate the wet deposition portion of the two-compartment collector, as well as a heater to preclude freezing of the samples. Wet and dry deposition sample fractions will be determined through gravimetric analysis. Each compartment will be coated to avoid sample contamination.

The tipping bucket rain gauge will be equipped with a windscreen and heater, with a resolution of 0.1 mm of precipitation. The collector should be equipped with a sample volume measurement unit.

Number of devices: 1 (one)

1.3.3.3 Sampling frequencies and procedures

Meteorological parameters will be continuously monitored and recorded. The gaseous pollutant concentrations (NO_2/NO_x and CO) and PM_{10} from automatic monitor in Roşia Montană will be continuously monitored and recorded using analysers housed in temperature-controlled shelters, with sampling through glass manifolds. Particulate matter concentrations, including metals, will be manually sampled using high volume integrated samplers. Sampling will take place for 24 hours, from midnight to midnight, every day, in order to provide statistically significant data for comparison with the annual average air quality standard, as well as the 24-hour standard. Wet/dry deposition samplers will be operated continuously with monthly tabulations of weekly sampling events.

These activities shall be conducted in accordance with manufacturers' suggested practices and the following RMGC Standard Operating Procedures (SOPs), as applicable:

- AQ-01, "Operation, Maintenance, and Calibration of the Total Suspended Particulates (TSP) Sampler" and AQ-02, "Operation, Maintenance, and Calibration of the PM_{10} Sampler"; manual particulate samples will be collected every day for TSP and PM_{10} on quartz filters. The TSP samples, after gravimetric analysis for net weight gain will be sent to a laboratory and analysed in accordance with AQ-06, "TSP Metals Sampling and Analysis" for concentrations of arsenic (As), cadmium (Cd), chromium (Cr), lead (Pb), manganese (Mn), nickel (Ni), zinc (Zn), vanadium (V), and cobalt (Co).
- AQ-03, "Operation, Maintenance, and Calibration of the NO – NO_x Automatic Analyser" and AQ-04, "Operation, Maintenance, and Calibration of the Automatic Analyser for CO"; all gaseous parameters will be continuously monitored and recorded on each station's data logger. The continuous analysers will be housed in temperature-controlled shelters; ambient air will be drawn by a blower through a glass sampling funnel into a glass manifold within the shelter and then exhausted back outside. Each analyser will pull air from the manifold for analysis. The ambient air will only be in contact with glass and Teflon throughout the process. Calibration features are integral to the sampling system, allowing fully automatic calibration checks of each analyser and the data acquisition system on a daily basis. Depending on instrument type, data will be downloaded or transmitted to the RMGC Environmental Management office for subsequent validation and evaluation.
- AQ-05, "Operation, Maintenance, and Calibration of the Meteorological Station"; meteorological parameters will be continuously monitored and recorded on each station's data logger. Depending on instrument type, data will be downloaded or transmitted to the RMGC Environmental Management office for subsequent validation and evaluation.

- AQ-07, "Operation and Maintenance of Wet/Dry Deposition Sampler"; the sampler will sample continuously with each week constituting a new sampling event. The rain sensor will trigger whether the dry deposition or wet deposition compartment is exposed for sample collection. At the conclusion of four weeks of sampling, all compartments will be removed and analysed for particle mass and acidic content.

1.3.4 Calibration Requirements

Calibration procedures for all air quality monitoring equipment shall be as noted in the applicable SOPs; minimum requirements are summarised in the following paragraphs. Different from the RO version

Meteorological Sensors
Meteorological sensors will undergo calibration audits at least semi-annually (once every six months). Each sensor will be checked for accuracy using prescribed methods. Wind direction output will be verified using a calibration jig and certified compass to check direction output in four directions. The wind speed sensor will be checked using a synchronous motor attached to the anemometer shaft. Temperature sensors will be calibrated at two points using ice and water baths and certified thermometers. Precipitation output from the tipping bucket rain gauge will be checked volumetrically. The relative humidity output will be verified against a sling psychrometer. Atmospheric pressure output will be verified with a certified barometer and the solar radiation sensor will checked for zero output when covered.

Manual Methods
TSP and PM_{10} samplers will be calibrated quarterly using a certified audit flow orifice. The calibrator orifice will be placed on each sampler's inlet and the actual flow rate, corrected to reference conditions, will be compared with the sampler's indicated flow rate. If there is a difference of greater than 7 percent, the sampler will undergo a full, multi-point calibration and a new calibration curve will be established for the unit.

The rain gauge for the wet/dry deposition monitor will be calibrated quarterly and the sensor mechanism for covering the wet or dry compartments checked for proper operation.

Continuous Analysers (NO_2/CO)
Gaseous analysers will undergo a daily, automatic calibration check (zero and span), using the station's automatic calibrator coupled with certified calibration gases or permeation tubes. A calibration controller will be part of each station's system and will automatically initiate daily zero and span checks on each analyser at approximately midnight. Each analyser will be challenged with certified gas concentrations, as well as zero gas, and the analyser response will be logged by the data acquisition system. Analyser response control charts will be maintained for each analyser to ensure that the calibration response remains within established control limits, typically $\pm$ 7 percent. On a quarterly basis or whenever control limits are approached, a full, multi-point calibration will be performed to adjust the linearity and slope of the analyser output. In addition, NO_x analysers will undergo gas-phase titration with ozone to ensure acceptable NO-NO_2 conversion.

Wet/Dry Deposition Sampler
No special calibration requirements will apply to the wet/dry deposition sampler.

1.3.5 Preventative maintenance

Preventative maintenance procedures for all air quality monitoring equipment shall be as noted in the applicable SOPs; minimum requirements are summarised in the following sections.

Meteorological Instrumentation
Preventative maintenance will follow the manufacturer's recommendations. A spare parts inventory will be maintained on-site including a spare sensor for each parameter, replacement bearings for the wind direction vane and wind speed anemometer, and other recommended components. At a minimum, wind sensor bearings must be replaced on an annual basis.

Air Quality Monitoring Instruments
Preventative maintenance procedures for both manual and continuous samplers and analysers will follow the manufacturer's recommendations. At a minimum, motor brushes will be replaced in the TSP and PM_{10} samplers on an annual basis, or sooner if needed. Consumable supplies, including desiccant, compressed gases, motor brushes, and chart paper will be maintained at each monitoring station. Inventories of spare parts (including motor brushes) will also be maintained onsite, following the manufacturer's recommendations.

Wet/Dry Deposition Sampler
Apart from maintaining a supply of the spare parts suggested by the manufacturer, no special preventive maintenance requirements apply to the wet/dry deposition sampler.

1.3.6 Data validation and reporting

Data Validation
Air quality monitoring data shall be verified and validated in accordance with AQ-08, "Air Quality Data Validation", in order to ensure that the data collected are complete, representative, accurate, precise, and comparable. Validity criteria will be established for each parameter as noted in SOP AQ-08. Control limits will be established for calibration activities; and out-of-tolerance conditions may invalidate affected data. In addition, specific tolerance limits will be established for each parameter based on reasonableness. Monthly data processing will include screening all data against the tolerance limits so established. Other criteria including variability, persistence, range of values, and missing data will be assessed routinely as part of the data validation process.

Monthly and Quarterly Reporting
All data will be processed and validated on a monthly basis. Data will be tabulated by hour of the day for each day of the month. On a quarterly basis, a summary monitoring report will be documented that includes all data by parameter, by site, by day, and by hour. Also included will be percent recovery for each parameter, monthly and quarterly means, and maximum and minimum values, compared against the monitoring limits specified by applicable regulations, as defined in the current Roşia Montană Project *Regulatory Requirements Register* (see MP-02, "Identification of Legal and Regulatory Requirements"). Quarterly calibrations, control charts, and significant maintenance records will also be included in the report.

An annual report will be prepared for each calendar year, combining the four quarterly reports and evaluating significant trends observed in the monitoring data.

Records Management
Calibration and maintenance records, quarterly and annual reports, and all other records specified by governing SOPs shall be forwarded to the RMGC Environmental Management

office and retained in accordance with MP-11, “Management of Environmental and Social Management System Records.”

1.4 Special Considerations – Noise & Vibration Monitoring

1.4.1 Project Noise and Vibration Monitoring

The monitoring stations discussed in Section 6.2.3 will be operated continuously in accordance with NM-03, “Ambient Noise and Vibration Monitoring."Periodic follow-up inspections of selected structures or habitations will be carried out to detect whether or not blasting has caused (or exacerbated existing) damage. In addition, noise-monitoring surveys will be conducted at specified locations in the adjacent communities on at least a monthly basis, using a sound level meter connected to a chart recorder. At least three 15-minute samples will be recorded per day for each monitoring site, along with wind speed and direction and other factors (e.g., traffic, animal, or insect noise) that could bear on the monitoring results.

1.4.2 Evaluation of Noise/Vibration Monitoring Data and Corrective/Preventive Action

The inspection data sheets specified in NM-03 will be completed and systematically forwarded to the RMGC Environmental Management office for evaluation and further action. Monitoring data summaries will be routinely made available to the public and other external stakeholders via the communications mechanisms defined by the *Public Consultation and Disclosure Plan*.

Any noted exceedances of the regulatory limits discussed in Section 5, blast vibration damage, or other noise/vibration-related complaints received from external stakeholders shall be documented as nonconformances and investigated and resolved through the corrective and preventive action process described in MP-10, “Corrective and Preventive Action for Environmental and Social Management System Non-conformances” and Section 5.2 of the *Roşia Montană Project Environmental and Social Management Plan*. The most likely physical source of any such complaint [e.g., blasting events, shipment of super heavy lift and over dimensional (SHLO) equipment, or construction activities] will be identified. Where appropriate, physical examinations of affected structures may be made and compared to pre-mining survey documentation to determine if damage is actually attributable to the source event. At a minimum, all such determinations shall be compared to the parameters of the associated event, and considered in adjustments to the design of future blasting activities, or to the mitigation of impacts associated with deliveries of materials and equipment, workforce transportation, or other potential sources.

All participants in the corrective and preventive action process described in MP-10, shall, at a minimum, (where noise and vibration nonconformances are concerned) specifically consider making appropriate adjustments to the affected blasting plan, or, where other noise and vibration sources may be involved, implementation of one or more of the potential mitigative measures listed in Table 6.6. or other appropriate BMPs.

Table 6-6. Potential Mitigation Measures for Observed Noise Exceedances

Potential Mitigation Measures	Minimisation Potential	BAT Sources
Adjust frequency of deliveries by heavy vehicles to prevent concentrated impacts to adjacent communities	Variable	[1]
Adjust construction schedules to minimise night-time activities requiring the use of high acoustical-energy equipment (e.g., dozers, excavators) at night	Variable	[1]
Install solid, modular concrete noise control barriers as close proximity sound walls (e.g., "Jersey" barriers) along haul routes and sensitive access roads	5 to 10 dB	[1]
Place solid, portable, modular wood/metal or concrete noise control barriers as close proximity sound walls around operating rock drills or excavators	5 to 10 dB	[1]
Create noise control barriers via earthen/slag berms ("bunds"), which can be as long as required and from 10 to 20m high depending on the topography and geometry of the source(s) and receiver(s)	5 to 20 dB	[7], [2], [3], [4]
Acoustic treatment of dwellings in special situations, as necessary to improve habitable spaces	10 to 20 dB	[10], [5]
Fit heavy haul trucks with noise control systems as necessary to achieve desired reductions; options include: engine combustion management systems enclosing engine bays aerodynamic radiator fan design noise-control louvers or baffles on radiator grille noise-control louvers or baffles on hydraulic system cooling fans high-performance silencers variable backup warning systems, adjusted for ambient conditions chain mesh mudflaps low-noise tyre tread design	 2 to 5 dB to 10 dB 2 to 3 dB 2 to 3 dB 2 to 3 dB 5 to 10 dB variable benefits` <3 dB 1 to 3 dB	[7], [10], [11], [6], [7], [8], [9], [10]
Fit excavators with noise control systems as necessary to achieve desired reductions; options include: engine combustion management systems sound-absorbing panels within engine bays, under the deck area, and inside the counterweight	 2 to 5 dB 3 to 5 dB 5 to 10 dB	[7], [10], [11], [13], [15]

[1] Professional experience, Advanced Acoustical Consultants, Inc. (AAC)
[2] *Mine Planning for Environment Protection*, Commonwealth of Australia, Environmental Protection Agency, Best Practice Environmental Management in Mining, June, 1995
[3] *Noise Management at Martha Mine, Newmont Mining; www.marthamine.co.nz/sound.html*
[4] *Noise, Vibration, and Airblast Control*, Environment Australia, 1998; www.ea.gov.au/industry/sustainable/mining/booklets/noise/noise3.html#3
[5] Australian Government, Department of the Environment and Heritage, *Checklists for Sustainable Minerals*, Checklist for Noise, Vibration, and Airblast Control, 2003
[6] *Pollution Prevention and Abatement Guidelines for the Mining Industry*, World Bank/UNIDO/UNEP draft guidelines, July 1993
[7] Caterpillar web site; www.cat.com
[8] *Essentials – Noise Management in the Construction Industry: A Practical Approach*, Government of Western Australia, 3/99
[9] *Noise Control Resource Guide – Surface Mining*, U. S. Department of Labor, Mine Safety and Health Administration (MSHA)
[10] *Environment and Community – Opportunities and Challenges for Mine Planning and Operations, Mt. Arthur Coal (BHP Billiton), May 2005*

Potential Mitigation Measures	Minimisation Potential	BAT Sources
sound absorbing panels around the powerpacks and hydraulic cooler house use multiple hydrostatically-controlled units for engine cooling (vs. single belt-driven fan) variable backup warning systems, adjusted for ambient conditions primary/secondary silencers, tuned to engine exhaust characteristics	2 to 4 dB 1 to 3 dB variable benefits 5 to 10 dB	
Fit dozers with noise control systems as necessary to achieve desired reductions; options include: engine combustion management systems high-performance silencers engine shrouding variable backup warning systems, adjusted for ambient conditions optional tread control devices to reduce “track slap” characteristics	 2 to 5 dB 5 to 10 dB 5 to 10 dB variable benefits variable benefits	7, 10, 11, 12, 11

1.5 Special Considerations –Soil Monitoring

Soil Monitoring During Construction, Operation, Closure and Post-Closure

All soil-related operations, from stripping through to the ecological reconstruction of the soil profiles need to be conducted under the guidance of a soil specialist. The latter will indicate, for each stripped area, the stripping depth of both topsoil and lower horizons. He /she will also supervise the building of the overburden stockpiles, in separate compartments for fertile topsoil and mineral soil. He/she will also monitor, through analyses conducted by a certified company, the developments in the stockpiled soil, and recommend the necessary measures.

Also based on analyses, the soil specialist will monitor the developments in the non-stripped soil, in regard to acidification and heavy metal loading. This activity is to be performed on an annual basis, starting with the first year of operation and until the site is closed.

In the event of accidental spills of chemicals or fuels, he/she will collect samples and have them analyzed by a permitted laboratory, and will indicate measures based on the type and intensity of the pollution.

During the closure/post-closure period, the soil specialist will supervise the dismantling of the soil stockpiles, soil transport to the reclamation sites and the buildup of the soil horizons. He/she will ensure that the base horizons are built with an adequate texture. If not, he/she will indicate the texture mix to be achieved. He/she will supervise the installation of the fertile horizon.

After the soil profile has been achieved mechanically, the soil specialist will collect samples for an agro-chemical analysis. The analytical data will help determine the potential doses of mineral or organic fertilizer required in order to enhance topsoil fertility. He/she will then coordinate sowing and planting activities.

[11] *Bulldozer Noise Control, U. S. Department of Labor, Mine Safety and Health Administration (MSHA).*

In the post-closure phase, the soil specialist will monitor the evolution of fertility and

1.6 Special Considerations –Waste disposal Monitoring

1.6.1 Extractive waste

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*. 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 acticities of

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

Monitoring of the TMF

Both the tailings dam and the Secondary Containment Dam will be instrumented. 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 spigotting of tailings is 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.

1.6.2 Non Extractive Waste 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-like wastes.

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 the acceptance of waste for landfills and the national list of waste accepted to each class of waste landfill.

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

The organic sludge resulting from the urban waste-water treatment will undergo a periodic measurement of the micro-pollutants content, in order to establish the agricultural use potential of the waste.

Government Decision (GD) no. 1159/02.10.2003 for the modification of GD no. 662/2001 regarding the management of used oils, establishes specific measures for the collection of used oils according to the category of the used oils. A specific requirement is the filling in of a declaration for each used oil batch documenting the absence of contamination. This will, in turn lead to the necessity of periodical laboratory testing to identify and monitor the characteristics of the used oils.

Anyway, the current manadatory practice for the incineration or co-incineration of hazardous wastes is 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.

1.7 Special Considerations –Potential Risks Monitoring

1.7.1 Emergency Planning

As indicated in the previous Sections, the RM Project is regulated by the Seveso Directive for the control of major accidents involving hazardous substances , and therefore the Safety Report will provide further information on the requisite safety and emergency response measures. Another requirement is the development of an Internal Emergency Plan in compliance with MAI Order no. 647 of 5/16/2005 for approving the Methodological Norms for the development of emergency plans in case of accidents involving hazardous substances.

Emergency planning is based on a management policy by which RMGC commits to create, establish, implement and maintain an environmental, health and safety management system in compliance with the Romanian law and international standards. This policy reflects the intention of RMGC to minimize the associated operational risks that might affect the environment, the staff, neighboring communities and visitors, and provides guidelines for the control and containment of the impacts of any emergency situation that might occur.

In previous sections, we have identified a number of potential accidents associated with the Roşia Montană Project, include or can arise as a result of or during the execution of the activities noted below:

- the construction, operation and decontamination of the process plant and ancillary facilities;
- the excavation and transport of overburden, ores, and tailings metarials;
- cyanide transport and handling on and off site;
- the storage, handling and potential spills of cyanide and other chemicals on site;
- the storage, handling and potential spills of fuels, lubricants, and other flammable materials on site;
- the transport, handling, storage and accidental detonation of explosives
- the on-site handling of wastewaters and storage in the TMF
- the handling, transport and storage or disposal of inert, hazardous waste and recyclable materials;
- vehicle operation;
- storage of compressed gases;
- the structural stability of earthworks (walls, roads, waste rock stockpiles, earth stockpiles, primary and secondary containment dams);
- structural fires (office buildings, dormitories, process plant or warehouses);
- power cuts;
- medical emergencies caused by disease or accidents;
- natural disasters (thunderbolt, forest fires, torrential rain, avalanche, floods, earthquakes, strong wind, landslides, etc.);
- human threats, such as terrorist threat/attack, illegal weapons, bomb threat/attack, vandalism, sabotage, or civil destruction.

In response to the pontential accident scenarios, a number of Standard Operating Procedures (SOPs) will be developed for accident prevention and emergency management.

An outline of the subjects that will be incorporated in the SOP is presented in the following table:

Table 6-7. Standard Operating Procedures (SOPs) for accident prevention and emergency management

Emergency response preparedness Emergency response equipment – maintenance, inspection and testing of hazardous materials storage and handling Evacuation procedures Site Security Explosives management Fuel facility management On-site fueling operations Investigation, reporting and record keeping of accidents and near accidents Electrical safety First aid provision Hearing protection Respiratory protection Evacuation procedures Safe evacuation of persons The use of equipment Personal Protection Equipment Vehicle and crane safety Access to close spaces Work areas, ladders and scaffoldig Protection against falls Fire protection Routine safety inspections Emergency power supply for cyanide handling equipment General inspection Compliance checks	Safety preparedness, drills and staff meetings Cyanide unloading and storage Carbon filtering operation Cyanide Detoxification Process Inspection of cyanide handling tankers, pipes, and other facilities Maintenance and Calibration of Hydrogen Cyanide Monitoring Equipment Decontamination of Cyanide Handling Equipment Corrective and Preventive Action for Environmental and Social Action Program Non-compliance Environmental and Social Management System Performance Verifications Management review Waste disposal Wastewater management Inspection or proves plant operations Emergency Notification Process Air Monitoring at the Process Plant /Equipment Operations and Maintenance of the Catchment Dam Operations and Maintenance of the Cetate wastewater Dam Erosion control in mine planning Tailings erosion control considerations

The main purpose of the Emergency plan is to provide detailed guidelines for the staff and contractors.

Definition of the Main Concepts and Terminology

- State of emergency – exceptional event, that by its size or intensity, poses a threat to the life and health of the population, the environment, important material and cultural assets, and where the re-establishment of normality requires the adoption of urgent measures and actions, allocation of additional resources and consistent management of the deployed forces and facilities .
- Class A, B, C State of Emergency – classification of a state of emergency based on the size of the impact area, speed of evolution and destructive effects of the events causing it;
- State of emergency management – all of the activities developed and procedures used by the decision makers in: evaluating the information and assessing the situation, developing forecasts, establishing alternative actions and implementing then in order to restore normality;
- Environmental media monitoring – a surveillance process necessary for the systematic evaluation of the environmental parameter dynamics;
- Emergency management – identification, recording and evaluation of events, triggering factors, stakeholder notification, warning the population of potential risks factors or negative effects, limitation, removal or mitigation of risk factors and negative effects and impacts caused by the respective exceptional events;

- Intervention – timely action taken by the specialist structures, in order to prevent a deterioration of the state of emergency, limit or remove its consequences, as applicable;
- Evacuation – a protective measure taken in the case of imminent threat of a state of emergency, and consisting of removing, in an organized manner, from the affected or potentially affected areas, the categories or groups of persons or goods and their relocation in areas that provide protection;
- Notification, information – transmission of certified information on the imminence of or actual occurrence of serious events to the local public administration authorities, the public and neighboring communities, in order to avoid surprise and implement protective measures;
- Alarm – transmission of warning messages/ signals to the public regarding the imminence or occurrence of exceptional events of serious consequences;
- Site, objective – the land associated to the company where the emergency situation was created.

In an emergency situation, it is very important to know the size of the incident immediately, in order to adopt the adequate level of intervention.

The following event classification system aims to communicate to the site and off-site response teams what intervention would be required.

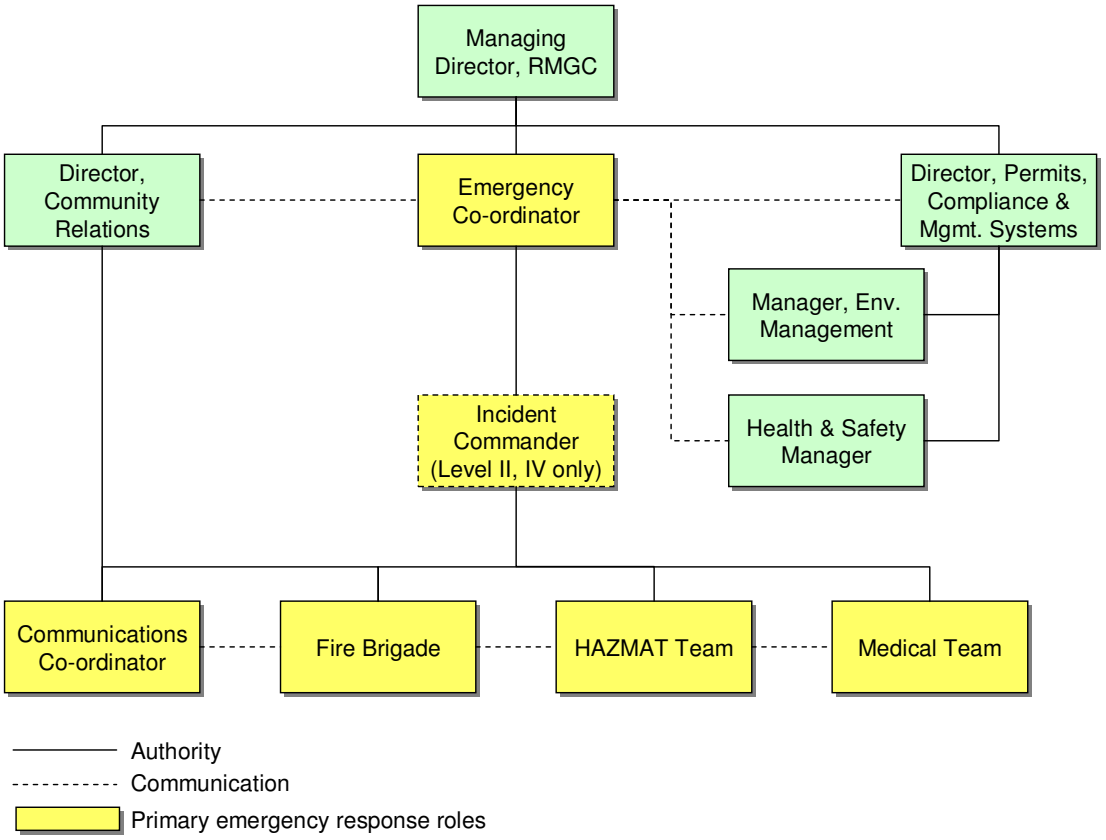
At the time of the initial reporting or identification of an emergency, incident classification should be done as soon as possible by the staff with the best information regarding the incident. These persons typically include:

- the first response persons (those who discover the incident)
- the emergency coordinator on the site
- the Manager, Environmental department, and
- the Manager, Health and Safety department

Often, the situation around an emergency incident may change or new information may come up to dictate a change in the incident classification. This change may be an increase or decrease the incident classification level. Typically, the decision to change the incident classification will be taken by the people listed above, together with the Incident Commander, if one was assigned.

1.7.2 The organzation of the emergency response

The organzation of the emergency response for the Roşia Montană Project it is presented in belowe figure



The Emergency Coordinator and the Incident Commander are key persons in organizing an emergency response. The main differences between their respective roles include: The Emergency Coordinator is responsible for maintaining emergency response training on the site and for making the initial decisions on how to respond to an emergency, i.e. the emergency classification level and the necessary resources. The Incident Commander is the person in charge at the site of the accident, i.e. controls the emergency response teams, decides what resources are necessary, coordinates the emergency response teams and communicates with the people outside the accident site. The Emergency Coordinator plays a continuous role within the organization (and has designated replacements), while the Incident Commander is an ad hoc designation and only lasts for the duration of the incident, for the documentation and the final closure for the emergency, .

1.8 Special Considerations – Biodiversity Monitoring

1.8.1 The Monitoring of Habitats and Wild Life

This program is intended to monitor changes in biodiversity at the community and ecosystem levels. It is concerned mainly with the effectiveness of maintaining the extent and quality of habitat, and of maintaining ecosystem processes. As the maintenance of ecosystem processes directly affects the success of biodiversity conservation, it is desirable that these processes should be monitored. This section describes four tasks that have been identified by the World Bank as reliable means of monitoring biodiversity at the community level and in the ecosystem. (World Bank, 1998).

The ecological baseline reports (*Ecological Baseline Reports for the Roşia Montană Project*): *Report 7*) describe the biological diversity conditions prior to commencement of the project (although mining has been ongoing in the area for the past two millennia, and has shaped the landscape and ecological features contained therein). This comprehensive study serves as a benchmark against which management-induced changes can be identified and measured. However, it is important to note that future monitoring generally does not need to update the full data set gathered during the baseline studies. In most cases, management is concerned with trends rather than absolute values. Absolute values (total number of species, exact densities, etc.) are generally not needed on a day-to-day basis. Changes in relative indices of these parameters (trends) will provide the information that environmental managers need to show progress is being made, or if indicators are falling dangerously close to unacceptable levels.

The following sections summarize the monitoring activities to be undertaken as part of the Biodiversity Management Plan. **These monitoring activities should be undertaken on an annual basis.**

1.8.1.1 Habitat Mapping

Habitat mapping should be undertaken on an annual basis, and will focus on:

- Habitat Distribution
- Vegetation Structure

Habitat Distribution

Habitat distribution will be monitored by mapping changes of habitat boundaries, including riparian habitats. The location of habitat boundaries can show expansion or retreat of crucial habitats, and can be determined through annual surveys/fixed point photography of permanent plots or transects.

Changes in riparian vegetation can have significant effects on aquatic biodiversity through direct (e.g. change in water temperature and light availability) and indirect (e.g. increased runoff and siltation) impacts. The use of remote sensing, combined with surveys of plots or transects, can be used to measure the area and boundaries of riparian vegetation.

Vegetation Structure

Vegetation structure will be monitored by the change in the percent of crown cover in the upper canopy level (whether it be tree, shrub, grass, etc.). This is accomplished through standard canopy cover measurement methods, conducted seasonally, or at least annually in the same season. Significant habitat disturbance is generally indicated by changes in canopy cover and dominant species. However, records need to be taken over an extended time period to take into account short-term fluctuations due to factors such as fires and weather patterns.

A Standard Operating Procedure will be developed for undertaking habitat mapping.

1.8.1.2 Wildlife Monitoring

The change in the number, composition, and distribution of wildlife species (birds, mammals, reptiles, fish and benthic invertebrates) can indicate changes in ecological processes, particularly the ability to support sustainable populations of keystone species. Monitoring of local wildlife will be undertaken through surveys along transects and/or in strategic sites (depending on the type of wildlife being surveyed) on an annual basis. Monitoring of nest boxes, roost boxes and other measures intended to provide habitat opportunities for wildlife, can be used to evaluate the effectiveness of these initiatives.

Standard Operating Procedures will be developed for undertaking wildlife monitoring.

1.8.1.3 Rare Species

Occurrence records of any rare species encountered in the project area will be kept. These records will include rare species that are encountered both during the formal wildlife monitoring programs and from casual observations. A Standard Operating Procedure for recording rare species will be developed.

1.8.1.4 Indicator Events

Natural events, which are related to biodiversity health at the community/ecosystem level, will be recorded and mapped as they occur. Examples of such occurrences include landslides, floods, forest fires and wildlife mortality. A Standard Operating Procedure for recording such events will be developed.

1.8.2 Promoting Stewardship Ethic

Community participation in conservation activities from an early stage in the Project will sow the seeds of environmental responsibility, and eventually a responsible stewardship ethic that will extend beyond the life of the project. Community involvement in conserving biodiversity resources will develop trust and foster open dialogue between the community and the project. Two critical components for the success of the Biodiversity Management Plan are:

- Increased awareness of environmental issues by residents in the Roşia Montanã area; and,
- Promotion of research and cooperative efforts with non-government organizations, universities and Romanian conservation institutes.

Local awareness of environmental issues will be increased through the adaptation of an environmental extension program supported by RMGC. The scope and complexity of the extension program should be defined through a participatory consultation process including RMGC, local government agencies, and interested stakeholders. Specific activities undertaken as part of the extension program can range from simple (such as naming new streets, buildings and other facilities after local flora and fauna) to more complex (such as volunteer wildlife monitors, guidebooks and newsletters).

RMGC will endeavour to make formal agreements with relevant non-government organisations, universities and institutions to undertake research, and implement management activities in the project area. This transfer of knowledge and skills will improve knowledge both in the project area and throughout Romania.

Evaluation of the Biodiversity Management Plan

Annual evaluations of the BMP should be conducted to monitor the progress of implementation, and to ensure that the desired results are being attained. This section outlines the logic and practical framework for the evaluation process.

1.8.3 Evaluation Framework for the Management Plan

The evaluation framework utilizes a Logical Framework Analysis to establish indicators for each of the objectives of the Biodiversity Management Plan. The Logical Framework Analysis is an organizational framework, typically a 4 by 4 matrix that identifies the components for a program or project in its planning, monitoring and evaluation phases. The Logical Framework Analysis was developed by USAID in the late 1960s and early 1970s and has become a common tool for development project planning and management.

The traditional Logical Framework Analysis employs a double logic – the horizontal logic and the vertical logic – presented in the four rows and columns of the matrix, forming sixteen 'views'. The key principle to the Logical Framework Analysis is the interconnected cause and effect and non-overlapping relationships between elements of the vertical logic, which represent the linkages between the four hierarchical levels (Goal, Objectives, Outputs, and Inputs). These levels are described as follows:

Goal: The highest level in the hierarchy, located in the top row of the Logical Framework Analysis. It is the major purpose of the plan.

Objectives: Objectives are the desired effects from the production of outputs. They are the operational results against which success is normally judged and contribute to the achievement of the goal.

Outputs: Outputs relate to the achievement of particular activities that result from the use of inputs, and are meant to be the cause of achieving the objectives.

Inputs: Inputs refer to the baseline conditions and stakeholder resources that initiate output. Given the nature of the Biodiversity Management Plan, only inputs related to biodiversity in the project area are considered.

Table 6.8. shows the Logical Framework Analysis used to evaluate the Biodiversity Management Plan.

This section provides a description of the vertical and horizontal logic applied by the Logical Framework Analysis for this study. The horizontal logic, as presented in the column, deals with three main elements: the Narrative Summary, which describes the levels; the Objectively Verifiable Indicators of the study levels; and the Means of Verification for the measurement of these indicators. It also identifies Critical Assumptions that are beyond the control of the study, but could affect the measurement of indicators at the four levels, as well as the accuracy and validity of the study. These assumptions include the context in which the study takes place, and the risks that may be inherent in that context. Specific indicators for the BMP have been described in *Section 6.2*. Means of verification have been incorporated into RMGC's Standard Operating Procedures, and are referenced accordingly.

1.9 Special Considerations – Social Monitoring

Evaluation, monitoring and reporting
There are two components with regard to monitoring:
1. Monitoring the indicators of the activities of the Foundation;
2. Monitoring the Foundation.

The results of the performance monitoring will be included in a report.

1.9.1 Monitoring the activity *indicators* of *the Foundation*

By monitoring key Community development and socio-economic indicators, changes to the socio-economic circumstances in the Community, and of the activities under the CSDP, can be noted. Additionally, socio-economic indicators, not specifically related to the CSDP, provide information concerning changes to the state of the Community.

This provides crucial information especially with regard to tailoring and improving the activities of the Foundation. As well, it enables people within the Community to better understand the Foundation and why it chooses to pursue certain activities over others.

Monitoring will also derive indicators from other sources, such as, RMGC indicators and those of local and regional authorities. These include:

- RMGC records: hiring, Corporate Social Responsibility, on the job training, amounts paid in taxes and royalties, etc;
- Authorities: statistical departments, health and education development, environmental management systems and transport infrastructure development, etc.

Table 9.3 summarises the principle impact monitoring aspects.

1.9.2 *Monitoring of the Foundation*

The board level committees as presented in Sections 9.4 and Table 6.8. and further elaborated in Table 6.9. below, will ensure good corporate governance and financial transparency.

Table 6-8. Foundation monitoring Committees

Committee	Responsibility	Outcome
Governance committee	Ensures that operations are in accordance with the constitutive act, observes good public order and ethics and complies with all relevant laws	Compares the operations and activities of the Foundation against statutory & legislative requirements
Audit committee	Ensures financial integrity by appointing a qualified auditor to perform yearly financial audits of the Foundation	Controls the Foundation's financial transactions to ensure consistency with established goals & objectives based on financial transparency
Compensation committee	Responsible for issues concerning human resources, and compensation policies and guidelines	Ensures fair and reasonable work conditions and the payment of salaries to staff for functions and duties undertaken

Transparency of financial transactions and of decisions made by the management team and Board of Directors is essential to ensure that the Foundation operates at an optimal level towards meeting its stated goals and objectives.

1.9.3 Reporting

Annually a report will be produced documenting the activities and functions of the Foundation. This Report will provide information on:

- Operational highlights;
- Financial Statements and Notes to the Financial Statements, ie: Balance Sheet, Statement of Profit & Loss, Statement of CashFlows;
- Year in review;
- Activities – by the departments within the Foundation;
- Results achieved against objectives set – by the departments within the Foundation;
- Projections;
- Report by the Committees;
- List of Board Members;
- Description of Management team and staff, by function;
- Amongst other possible criteria.

The Financial Statements will be subject to an independent annual external audit. The auditors report will be made publicly available. The external auditor will be appointed annually by the Foundation's Board of Directors , and will prepare and present their report to the Board of Directors.

The Foundation's Annual Report will be submitted to the Board of Directors for review and approval. The Annual Report will comply with all all statutory rights and shall be made publicly available.

Table 6-9. Summary of social impact monitoring actions

No.	Impact	Monitoring aspect	Summary of indicators	Responsibilities	Frequency
1	In-flux of predominantly male job-seekers and workers from outside the area	Employment dynamic Community composition	Hiring Policy: Employment – local vs non-local Compliance with code of conduct. Health awareness training for workers (part of inception training) & the Community	RMGC & EPC contractors	Quarterly
2	Risks of disruption and (cultural) conflict with locals including health risks	Community relations & health		RMGC & EPC contractors	Quarterly
3	Social impacts of new workers related to interactions with local population - Increased cultural and social diversity and revitalisation	Cultural diversity	New initiatives – sports, social, cultural: Numbers of new initiatives, sectors, purpose, Number & changes in numbers of members	Foundation.	Yearly
4	Closure of Minvest/Rosiamin	Hiring Policy CSDP – re-training	No.s ex-Rosiamin employed in RMP No's re-trained & engaged in other activities	RGMC Foundation	Quarterly Yearly
5	Rejuvenated and improved employment market and possibilities	Economic development	New business development Employment – non-RMP Flow-on effects throughout Community	Local authorities; Foundation; RMGC	Quarterly & Yearly
6	Increased income levels	Wealth & economy in Community	Per capita income & wages	Local authorities	Yearly
7	Demand for local services & property		Property market changes No. business permits, new start-ups Changes to turnover/profit of new/existing businesses Money earned & spent in Community	Local authorities +/- Foundation	Yearly
8	Inflation & cost of living impacts	Price of goods & services	Price & cost of living in Community Monitoring impacts on vulnerable persons, Compensatory measures – frequency, type	RMGC & local authorities +/- Foundation	Quarterly, yearly
9	Loss of trained staff from other businesses to fill positions in RMP	Business impacts	New hires in Community Employment increase, capacity drain (to RMP) Training programs to increase remaining capacity	RMGC, Foundation, local authorities	Quarterly, yearly
10	Adult education, vocational training, on the job training	Post-secondary education Skills enhancement; training. RMP - training programs	Post-secondary education facilities & curriculum Applicants, training courses & subjects; Post training employment	Local authorities; Foundation; RMGC	Yearly

No.	Impact	Monitoring aspect	Summary of indicators	Responsibilities	Frequency
11	Construction period – short, intense activity	Short term buoyant economy	Awareness of short term nature of buoyant economy RMP - local procurement as a % of total	RMGC & Foundation	Quarterly, yearly
12	Primary & secondary education	School facilities & equipment	Demand for school placement Improvements school facilities	Local authorities	Yearly
13	Local health service provision	Health services	Access of population to health services; Number of visits; Mortality rate, including infant	Local authorities RMGC	Yearly
14	Transport & utilities infrastructure	Community infrastructure	Improvements to road & transport networks; Improvements to Community environmental management systems	Local authorities RMGC	Yearly
15	Safety and hazard management	Community safety	Traffic management programs including compliance; Mine safety management including compliance; Traffic safety training for schools – number & frequency Traffic safety statistics per capita	Local authorities, RMGC	Quarterly, yearly
16	Interruption including access, either temporary or permanent due RMP to land or businesses	Land access Business impacts	Occurrence, frequency & duration of interruption of access No. affected businesses, compensation paid	RMGC	Quarterly
17	Promotion of Community based on improved infrastructure & attractions	Visits & tourism Investment including foreign	Number of tourists, duration of stay, amounts spent; people employed in tourism sector Investments – total, changes to, sectors receiving investments.	Foundation & local authorities	Yearly
18	Increase in fiscal resources paid to local and national authorities	Taxes & royalties, direct & indirect	Amounts paid Earmarked for what public services	RMGC Local authorities	Quarterly
19	Difficulty of vulnerable & disadvantaged people to benefit from RMP	Distribution of benefits of RMP throughout Community	Disadvantaged persons assistance: Employment training; skills enhancement; in-kind social programmes	RMGC, Foundation, local authorities	Yearly
20	Social & economic risks of eventual mine closure	Economic planning and preparation	Sustainable non-mining economic development Investments in non-mining related sectors Contribution of non-mining related industry to local revenue & employment	Foundation, local authorities	Yearly

1.10 Special Considerations – Cultural Heritage& Archaeology Monitoring

Monitoring actions regarding the cultural heritage considered by RMGC during the phases of the Project

- RMGC will therefore seek to achieve in a sequential manner, the progressive development of a better appreciation of Roşia Montană's cultural heritage and potentially related opportunities.

- One of the initiatives shared between the *Community Sustainable Development Plan* and this plan, is the creation by RMGC of a **Foundation** to promote sustainable development and to preserve and display the cultural heritage of Roşia Montană.

- RMGC recognises that it will need to take some direct actions until sufficient local capacity is in place and that it will be required to provide the Foundation with adequate resources and funding to ensure its success.

- Ensure that development does not damage or disturb sites, items or places of significant cultural heritage value, prior to preventive archaeological researches.

- Minimise and mitigate the negative impacts caused during the construction and operational phases of development.

- Will endeavour to incorporate sites or artefacts of significant cultural heritage value into new sustainable development.

- Will endeavour to ensure the independent management of cultural heritage assets in a way that involves residents in their local heritage and ensures that potential tourism-generated revenue remains in the community.

- The Mining Manager will be responsible for ensuring that RMGC complies with the legal requirements pertaining to the potential discovery of archaeological remains, referred to hereafter as "chance finds".

- The other responsibilities of the Mining Manager include the management of grievances and complaints, supervising the training of foremen and operators to recognise voids that may contain chance finds, the creation and updating of the Chance Finds section of the RMGC Operations Manual, and ensuring that standard operating procedures relating to chance finds are properly implemented. This also includes a responsibility for regular statutory reporting as outlined in a standard operating procedure that will be developed.

- The Mining Manager will be required to ensure that an independent archaeological team, approved by the Ministry of Culture and Religious Affairs (Ministerul Culturii şi Cultelor) via the National Commision of Archaeology, is on-site for all topsoil stripping activities and for the archaeological investigation of the churches in Corna that will be directly affected by the Project.

- The Mining Manager will be responsible for ensuring that the independent archaeological team is notified of the discovery of any chance finds and significant voids brought to his/her attention by one of the foremen.

- The Mining Manager will also be responsible for managing internal company policies and determining any RMGC involvement in future cultural heritage initiatives, whether under the direction of RMGC, the Ministry of Culture and Religious Affairs (Ministerul Culturii şi Cultelor), or the Foundation.

- Foremen will implement standard operating procedures that require that the mining activities be suspended when an operator under their supervision brings a significant void to his/her attention, according to the legal Romanian provisions for chance finds.

- Public access to the Protected Zone will be maintained throughout the life of the proposed project.

- RMGC will be the founder along with an Honorary Founder, who is still to be identified. RMGC will appoint the Board of Directors who will determine the strategic direction of the Foundation.

- Seed funding for the Foundation will be provided by RMGC via a 100% grant. The initial commitment from RMGC will be further supplemented by an annual contribution from RMGC based on established criteria i.e.: percentage of profits, or a royalty, etc.

- RMGC will make available to the executive director any relevant information acquired during RMGC's public consultation activities.

- Impacts to the visual landscape resulting from the Project will be progressively rehabilitated in accordance with the **ESMS Plan J,** *Mine Reclamation and Closure Plan*.

- RMGC will commit to maintaining the Historical Monuments in their present condition during the transitional period leading up to transferral of ownership to the Foundation.

- RMGC will fund the renovation of all the Historical Monuments and houses in the Protected Zone that are in a relatively good structural condition.

- For the congregations that will be displaced as a result of the Project, new churches will be constructed in the new resettlement community of Piatra Albă in order to accommodate the various congregations. If there are not enough parishioners from any of the religions to support a congregation in Piatra Albă, a settlement for the value of the church will be negotiated. The Historic Churches and their locations that will be adversely affected by the Project will be architecturally investigated and recorded prior to any damage.

- Except the two churches from Corna, the churches located within the protected area will not be directly impacted by the Project and access to them will be maintained throughout the life of the Project.

- As was the case with the churches outside the Protected Zone, churches will be constructed as required in Piatra Albă to accommodate the needs of the various active congregations. However, if there are not sufficient parishioners

to warrant construction of a new church, as a result of the churches remaining intact in the Protected Zone, compensation will not be required for the Church.

- Some 13 hectares have been allocated at the Piatra Albă site for cemeteries.
- Wherever existing graves have to be removed and if desired by the family, a service conducted by a priest will be conducted both for the re-opening of the grave and the subsequent burial. All fees relating to the relocation of graves and associated ceremonies will be funded by RMGC.
- The grave of the local hero Simion Balint will not be directly impacted by the Project. Access will be maintained to this grave throughout the Project, although access may have to be restricted at times for safety reasons.
- A member of the independent archaeological team will be present during the exhumations to monitor for any significant archaeological finds. In the same manner that churches are often established on the foundations of older churches, cemeteries can also be established on older burial grounds.
- RMGC will enter into consultation with RosiaMin, the owners of the existing museum, and the Ministry of Culture and Religious Affairs (Ministerul Culturii şi Cultelor) in order to be permitted to relocate the movable heritage from the existing museum to a new location. Members of the Cultural Heritage Team will undertake the careful dismantling and storage of such items, prior to decisions on an appropriate site for reconstruction, preservation and public display.
- A 6-year investigation programme will be undertaken for the Orlea and Țarina underground mining networks.
- The networks of Păru Carpeni, where an ancient water wheel was discovered, will be investigated through a dedicated research programme starting in 2007.
- All artefacts uncovered in the investigation of Păru Carpeni and Cătălina Monuleşti will be further investigated starting 2007 and preserved accordingly, in the future they will be stored in the new museum or in the RMGC funded existing storage area.
- The decision on which gallery (Cătălina Monuleşti or Păru Carpeni) is to be made available for the public and to be funded by RMGC, will be made by RMGC in consultation with the independent archaeological team following the public consultation process of EIA.
- The funerary monument located on Tăul Găuri will be preserved in-situ. RMGC has committed to funding the complete in-situ reconstruction of this monument. RMGC will pay any costs associated with the funerary monument until the Foundation has been established, both in terms of expertise and funding, after which it will become the responsibility of the Foundation.
- The Roman Constructions on Carpeni Hill will be preserved in situ. RMGC will pay any costs associated with the ancient building foundations until the Foundation is established and is deemed able to manage this responsibility, both in terms of expertise and funding.

- RMGC is also committed to the preservation of one of the more significant areas of Roman works for future research, which is located beneath Piatra Corbului, in eastern part of Cârnic massif.

- RMGC will establish the museum and will provide the funds required to equip the museum with displays, office space, to be operated by the Foundation, according to legal provisions.

- Evaluation of these two potential locations for the new mining museum (CCMM) will be conducted in consultation with MNIR, MCC, and local stakeholders to determine the most suitable and advantageous location, both from a cultural and sustainable development perspective. RMGC will facilitate meetings of these groups upon approval of the Project so that construction of the CCMM can be achieved in a timely manner.

- RMGC is proposing to fund up to 100% of a series of replicas that would consist of a construction either located above ground, in a backfilled feature of the Project such as a quarry or dug out in an area of competent rock. These options will be further evaluated as the Project progresses, with construction not likely being completed until year 10 of the Project. RMGC will secure the remainder of the funding for this commitment by applying for available grants, donations, and partnerships.

- It should be noted that based on further assessment, it may be more advantageous to place the reconstruction of a water wheel in the underground mining network that is being opened for public access. Regardless of the location, RMGC will commit to showing a replica of a water wheel.

- Through the understanding of the historical cultural landscape that previous investigation has made possible, areas will be categorized according to the likelihood of discovering unique archaeological resources (low, medium, high).

- A special protocol will be implemented that requires the supervision of all soil stripping and the opening of the quarry steps by a team under the supervision of the Manager of Archaeology, reporting to Director-level company officers.

- The management structure will respond without delay to the uncovering of artefacts or mining remains and will as required issue temporary or permanent work stoppage where further archaeological research, or relocation activities, or in situ preservation of a monument is required.

- Implementation of the chance finds protocol will abide by the requirements of the standard operating procedure to be developed for the management of environmental and social management system records.

- RMGC will continue to publish volumes in the Alburnus Maior monographic series.

- RMGC will facilitate the setting up of a weblog, more commonly known as a blog.

2 Monitoring - Construction Stage

Environmental and social monitoring activities for the construction stage of the Project will be defined via the process summarised in **Figure 1.1** and Section 4.2 of the *Environmental and Social Monitoring Plan* (**ESMS Plans, Plan P**). Activities will include environmental inspection during construction, and the collection and analysis of associated monitoring data, along with the monitoring of internal and external stakeholder concerns and considerations via the processes identified in Table 1_6. Such inspections, analyses, and monitoring are required in order to ensure:

- appropriate construction management techniques are being employed, particularly as they relate to erosion and sediment control for construction activities performed adjacent to existing watercourses;
- continued compliance with regulatory requirements and approved construction practices; and,
- that appropriate mitigation measures are specified, implemented, and functioning properly.

Projected locations for water monitoring during the construction stage of the Project are shown on **Exhibit 6.2**, "Surface Water and Groundwater Sampling Locations for Pre-construction/Construction Phase." Actual locations will be determined during construction preparations to ensure adequate representation of current site conditions. These locations will be selected to facilitate the monitoring of potential airborne dust and other impacts on surface water regimes, air quality, and vegetation that may be caused by:

- the development of access, plant, and mine haul roads;
- quarrying activities;
- mine pre-stripping activities and open pit development;
- waste rock stockpile area development;
- the construction of the process plant, temporary hazardous waste storage facility, and other ancillary facilities;
- vehicle fuelling and maintenance operations;
- mobilisation, operation, and demobilisation of the construction camp;
- removal, relocation, and/or construction of electrical power lines, installation of transformers, and the construction of a new substation;
- the construction of major earthworks [e.g. the Tailings Management Facility (TMF) starter dam, various catchments or diversion channels, the Cetate Water Catchment Dam, and/or the inert waste landfill]; and
- segregation and recycling or disposal of waste materials in accordance with the RMGC *Waste Management Plan* (see **ESMS Plans, Plan C**).

Air monitoring stations will also be established at or near the boundary of the Project industrial protection area (including protected areas within the major project boundary) and downwind of major earthworks projects and haul roads. The air monitoring stations will be established in order to monitor concentrations of dust and atmospheric pollutants from blasting operations, ore processing, and the operation of heavy equipment, as described in the RMGC *Air Quality Management Plan* (**ESMS Plans, Plan D**). Ambient noise and vibration surveys will also be performed within the Project industrial protection area as well as at specific structures and residential locations within specific protected areas or adjacent to the Project boundary as noted in the *Noise and Vibration Management Plan* (**ESMS Plans, Plan E**). Workplace air quality and noise and vibration monitoring will be conducted in accordance with the requirements of the RMGC *Occupational Health and Safety Plan*, in association with major construction activities, heavy equipment use, and blasting operations.

Construction Phase Monitoring

Construction phase monitoring activities include site inspections and collection and analysis of associated monitoring data.

Such inspections, analyses, and monitoring are required in order to ensure:

- appropriate construction management techniques are being employed in accordance with the design criteria, environmental factors are protected and impacts are minimized, and human health and property are not affected;
- continued compliance with regulatory requirements and approved construction practices; and
- that appropriate mitigation measures are properly specified, implemented, and functioning.

Exhibits 6.1 and 6.2 shows the surface water and ground water monitoring locations during pre-construction and construction.

Air quality, noise and biodiversity monitoring locations will be set near the following work areas: roads, dams, TMF storage pond, diversion channels within the Project footprint, in the vicinity of protected areas, on wind directions in accordance with the *Air Quality Management Plan*, *Biodiversity Management Plan* and *Occupational Health and Safety Plan*.

3 Monitoring - Operations Stage

Environmental and social monitoring activities for the operational stage or phase of the Project will also be defined via the process summarised in **Exhibit 6.1** and Section 4.2 of the *Environmental and Social Monitoring Plan* (**ESMS Plans, Plan P**). These activities will include the monitoring of air quality; surface water and groundwater quality and quantity; potable water quality; noise and vibration; biota; soil, tailings, and waste rock chemistry; and water treatment plant influents and effluents, as necessary to address potential impacts of mine/process plant operation. Environmental inspections will continue to be performed and environmental and social monitoring data will be collected and analysed in order to:

- identify changes or potential impacts to the environment and/or adjacent communities resulting from the daily operation of the mine;
- provide the basis for predicting potential environmental or social impacts;
- prompt appropriate corrective and preventive actions to avoid or mitigate potentially adverse environmental and social impacts;
- ensure that RMGC maintains continuing compliance with currently applicable legal and regulatory requirements, permits, licenses, and environmental endorsements; and,
- ensure that proper procedures, management systems, and training are in place to prevent or respond to spills or other emergencies, as required by the RMGC *Emergency Preparedness and Spill Contingency Plan* (see **ESMES Plans, Plan I**) and its supporting procedures.

Projected locations for surface and groundwater monitoring during the operational phase of the Project are as shown on **Exhibit 6.2**. As noted in the Exhibit, a number of sampling sites will be moved or created to facilitate the monitoring of potential impacts on surface water and groundwater regimes that may be caused by:

- the ongoing blasting and excavation of the Cârnic, Jig, Orlea, and Cetate pits;
- the raising of the Tailings Management Facility dam;
- the continued operation of the inert waste disposal facility;
- ongoing site reclamation and erosion control activities;
- ore and waste rock hauling;
- vehicle fuelling and maintenance activities;
- operation of the quarries and waste rock stockpiles;
- the delivery, unloading, and storage of cyanide and other process chemicals;
- operation of the cyanide leaching system in the process plant, including cyanide detoxification prior to release of tailings-laden effluent to the tailings management facility; and
- segregation, and recycling or disposal of waste materials in accordance with the RMGC *Waste Management Plan* (see **ESMS Plans, Plan C**).

Air monitoring stations will also be established at or near the boundary of the Project industrial protection area (including protected areas within the major project boundary) and downwind of major earthworks projects and haul roads, in order to monitor concentrations of dust and atmospheric pollutants from blasting operations, ore processing, and the operation of heavy equipment, as described in the RMGC *Air Quality Management Plan* (**ESMS Plans, Plan D**). Ambient noise and vibration surveys will also be performed within the Project industrial protection area as well as at specific structures and residential locations within specific protected areas or adjacent to the Project boundary as noted in the *Noise and Vibration Management Plan* (**ESMS Plans, Plan E**). Workplace air quality and noise and vibration monitoring will be conducted in accordance with the requirements of the RMGC *Occupational Health and Safety Plan*, in association with major construction activities, heavy equipment use, ore processing, and blasting operations.
The tailings management facility (TMF) requires extreme care from the mining operator (RMGC).

Operations Phase Monitoring
The Engineering Design for the TMF and associated facilities should include specific construction, inspection and acceptance procedures for all completed works.
The environmental impacts and quality of completed works should be monitored as early as the construction phase.
Monitoring of environmental impacts, quality of works and equipment condition will continue throughout operation and closure.
The overall monitoring, inspection and reporting/recording activity will be conducted based on specific procedures to be developed.
The TMF Corna dam will be instrumented as follows:

- Vibrating wire piezometer;
- Hydraulic piezometer;
- Slope indicators;
- Deformation monitoring stations;
- Piezometer nests for groundwater monitoring; and,
- 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 will be located at different elevations downstream of the grout curtain. Two additional vibrating wire piezometers are proposed at two locations in the downstream shell of the dam 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 spigotting of tailings is 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.

Table 6.10 lists typical monitoring parameters and recording frequency that will be used to evaluate the TMF performance. Drawing 12A and 12B indicates the location and type of instrumentation that will be installed in the dams.

Table 6-10. Frecvency of monitoring parameters

Parameter	Frequency
Precipitation	Daily
Vibrating Wire Piezometer	Weekly
PM-10	Monthly and Quarterly
Total Tailings Slurry Volume	Continuous
pH of tailings slurry	Continuous
Slurry Concentration (Density)	Continuous
Tailings Line Pressure	Continuous
Dilution Water Flow Rate (to cyclone)	Continuous
Water Reclaim to Mill	Continuous
Tailings Stored Volume (from topographic survey)	Annual
Tailings Chemistry	Weekly
Supernatant Volume in the TMF	Monthly
Supernatant Water Quality	Monthly, Quarterly, and Bi-Annual
Seepage Total Volume	Weekly
Seepage Chemistry	Weekly
Survey Profiles of Dam	Monthly
Visual Inspection of Dam	Daily
Expert Review of TMF	Annual

In addition to the above parameters, the following will be monitored:

- Air quality within the Corna dam area;
- Surface water flow rates and quality in the Corna Valley downstream of the TMF (Exhibit 6.3);
- Groundwater flow rates and quality along the Corna Valley downstream of the TMF and on the north hillside (Exhibit 6.3);
- Wildlife mortality downstream of the Corna Valley;
- Personnel health status and safety conditions.

The main purpose of the TMF is to contain process water in a manner that allows it to be recycled to the plant, prevent accidental tailings and process water discharges to the environment, capture and contain contaminated waters from areas in the Corna Valley basin that are disturbed or impacted by mine operations and to provide a full containment of all flood events, including the Probable Maximum Flood (PMF), and to accommodate the safe long-term (hundreds of years) deposition of tailings even after mine closure.

These objectives of the TMF may be reached by complying with the following:

- Operation of the tailings distribution system will be performed in accordance with procedures TF-01 "Operations Start-up", TF-02 “Normal Operating Procedures – Tailings Deposition” and TF-03 “Normal Operating Procedures - Tailings Water Management”;
- Operation of the reclaim water system in accordance with procedures TF-01 and TF-02;
- monitoring of the water quality in the tailings in accordance with the operational and environmental requirements established for the current approved version of this Tailings Management Facility Plan; sampling, analysis and reporting of water quality in the tailings will be conducted in accordance with the Environmental and Social Monitoring Plan;
- monitoring and reporting groundwater and surface water quality at the predetermined control points downstream of the TMF, to ensure compliance with environmental and water management permits; such activities will be performed in accordance with the requirements of the Project Stream Flow Measurement Process Operation Manual and the Roşia Montană Environmental Database;
- monitoring surface water flow in the Corna Valley downstream of the TMF to ensure compliance with the requirements of the environmental permit and water management permit;
- reviewing and improving the procedure for tailings deposition in the TMF: TF-02, “Normal Operating Procedures – Tailings Deposition”;
- reviewing and updating the TMF water balance according to WT-01, “Preparation, Review and Periodic Update of Project Water Balance”
- maintaining records of the tailings that go into the impoundment with respect to flow and concentration;
- maintaining records of the sludge from the ARD treatment plant that goes into the impoundment with respect to flow and concentration;
- maintaining records of the flow of water recycled by pumping from the Secondary Containment Pond;
- maintaining and inspecting clean surface water diversion channels so that they continue to operate at design capacity;
- maintaining records of the flow of recycled water delivered to the processing plant;
- periodically reviewing and updating supernatant water quality standards in response to changes in operational and environmental requirements.

Inspections and Reporting

Operational inspections of the TMF will be completed on regularly scheduled intervals in accordance with procedure TF-04, “Tailings Management Facility-Operations Inspection.” This procedure addresses the detailed inspection requirements and schedule for inspection of the:

- embankment;
- impoundment;
- surface water ditches;
- diversion channels;
- tailings delivery and discharge system;

- tailings water reclaim system;
- compaction level of waste rock fill for dam raise;
- slope angle of downstream half of the tailings dam;
- monitoring instrumentation.

The majority of the inspections will involve assessment of the physical and operational soundness of these systems.
Standard reports will be completed in accordance with the protocols presented in procedure **TF-05, "Tailings Management Facility- Operations Reporting"** that summarize the inspections that have been made on the various facets of the TMF. Reporting will be completed on standard forms (see TF-05) to ensure that all the correct elements for the TMF are inspected and that there is uniformity and comparability in the inspection data even though different personnel may have performed the inspection.
After required reports are completed, they will be filed in accordance with **MP-12, "Management of Environmental and Social Management System Records."**
In addition, reports that are required by the mine permit will be forwarded to the necessary regulatory agencies in accordance in accordance with **MP-02, "Identification of Legal and Regulatory Requirements."**

4 Monitoring – Decommissioning Stage

Environmental and social monitoring activities for the decommissioning stage of the Project will also be defined via the process summarised in **Figure 6.1** and Section 4.2 of the RMGC *Environmental and Social Monitoring Plan* (**ESMS Plans, Plan P**). These activities will be documented in the final version of the *Mine Rehabilitation and Closure Plan* (the first iteration of which is provided as **ESMS Plans, Plan J**) and will include the monitoring of air quality; surface water and groundwater quantity and quality; potable water quality; noise and vibration; biota; and water treatment plant influent and effluent characteristics. Monitoring will continue until such sources are decommissioned and as otherwise necessary to address the potential impacts of decommissioning activities. These activities will include:

- detoxification, demolition, and removal of process plant structures and equipment, including the cyanide leaching system and tailings detoxification circuits;
- flushing and removal of the tailings delivery and distribution pipeline;
- removal of stored chemicals or fuels, including detoxification of any residual stored cyanide;
- decontamination, detoxification, and removal of all above-ground storage tanks;
- demolition and removal of concrete pads or berms associated with aboveground tanks;
- removal of all unused explosives and demolition and removal of the explosives magazine;
- removal of disused heavy equipment and spare parts or tyres;
- segregation and recycling or disposal of waste materials in accordance with the RMGC *Waste Management Plan* (see **ESMS Plans, Plan C**);
- installation of a soil and vegetative cover, closure spillway, final diversion ditches, and surface regrading at the Tailings Management Facility;
- regrading, installation of soils and vegetative covers, and final surface water diversion ditches at the waste rock stockpiles;
- installation of perimeter berms and bulkheads at the open pits, as required;
- potential breaching, regrading, and revegetation of the Cetate Water Catchment and Secondary Containment System dams, subject to acceptable water quality determinations;
- removal of electrical power lines and transformers, subject to post-mining land use needs; and
- purging, decontamination, demolition, and removal of the onsite sewage treatment facility (unless agreements are reached to turn the facility over to local authorities).[12]
-

In the decommissioning stage, environmental inspections will continue to be performed and environmental and social monitoring data collected and analysed in order to:

- identify any unanticipated changes or potential impacts to the environment and/or adjacent communities resulting from decommissioning activities;

[12] The Wastewater Treatment Plant will continue to be operated to treat ARD over the time-period specified by the final version of the *Mine Rehabilitation and Closure Management Plan*.

- prompt appropriate corrective and preventive actions to avoid or mitigate potentially adverse environmental and social impacts;
- ensure that RMGC maintains continuing compliance with currently applicable legal and regulatory requirements, permits, licenses, and environmental endorsements; and,
- ensure that proper procedures, management systems, and training are in place to prevent or respond to spills or other emergencies, as required by the Project Emergency Preparedness and Spill Contingency Plan (ESMS Plans, Plan I) and its supporting procedures.

Projected monitoring locations for water and air quality monitoring during the decommissioning phase of the Project will be essentially the same as shown on **Exhibit 6.2,** and will continue systematically as long as a potential source exists. Sampling frequencies may be reduced in appropriate circumstances, however, commensurate with operational status or the level or significance of the potential impact being monitored. Air monitoring stations will also be established at or near the boundary of the Project industrial protection area (including protected areas within the major project boundary) and downwind downwind of the process plant, major earthworks projects, and haul roads to monitor concentrations of dust and atmospheric pollutants from decommissioning activities, as noted in the *Air Quality Management Plan* (**ESMS Plans, Plan D**). Ambient noise and vibration surveys will also be performed within the Project industrial protection area as well as at specific structures and residential locations within specific protected areas or adjacent to the Project boundary as noted in the *Noise and Vibration Management Plan* (**ESMS Plans, Plan E**). Workplace air quality and noise and vibration monitoring will be conducted in accordance with the requirements of the RMGC Occupational Health and Safety Plan, in association with process plant operation, maintenance activities, heavy equipment use, and any blasting or demolition operations.

5 Monitoring – Closure Stage (Environmental Restoration and Post-Decommissioning)

Environmental inspection and monitoring during the "closure" (i.e. environmental restoration and post-decommissioning) phase of the Project will be required to confirm that site restoration and remediation measures have been properly implemented, are effective, and that the biological, chemical, and physical attributes of the site that are associated with the mining operation have been stabilised. These activities will also be formally defined in the final version of the *Mine Rehabilitation and Closure Plan* (ESMS Plans, Plan J) via the process summarised in Figure 6.1 and Section 4.2 of the RMGC *Environmental and Social Monitoring Plan* (ESMS Plans, Plan P). They will include the monitoring of surface water and groundwater quality and quantity; the biosoil; and (if still in commission) acid rock drainage water treatment plant influents and effluents, as necessary to fulfil the commitments of the final approved *Mine Rehabilitation and Closure Plan.* Air monitoring stations will also be maintained at the boundary of the industrial protection area, downwind of major environmental restoration projects to monitor concentrations of dust and atmospheric pollutants from soil preparation, topsoil placement, and other revegetation activities, as noted in the *Air Quality Management Plan* (ESMS Plans, Plan D). Exhibit 6.3 depicts the projected locations for surface and groundwater monitoring during the closure phase of the project. As noted in the Exhibit, several water sampling sites will be discontinued, as the primary focus of the sampling activity will be on the

5.1 Closure Phase Monitoring

The EU Mine Waste Directive (Preamble, Paragraph 22) states that "it is necessary to establish monitoring procedures during the operation and after-closure of waste facilities."

The environmental monitoring program described in the RMGC *Environmental and Social Monitoring Plan* will be an essential component of maintaining the currency and accuracy of the *Mine Rehabilitation and Closure Management Plan*, and, through the management review process described in *the Environmental and Social Management Plan,* will provide a feedback mechanism for managing the known and potential impacts resulting from construction, operation, and closure of the mine facility. The following objectives are considered during the development of the monitoring program for the Roşia Montană Project:

- development of supplemental baseline data;
- ensuring that construction, operation and closure activities proceed as required and environmental data are current;
- determining and maintaining the effectiveness of mitigation measures;
- evaluating the accuracy of the impact predictions for residual impacts;
- comparing changes in the environment against existing baseline (pre-development) conditions and distinguishing Project-related impacts from natural events, including seasonal changes;
- detecting any unacceptable impacts to enable the implementation of supplementary mitigation and/or contingency measures in a timely manner;

- providing Project-specific data on field performance of various cover materials, combinations and thickness, as well as revegetation species for closure;
- determining the effectiveness of proposed reclamation measures carried out as part of closure;
- ensuring compliance with applicable environmental regulations, and guidelines;
- ensuring compliance with permit/license requirements;
- ensuring accountability through a system of routine reporting to mine management, with summary reports being sent to applicable regulatory agencies;
- investigating environmental incidents and identifying follow-up requirements; and
- documenting and responding to public or regulatory agencies' concerns.

This program is described in greater detail in the *Roşia Montană Project Environmental and Social Management Plan* and in the *Environmental and Social Monitoring Plan*

5.1.1 Overview of Closure Monitoring

Environmental monitoring (consisting of physical stability monitoring, chemical stability monitoring, and biological monitoring) will be conducted during the construction, operations, and decommissioning and closure phases of the Roşia Montanã Project. An overview of the monitoring during the closure phase is provided below.

Environmental monitoring during closure will be required to confirm that the remediation measures have been properly implemented and are effective. Closure monitoring will be performed under the guidance of the RMGC Managing Director and key operations personnel and will include the following:

- environmental inspections during active periods of closure; and
- the collection/analysis and reporting of monitoring data.

Mine personnel will regularly visit the site to inspect the property during periods of inactivity and will be trained to understand the objectives for the monitoring program. Personnel will be trained to identify areas of concern (e.g., areas where revegetation has not taken place, signs of physical stress, erosion or instability) which may arise between regularly scheduled monitoring periods. Following final closure, the property will be inspected by a qualified individual on an annual basis in accordance with procedures cited in the *Environmental and Social Management Plan* until it can be determined that the closure objectives have been met.

According to **Error! Reference source not found.**, the Environmental Superintendent is responsible for the Monitoring Program.

5.1.2 Details of Closure Monitoring Program

During closure, the monitoring program will include specific monitoring for physical stability, chemical stability, and biological conditions.

The ground and surface water parameters of the standard NTPA 001/2005 are sampled monthly at the points indicated in **Error! Reference source not found.**. If necessary, both the number of sampling points and the frequency of sampling will be increased.

Other parameters such as physical and biological stabilityare indicated in the corresponding Management Plans.

5.1.3 Quality Assurance/Quality Control

The monitoring program described in the RMGC *Environmental and Social Monitoring Plan* will include the following measures to ensure a high degree of confidence in the data:

- strict adherence will be kept to standard sampling protocols (for groundwater and surface water) that were established during the environmental baseline study for collection, preservation, storage, handling and shipping of samples and for *in situ* sampling; documentation of the sampling program will include documentation of any unusual conditions or deviation from the protocols;
- a field quality control program will be performed, including submission of blank and duplicate samples, testing of chemical preservatives, checking contamination of sample bottles, and other equipment used in sample collection or handling, in order to detect other systematic or random errors that may be introduced between the time of sampling and analyses;
- a quality control program will be maintained for the laboratory analyses, including ensuring the certification status or quality capabilities of the contract laboratory;
- a timely review of analytical results will be performed to identify areas of concern (including methodology and potential impacts); and,
- regular monitoring reports will be prepared (at least annually for ongoing monitoring and monthly during construction) that describe the objectives for each of the components of the monitoring program, describe the methodology including deviations from protocols, present the results (tabulated and summarised) and make recommendations regarding the monitoring program and/or the approach to the development, operation or closure of the mine.

5.1.4 Reporting During Closure

A reporting system for monitoring results is described in the *Environmental and Social Monitoring Plan* that invokes the use of the inspection, performance verification, and management review processes described in the *Environmental and Social Management Plan* for the purpose of early detection of conditions that may require mitigation or changes in operating practices, as well as to provide performance data on the environmental control measures in place. The results of the monitoring activities will also provide data required by governmental and regulatory agencies to assess Project impacts and compliance with applicable laws and regulations.

As noted in the *Environmental and Social Monitoring Plan*, reports summarising the various components of the monitoring activities will be prepared on at least an annual basis that address the following:

- waste management;

- mine water effluent monitoring programs;
- dust controls;
- spill incidents (e.g., oil, gas, tailings);
- special studies; and
- environmental effects monitoring.

Reporting to regulatory agencies will be dependent on specific regulations and the mining permit. With the exception of accidents, spills, and other malfunctions, reporting to regulatory agencies will typically be on an annual basis. An annual reclamation and rehabilitation report will also be submitted to appropriate Romanian regulatory officials. This report will detail the reclamation work carried out over the past year and any proposed work for the coming year. Any Project changes that may result in revisions to the *Mine Rehabilitation and Closure Management Plan or* proposed rehabilitation work; and the results of any progressive rehabilitation work will be included in the report.

5.1.5 List of monitoring activities

In general terms, the monitoring program of the Roşia Montană Project will be carried out according to the Best Practice described in the IPPC Reference Document "General Principle of Monitoring"[b].

The period of time in which monitoring is required differs from object to object (pits, waste dumps, TMF etc.), and depends on the physical and chemical processes which may release contaminants into the environment (such as seepage transport mechanisms in the TMF), may affect the physical or structural stability (such as TMF dam stability) or may require corrective action (such as vegetation on cover systems). As a general rule, monitoring is required as long as a negative impact on the environment cannot be safely precluded and the situation has not yet reached a final steady state which is unlikely to deteriorate in the foreseeable future.

An after-closure period for monitoring and control of Category A waste facilities will be laid down proportionate to the risk posed by the individual waste facility, in a fashion similar to the requirements of the EU Landfill Directive[c] (although the landfill directive does not apply here, it is a good guideline on monitoring waste facilities).

Table 6-11. Roşia Montanã Project Closure Monitoring Requirements

Component	Location	Parameters	Methods	Frequency
PHYSICAL STABILITY				
Cetate, Cârnic, Jig, and Orlea open pits	Ditches / berms / fences / signs around pits	Access	Visual inspection of condition	• Routine inspection frequency during construction • Weekly inspection during operations, annually during post closure • Frequency subject to review based on inspection results
	Within open pits	Slope stability	Visual inspection for tension cracks, signs of failure, gully erosion; survey slope movement and water levels	
Cetate and Cârnic waste rock stockpiles and site waste disposal area	Ditches / berms / fences / signs	Access	Visual inspection of condition of stock	• Annual visual inspection and surveys of slope movement • Frequency may be increased based on inspection results
	Stockpiles and waste disposal areas	Slope stability	Visual inspection for tension cracks, signs of failure, gully erosion, revegetation progress	
	Stockpile and waste disposal areas	Cover stability	Visual inspection for sheet and gully erosion, alluvial fans, revegetation progress	
Tailings impoundment and water management structures	Ditches / berms / fences / signs	Access	Visual inspection of condition.	• Routine inspections (weekly) • Frequency may potentially be decreased in closure based on inspection results
	Tailings cover surface	Consolidation behaviour, differential settlements	Standard surveying techniques	• Annually • Frequency may potentially be decreased in closure based on inspection results
	Ditches, spillways and dam structures	Physical stability	Visual inspection for tension cracks, signs of failure, gully erosion, wind erosion, slope deformation, revegetation progress, seepage stains, survey rates of settlement; piezometers for monitoring water levels in impoundment area; weirs sampling and volumetric measurements for monitoring surface water discharge and water quality; well sampling for monitoring groundwater elevations and groundwater quality	• Yearly visual inspections, with quarterly sampling/ measurement of weirs, and groundwater wells • Frequency may potentially be increased or decreased based on monitoring results
TMF Dam	Tailings Management Facility	Physical stability	Instrumentation (vibrating wire	• Monthly measurements of embankment

Component	Location	Parameters	Methods	Frequency
			piezometers, survey monuments and slope indicators) installed to determine phreatic head and signs of lateral movement settlement	piezometers • Frequency may potentially be increased or decreased based on monitoring results
Surface Water Quality				
• General	All fourteen (14) established operational phase baseline water quality stations	General physical / chemical parameters used during the operational phase.	Grab samples	Seasonal (excluding winter) with the numbers of stations, parameters and frequency modified in accordance with pit flooding and tailings area results.
• Tailings management area discharge	Secondary containment pond outlet.	As per operational phase evolving to selected general phy/chem and metal parameters as area is rehabilitated	Grab samples	As per operational phase with reduced frequency (seasonal or annual) as area becomes rehabilitated.
• Waste rock stockpile and plant site runoff ponds	Sediment pond outlet (or drainage ditch when pond removed)	General phy/chem parameters plus metals scan (or as appropriated based on operational phase dam	Grab samples	Seasonal assuming progressive rehabilitation has been successful.
• Flooded pit	Flooded pit lake	General phys./chem. parameters plus metals scan (or as appropriate based on operational phase data)	Depth integrated composites, deep grabs	Seasonal with frequency and parameters reduced as pit lakes water quality stabilizes.
Hydrogeology:				
• Groundwater flow patterns	Groundwater monitors adjacent to pit areas	Groundwater levels	Depth to water level measurement.	Seasonal, subject to review based on water level recovery in relation to all aspects of site operation.
• Groundwater quality downgradient of waste rock stock piles	As per operational phase	General chemistry, metals scan and total phosphorus or as appropriate based on operational phase data.	Sampling of selected monitoring wells following current protocols.	Will be subject to review annually based on data results.

Component	Location	Parameters	Methods	Frequency
• Groundwater quality downgradient of tailings dam	As per operational phase	General chemistry and metals scan or as appropriate based on operational phase data.	Sampling of selected monitoring wells following current protocols.	Will be subject to review annually based on data results.
Air quality (during remediation works):				
• Dust, carcinogens, toxic particulates, NO_x	Around objects under remediation In affected settlements	Concentrations of dust, carcinogens, toxic particulates, NO_x in air	Air and dust samplers	Weekly during remediation works
• Dust, carcinogens, toxic particulates,	Downwind of uncovered waste dumps and TMF tailings beaches	Concentrations of dust, carcinogens, toxic particulates in air	Air and dust samplers	Weekly until cover has been placed on wastes
Noise (during remediation works):				
• Noise from remediation works	Around objects under remediation In affected settlements	Loudness, frequency distribution	Noise meters	Weekly during remediation works, under typical working conditions
Biological stability:				
• Vegetation on covers and other revegetated areas	All sites with revegetation (waste rock dumps, TMF cover, revegetated plant sites etc.)	Vegetation health, dominance of species, occurrence of weeds or unwanted species	Visual assessment	3 times during vegetation period (spring, summer, autumn)
• Fauna, flora	General survey, possibly in areas with special ecological niches	General floristic and faunistic surveys, Occurrence and/or abundance of rare and endangered species	Animals: visual observation, traps or collector systems Plants: Visual observation	Animals: depending on living habits of targeted species Plants: during vegetation period (spring-autumn)

[a] Government of Romania, 2002: *Ministerial Order (M.O.) 863 dated 26.09.2002 on Approval of the methodological guidelines applicable to the stages of the environmental assessment procedure*.
[b] European Commission (2003): Integrated Pollution Prevention and Control (IPPC) - Reference Document on the General principles of Monitoring, July 2003

[c] COUNCIL DIRECTIVE 1999/31/EC ON THE LANDFILL OF WASTE (EU Landfill Directive) 1999/31/EC