9. Non Technical Summary

EIA STUDY REPORT

Volume 19

MAY 2006
This document is a SUMMARY of the report on the EIA study. The details behind each statement contained in this document may be found in the relevant chapter of the full report on the EIA study.
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Chapter 9 Non Technical Summary

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1 General Information

The Roşia Montană Project (RMP) involves mining and processing the gold and silver ore deposits situated in the valley of Roşia Montană, in the Apuseni Mountains of Transylvania, Romania. Due to the nature of the activities and the possible impacts including social, environmental and economic, Romanian environmental legislation, that transposes the *acquis communautaire*, requires that the RMP be subject to the process of Environmental Impact Assessment (EIA).

An Environmental Impact Assessment (EIA) is a method by which a proposed development is assessed from a social, environmental and economic perspective. This allows whoever is interested the opportunity to understand, comment and take part in the decision-making process on the proposed development.

The RMP EIA has therefore been conducted in compliance with Romanian law and in accordance with European Directives and International Best Practice, and it comprises:

- An analysis of the likely effects of a proposed project on the environment and the population;
- The establishment of preventative measures and/or impact mitigation;
- The recording of these effects and measures in a report;
- The undertaking of a public consultation exercise on the project and report;
- The consideration of the report, and of comments received on it, when making the final decision; and
- Informing the public about that decision.

For a major technical project such as the RMP, an EIA can be a very large undertaking, and very technically demanding. In the case of the RMP, the full EIA report including the description of the existing conditions and the management plans, is in excess of 3500 pages.

Obviously this can be quite a challenge to read and digest. A Non Technical Summary (NTS) of the EIA has, therefore, been created in order to facilitate access to the information provided in the full EIA as required by the regulations in force. This includes:

1. A description of the project avoiding as far as possible the use of specialist technical terminology and detailed scientific explanations;
2. The methodologies used in the EIA to assess the project and, if any, significant uncertainty on the project, and its effect on the environment;
3. What are the predicted impacts on the environment;
4. The identification and description of the physical area where the impacts are felt;
5. What are the measures to reduce impacts on the environment and people,
6. The main conclusions resulting from the EIA;
7. A forecast of the standard and quality of life and the social conditions in the communities affected by the RMP;
8. The legal agreements within which the project is developed.
1.1 The background of Roșia Montană and the RMP

Roșia Montană is a commune covering 4200 hectares with 16 villages, one of which is also called Roșia Montană. The first written record of Roșia Montană dates from 6th of February 131 AD, and comprises a wax coated tablet found in one of the Roman-era mine galleries. From its origins Roșia Montană is linked with the gold that lies in its rocks.

Gold mining which has occurred almost continuously over the last 2000 years has influenced the social, economic, cultural and environmental conditions of Roșia Montană. Every governing authority, from the Romans and Austro-Hungarians to the present day Government of Romania has sought to exploit the mineral wealth of Roșia Montană. Numerous ethnic groups have in-migrated to take part in extracting the gold, subsequently influencing Roșia Montană with their own cultures.

Many of the impacts of this development and exploitation have been beneficial, such as the long history, the diversity of the religion and culture, economic welfare proven by the wealth of archaeological patrimony. Some of the impacts however have been negative.

Environmentally, past mining has caused serious problems including pollution of soils and streams, landscape scarring, and impact on land use and biodiversity. Also, there have been no significant attempts at environmental rehabilitation and no effective environmental controls to reduce the impacts.

Economically Roșia Montană owes its origins to mining and therefore became almost exclusively dependent on it for its income. As mining has declined in Romania and Roșia Montană since 1989 with dwindling State-funded support, so too has the quality of life in the community declined.

Socially and culturally, Roșia Montană is in decline as people leave to seek a better life elsewhere. Roșia Montană remains, despite its touristic potential, an isolated location that does not attract investments capable of reinvigorating the whole commune, with the exception of the potential for mining.

The RMP design includes opportunity to significantly improve the poor condition of the roads, water supply, waste water treatment, electricity supply and waste management systems. Also the RMP enables significant employment and income opportunities both to citizens and local governments. Many components of the RMP are also designed to enable the development of a local tourism industry. The existing environmental pollution will also be addressed by the RMP.

Roșia Montană Gold Corporation S. A. (the “Developer”) has documented in the RMP management plans that every effort will be made in cooperation with local authorities and the people of Roșia Montană to develop a range of non-mining activities which can support the social, cultural, environmental and economic welfare of the Community long after the mine has closed. From a community viewpoint this would comprise the greatest impact and benefit of the RMP.
### 1.2 Using the Non Technical Summary (NTS)

The **Non Technical Summary (NTS)** of the EIA of the RMP can be broken down into three broad parts – see table 1.1:

#### Table 1.1 The Components of the NTS

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
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</table>
| 1. The EIA study’s general framework | • EIA  
  • Introduces the RMP  
  • the regulatory framework governing the EIA  
  • public consultation.  
  • The geographical and natural setting in which the RMP is situated.  
  • Alternatives |
| 2. Description of the RMP | • Technological processes, installations, equipments, utilities and practices at different stages of the project: construction, operation, closure and post-closure. |
| 3. RMP’s impacts on the environment and prevention measures and/or impacts mitigation | • RMP’s impact on the environment  
  • How impacts can be controlled and managed  
  • The social and economic aspects of the RMP, the community’s current condition and how the RMP is likely to affect it.  
  • Risks and transboundary impacts |

Figure 1.1 graphically illustrates and summarises the structure of the NTS.

#### Figure 1.1 Structure of the Non Technical Summary

- **Sections 1 to 5** Describe the:  
  • Introduction,  
  • Roșia Montană Project (RMP),  
  • EIA process,  
  • Relevant policies and laws,  
  • Public consultation.  

- **Section 6** Describes the environmental setting of the RMP:  
  • Landscape,  
  • Soils and Land use,  
  • Water,  
  • Air,  
  • Biodiversity.  

- **Section 7** Describes the Project alternatives.  

- **Sections 8 – 11** Describe the RMP in relation to the:  
  • Environmental,  
  • Social – Economic, and  
  • Cultural aspects of Roșia Montană.  

- **Sections 12 – 15** Describe:  
  • Monitoring,  
  • Risks,  
  • Difficulties, and  
  • Transboundary impacts of the RMP.
1.3 The Project Ownership

The RMP is owned and managed by Roșia Montană Gold Corporation S.A. (RMGC or the “Developer”). RMGC is a joint venture between Gabriel Resources Ltd., a Canadian mining company, and National Company for Copper, Gold and Iron Minvest S.A. (Minvest), a company owned by the Government of Romania and three other shareholders as shown in Figure 1.2.

Figure 1.2 RMGC Shareholders

1.4 List of relevant licences / agreements to date for the RMP

Permits already received for the RMP are:

2. Roșia Montană Local Council Decision no. 45/19.07.2002 for approval of modified PUG for Roșia Montană commune, Alba County;
4. Environmental agreement no. 181/03.07.2002 for PUZ for industrial development zone Roșia Montană Gold Corporation SA;
5. Environmental agreement no. 179/03.07.2002 for PUG for the Roșia Montană commune.
2 The Roşia Montană Project (RMP)

The RMP essentially has two components:

1. Metal production activities and the technology used, and;
2. The social and environmental management of the RMP.

2.1 The RMP Mining Activities

The metal production component comprises the development, operation, closure and post-closure activities for the mining and processing of gold and silver ore. The timeline for these activities is presented in Figure 2.1.

Figure 2.1 The RMP Timeline

<table>
<thead>
<tr>
<th>1997</th>
<th>2000</th>
<th>2006</th>
<th>2007</th>
<th>2009</th>
<th>2026</th>
<th>2029</th>
<th>Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geology</td>
<td>Design</td>
<td>Authorisation</td>
<td>Construction</td>
<td>Operation</td>
<td>Closure</td>
<td>Post-Closure</td>
<td>Land Use</td>
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<tr>
<td>Exploration</td>
<td>and EIA</td>
<td>&amp; Public Debate</td>
<td></td>
<td></td>
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</table>

When operating, the RMP will process approximately 13 million tonnes of gold and silver ore per year for about 16 years. The average grade (amount per tonne) of the ore is:

- Gold 1.46 grams per tonne (or g/t);
- Silver 6.95 grams per tonne

Estimations concerning yearly gold and silver production on average are presented in table 2.1 and estimations concerning mineral reserves are presented in table 2.2.

Table 2.1 Expected average production per year of gold and silver

<table>
<thead>
<tr>
<th>Metal</th>
<th>Grade</th>
<th>Ore mined per year</th>
<th>Ounces produced</th>
<th>Tonnes produced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>1.46 g/t</td>
<td>13 million tonnes</td>
<td>500,000</td>
<td>16</td>
</tr>
<tr>
<td>Silver</td>
<td>6.95 g/t</td>
<td></td>
<td>1.8 million</td>
<td>58</td>
</tr>
</tbody>
</table>

*Figures rounded off for simplicity. Ounces in Troy Ounces.*

Table 2.2 Estimated ore reserves of the Roşia Montană Mine

<table>
<thead>
<tr>
<th>Reserve estimate</th>
<th>Grade</th>
<th>Proven in ounces</th>
<th>Probable in ounces</th>
<th>Total in ounces</th>
</tr>
</thead>
<tbody>
<tr>
<td>215 million tonnes</td>
<td>1.46 g/t Au</td>
<td>5,900,000</td>
<td>4,200,000</td>
<td>10,100,000</td>
</tr>
<tr>
<td></td>
<td>6.9 g/t Ag</td>
<td>32,800,000</td>
<td>14,000,000</td>
<td>47,800,000</td>
</tr>
</tbody>
</table>

*The terms “proven” and “probable” indicate the level of information available to define the reserves and indicate a sufficient level of definition for the total reserve figure. In accordance with the EU code for the reporting of mineral results, mineral resources and mineral reserves, October 2001.

Table 2.3 presents the size of the local administrative areas and the land required by the proposed RMP. Table 2.4 presents the amount of land area required for the open pits of the
RMP in comparison to that currently being mined at the site of the proposed pits by the existing State-owned mining operation.

### Table 2.3 Land required\(^1\) for the RMP

<table>
<thead>
<tr>
<th>Locality</th>
<th>Area of administrative unit (ha)</th>
<th>Land required for the proposed RMP (ha)</th>
<th>% of Locality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roşia Montană Local Council</td>
<td>4 200</td>
<td>1 054</td>
<td>25</td>
</tr>
<tr>
<td>Abrud Local Council</td>
<td>3 500</td>
<td>170</td>
<td>4.8</td>
</tr>
<tr>
<td>Bucium Local Council</td>
<td>8 778</td>
<td>32</td>
<td>0.4</td>
</tr>
<tr>
<td>Câmpeni Local Council</td>
<td>8 520</td>
<td>1.6</td>
<td>0.02</td>
</tr>
<tr>
<td>Total</td>
<td>24 998</td>
<td>1 258</td>
<td>5.0</td>
</tr>
</tbody>
</table>

### Table 2.4 Land area to be mined

<table>
<thead>
<tr>
<th>Locality</th>
<th>Land area to be mined by the proposed RMP (ha)</th>
<th>Of which is currently impacted (ha)</th>
<th>% land required already mined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roşia Montană Local Council</td>
<td>205</td>
<td>95</td>
<td>46</td>
</tr>
<tr>
<td>Abrud Local Council</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bucium Local Council</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Câmpeni Local Council</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>205</td>
<td>95</td>
<td>46</td>
</tr>
</tbody>
</table>

Once the mining operations finish, the mine will be closed. To ‘close’ a mine means to make the area (the site) stable and safe for both people and animals, in balance with the ecology of the area and aesthetically improved. In practice, closure activities will begin from the outset of the RMP so that it is constructed and operated in a way that makes closure easier and more effective.

Closing a mine involves cleaning it up, rehabilitating the land and returning the site to a productive end use. This requires that the site is physically, chemically and biologically stable.

After-care is needed to ensure that closure works remain effective in the long term. The after care of the mine may last decades depending on the specific circumstances of the mine at the time of closure. The RMP includes an environmental monitoring programme to ensure no legacies exist from the operations.

Funds to cover closure of the RMP will be covered by a financial guarantee to ensure money is available for this work, irrespective of any change in economic conditions.

The proposed new mine will consist of four open pits mined using conventional modern equipment. The ore will be processed on-site to produce an impure gold and silver metal product. The four pits correspond to four main ore deposits known as Cetate, Cîrnic, Orlea and Jig. The sizes of these pits are shown in Table 2.5.

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\(^1\) This includes pits, waste dumps, tailings management facility and all supporting infrastructure such as access roads, water catchment dams for environmental protection, water supply to the site, and the new road to Rosia Poieni. This land take reflects the current preferred alternatives for the layout of the project. The results of the public consultation may move this layout around. All numbers over 10 are rounded to the nearest whole number.
Table 2.5  Size of the Proposed Pits for the RMP

<table>
<thead>
<tr>
<th>Pit</th>
<th>Dimensions of pit at surface (metres)</th>
<th>Area of land used by pit (Hectares)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Longest diameter</td>
<td>Shortest diameter</td>
</tr>
<tr>
<td>Cetate</td>
<td>1 226 m</td>
<td>621 m</td>
</tr>
<tr>
<td>Clunic</td>
<td>1 144 m</td>
<td>987 m</td>
</tr>
<tr>
<td>Orlea</td>
<td>1 039 m</td>
<td>418 m</td>
</tr>
<tr>
<td>Jig</td>
<td>647 m</td>
<td>291 m</td>
</tr>
<tr>
<td>All</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

2.2 Impacts of the RMP

There will be social, environmental and economic impacts because of the RMP. Some will be beneficial and some negative. Some impacts affect only the site area and some have a wider influence. All these components are summarised in this NTS and they are examined in depth, together with all required mitigation measures, in the main part of the EIA report.

Foreign direct investment to date for the RMP as of December 31, 2005 was in excess of US$ 150 million. This has all been spent in the pre-authorisation stage. Future construction costs for the RMP are estimated at $US 638 million during the construction years, with further capital investments of $US 284 million during operation and closure. Operational expenses are expected to exceed $US 2,000 million.

The RMP promises the benefits of employment, both directly for RMGC and also indirectly as a result of the demand for services and supplies. Table 2.6 summaries these.

Table 2.6  Expected employment at the RMP

<table>
<thead>
<tr>
<th>Job Creation Factor</th>
<th>Job numbers on average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current employment</td>
<td>300</td>
</tr>
<tr>
<td>Expected direct during construction phase</td>
<td>1200</td>
</tr>
<tr>
<td>Expected direct during operation phase</td>
<td>563</td>
</tr>
<tr>
<td>Expected indirect during operation phase</td>
<td>Exceeding 5500</td>
</tr>
</tbody>
</table>

The RMP will use technologies that involve hydrochloric acid and cyanide. Management and use of these and other toxic chemicals require compliance with Romanian and European laws and use of modern international best safety practices to avoid pollution.

The RMP requires land in order to be developed. As noted above, much of the land to be mined is an existing source of pollution and because of the proposed management of water and wastes, the RMP will have a beneficial impact by controlling and treating discharges for the first time.

However, this need for land also causes one of the most significant direct impacts – the need for resettlement or relocation (see Table 2.7) of 974 households. This sensitive issue is dealt with by a dedicated team and department within RMGC, the Community Relations Department. The plan to guide the resettlement and relocation of the households is based upon the World Bank’s involuntary resettlement recommendations and in line with Romanian laws and EU Directives. The guiding document for this process is the Resettlement and Relocation Action Plan, the RRAP.

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1 World Bank Operational Policy OP4.12
2 Resettlement and Relocation Action Plan (RRAP) - see [www.rmgc.ro](http://www.rmgc.ro)
Of the people affected by the resettlement and relocation process 42% have already chosen to take the relocation package as guided by the RRAP. The remaining 58% of the immediate community are awaiting the results of this EIA. Most of these wish to move. Some of them do not. The final layout of the RMP will take into consideration the wishes of those who wish to move and those who wish to stay. The Alternatives Chapter of the EIA outlines some of the possible reconfigurations available for the final RMP layout.

Table 2.7  Resettlement vs. Relocation

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
</table>
| **Resettlement** | Project-affected households choosing a new house build for them by the RMP in one of the resettlement sites.  
Resettlement site 1: Piatra Alba in the Roșia Montană valley. This will be built in the style of a mountain village with modern facilities and would be built in time for people to resettle before the RMP is implemented.  
Resettlement site 2: La Recea in Alba Iulia. This will be built as modern houses in a residential zone in the county town on Alba. |
| **Relocation**  | Project-affected households move to a new house of their choice using a cash compensation from the RMP. |
3 The Environmental Impact Assessment Process

The EIA study report has been prepared by an independent team of Romanian and International consulting companies.

To date, the main focus of the EIA process has been to ensure that all potential impacts of the RMP on the natural and human environments have been identified, fully assessed, reported and when necessary, mitigated or managed. As a result, the EIA includes both environmental and social assessments. The EIA also provides a mechanism for ensuring that stakeholders’ concerns are represented in RMP decision-making.

The EIA process began in 2000 when the RMP moved from a purely geological exploration phase into a feasibility study phase. Environmental work commenced with preliminary assessment of the sensitivity of the site and its setting and gathering of environmental information on the area. The RMP development has advanced through scoping, pre-feasibility, final feasibility and basic engineering studies. During that time, the preparatory EIA studies continued to guide formulation of the design and layout of the RMP, leading up to the commencement of a formal EIA study under Romanian environmental regulations.

The EIA process has used a range of approaches to identify, assess, mitigate and manage the likely impacts associated with the RMP. These have ranged from stakeholder consultations and environmental monitoring surveys to sophisticated modelling of predicted emission levels.

The approaches regarding mitigation of the impacts of the RMP are described in the box below.

Box 3.1 Impact mitigation approaches in the RMP

Impact Mitigation in the Roșia Montană Project has used a hierarchy of approaches:

- The primary objective was to avoid impacts if possible by ‘designing-out’ potential negative impacts, for example through decisions on favourable locations and layout or through the use of technologies that would avoid harmful emissions;
- If it was not possible to avoid an impact, then impacts were minimised at their source, for example through reducing waste or minimising the land ‘footprint’ required for RMP facilities;
- Where impacts could not be minimised at source, they were managed on site, for example through erosion control, protective fencing or water management;
- Where none of the above were practical, impacts were managed at the affected ‘receptor’, for example through the resettlement and relocation of Project affected communities;
- Some impacts are completely unavoidable and have required ‘restoration’ mechanisms such as the closure and aftercare of the mine site and the tailings management facility;
- Some impacts are positive in nature (for example, employment opportunity and water quality improvement) and the EIA identified ways to maximise these benefits.

Figure 3.1 presents a schematic overview of the EIA process.
Figure 3.1 Overview of the EIA Process

- **EIA Scoping**
  - Identify potential impacts & Evaluate alternatives

- **Predict magnitude of impacts**

- **Assess significance of impacts**

- **Evaluate mitigation options**

- **Prepare EIA report (and management plans)**

- **Submit the EIA Report**

- **EIA PCDP Process**

- **Environmental Endorsement Approval**

- **Management plans implemented**

- **Audit & corrective actions**

- **Baselines studies**

- **Project Definition & Interaction with Design Process**

- **Consultation with Stakeholders**
In addition to the processes outlined above, and the process of public consultation and disclosure, described in Section 5 of this document, two other important processes are included within the EIA. These are:

- **Ongoing EIA-Design interaction**: The EIA and design engineering teams have worked together closely throughout the development of the RMP, particularly in key areas such as dam design, water management, undertaking environmental risk assessments and developing landscaping and post-closure management measures.

- **Baseline data collection**: Through a combination of field surveys, desk studies and public consultation, the collection of baseline information has been a vital EIA activity for over six years. Some of the main baseline information collection studies are summarised in the box below:

**Box 3.2 Baseline information collection**

<table>
<thead>
<tr>
<th>Baseline Information Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Water Baseline Report</td>
</tr>
<tr>
<td>• Biological and Bacteriological Report</td>
</tr>
<tr>
<td>• Sediment and Water Sample Analysis Report</td>
</tr>
<tr>
<td>• Meteorological Baseline Report</td>
</tr>
<tr>
<td>• Hydrogeological Baseline Report</td>
</tr>
<tr>
<td>• Air Quality Baseline Report</td>
</tr>
<tr>
<td>• Noise and Vibration Baseline Report</td>
</tr>
<tr>
<td>• Soil Baseline Report</td>
</tr>
<tr>
<td>• Ecological Baseline Report</td>
</tr>
<tr>
<td>• Health Assessment Baseline Report</td>
</tr>
<tr>
<td>• Cultural/Archaeological Heritage Baseline Report</td>
</tr>
</tbody>
</table>

### 3.1 RMGC’s Approach to the Development of the RMP

On the basis of the EIA, a series of Management Plans has been developed and will be implemented to ensure that the RMP achieves the necessary environmental and social performance. A sophisticated *Environmental and Social Management System* guides the implementation, monitoring and improvement of environmental and social management and impact mitigation plans through the life of the RMP. This system is outlined in Figure 3.2.
The Environmental and Social Management System includes a range of 16 specific management plans that sets out RMGC’s environmental, socio-economic, and public consultation and disclosure commitments related to particular issues.

**Figure 3.2  Roşia Montană Gold Corporation’s Environmental & Social Management System**
4 Policy and Regulatory Context

The RMP received its Exploitation Concession Licence in 1998, with the objective of developing, constructing and operating a gold and silver mine within the Roşia Montană Mining Perimeter. Romania has undergone the process of adopting the full body of EU law – the so-called *acquis communautaire* – as well as restructuring and refining its own national laws and at this stage the vast majority of EU environmental laws have been transposed into Romanian law. This means that the EIA has been undertaken not only in compliance with Romanian law, but also within a regulatory framework consistent with EU requirements and standards.

The key items of Romanian legislation related to EIA policy, procedures and requirements are summarised in Box 4.1:

Box 4.1 Romanian legislation relevant for the EIA

<table>
<thead>
<tr>
<th>Romanian legislation relevant for the EIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIA procedures are set out in Governmental Decision 918/2002 and the following Ministerial Orders provide procedural frameworks for EIAs:</td>
</tr>
<tr>
<td>▪ <strong>Ministerial Order 860/2002</strong> for approval of the environmental impact assessment and the issuance of environmental agreement procedures;</td>
</tr>
<tr>
<td>▪ <strong>Ministerial Order 863/2002</strong> for approval of the methodological guidelines applicable to the stages of the environmental impact assessment framework procedure;</td>
</tr>
<tr>
<td>▪ <strong>Ministerial Order 864/2002</strong> for approval of impact assessment and public participation in the decision-making procedures for projects with transboundary impact.</td>
</tr>
</tbody>
</table>

These regulations transpose EU EIA legislation into Romanian law, and as such also reflect the UN-ECE Convention on Environmental Impact Assessment in a Transboundary Context (the Espoo Convention), which was ratified by Romania through Law no. 22/2001, and the Aarhus Convention concerning access to information, public participation in decision making and access to justice in environmental issues ratified through law 86/2000.

Under Annex 1.1 of Ministerial Order 860/2002, proposed mining activities require an EIA. Moreover, given the project’s size, the environmental agreement would have to be issued through a Government Decision according to article 19 or the Government Emergency Ordinance number 195/2005 concerning environmental protection.

In addition to meeting current Romanian and EU legal requirements, RMGC has adopted the more stringent requirements regardless of whether they are implemented in Romanian law, EU legislation, World Bank guidelines or industry best practice and best available techniques (BAT).

The EU Mine Waste Directive\(^1\) that specifically addresses the management of mining wastes was published in the Official Journal of the European Union on the 11th April 2006 and

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entered into force as an EU Directive in May 2006. The Directive is accompanied by a “Best reference” document (BREF-MTWR) that sets out “Best Available Techniques” (BAT) for dealing with mining wastes. These documents have already been referenced by the Romanian authorities in the EIA Guidelines issued for the RMP in May 2005 and have been fully adopted for the RMP.

As well as Romanian and EU regulatory requirements, RMGC follows or exceeds the requirements of the World Bank guidelines\(^1\). The guidelines of the World Bank address a number of issues not fully addressed by Romanian and EU law, and provide an important framework for the RMP particularly in relation to the resettlement and relocation of local residents who own property likely to be affected by the RMP. Additionally with regard to financing the RMP, RMGC has followed the requirements of the ‘Equator Principles’ which have been adopted by many of the world’s leading financial institutions\(^2\).

**Box 4.2 International guidelines relevant for the RMP EIA**

**Other guidelines and agreements that have been taken into account by the EIA include:**

- International Council on Monuments and Sites (ICOMOS)
- UNEP/ICME International Cyanide Management Code for the Manufacture, Transport and Use of Cyanide in the Production of Gold
- International Commission on Large Dams (ICOLD)
- The biodiversity conventions outlined in chapter 4.6 of the EIA study report.

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\(^2\) http://www.equator-principles.com
5 Public Consultation and Disclosure

Public consultation is essential for developing an understanding of how a project may affect the public concerned (stakeholders), and obtaining their ideas and suggestions on how impacts can be managed. Feedback from consultation processes has a significant influence on both project design and its implementation. Consultation also provides an opportunity for local people directly affected by the RMP to become better informed about current and planned RMP activities.

A distinction is made regarding the public consultation and disclosure process required for the EIA itself, and the public consultation and disclosure over the lifetime of the mine following the EIA process. Public consultation and disclosure during the EIA follows strict legal requirements as stipulated by the Romanian authorities and, where relevant, the EU Directives and international conventions, such as Espoo and Aarhus Conventions.

The public consultation and disclosure plan with respect to the EIA is to encourage and enable interested and relevant concerned public (stakeholders) to influence the decision making process of the RMP design and its implementation. This plan is called the EPCDP – Environmental Impact Assessment Public Consultation and Disclosure Plan – and is available as part of the EIA documentation. Even though the EPCDP follows legal requirements, its most important role is to enable the concerned public to fully understand the RMP and its consequences on the environment and local economic and social conditions.

In support of the EIA’s public participation program (EPCD), RMGC has initiated an ‘Open Door’ program, including a greenline (08008 ROȘIA = 0800 876742), site visits, technical workshops, information centres and exhibitions, multi-media campaigns, fact sheets, leaflets and brochures, as well as surveys, interviews and questionnaires. These activities are designed to make it as easy as possible for people to get involved in the RMP such that they can understand it and contribute to the decision making process regarding the RMP.

Consultation does not stop once the EIA process is completed. Public consultation will continue throughout the detailed design, construction, operation and closure phases of the RMP. The consultation process so far has included over 5 years of activities as summarised in Box 5.1.

Box 5.1 Consultation activities to date

<table>
<thead>
<tr>
<th>Consultation Activities to Date have Included:</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Publication of a local ‘Gazette’</td>
</tr>
<tr>
<td>▪ Holding workshops with local residents &amp; community leaders</td>
</tr>
<tr>
<td>▪ Holding local community-level and individual consultations on resettlement &amp; relocation issues</td>
</tr>
<tr>
<td>▪ Holding interviews with businesses within the Project Affected Area</td>
</tr>
<tr>
<td>▪ Consultations on cultural heritage with experts, regulators and religious leaders</td>
</tr>
<tr>
<td>▪ Public meetings, technical seminars &amp; presentations</td>
</tr>
<tr>
<td>▪ Project presentation and site visits with participants including: the Minister of Environment from Hungary, the Cultural Commission of the Parliamentary Assembly of the Council of Europe, representatives of UNESCO, and a Romanian Parliamentary Committee.</td>
</tr>
</tbody>
</table>
Consultation to date has identified a number of key issues, including both perceived benefits and concerns related to the RMP. These issues relate to the environment, employment, property acquisition and compensation, resettlement and relocation, public health and safety, infrastructure, and the impact of construction and RMP associated traffic on local residents. Concerns relating to these and other issues have been fed into the EIA and have resulted in modifications to the RMP design.

The RMP will continue consultation and dialogue with stakeholders during the construction, operation and closure of the RMP. Key elements of the ongoing public consultation and that will continue after the EIA procedure is complete are outlined in Box 5.2.

**Box 5.2 Ongoing and planning of future consultation**

<table>
<thead>
<tr>
<th>Ongoing and Planned Future Consultation will Include:</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ The public consultation period to allow the public concerned (stakeholders) to review and provide comment on the EIA study report. The Romanian government will then issue a summary of public input. RMGC will then have to submit an appendix to the EIA report to respond to the public comments or proposals – see the EIA Public Consultation and Disclosure Plan for details,</td>
</tr>
<tr>
<td>▪ Continued Consultation regarding impact on local property owners and social impact mitigation,</td>
</tr>
<tr>
<td>▪ Continued Consultation regarding the project’s operation if or when the project is approved,</td>
</tr>
<tr>
<td>▪ Government and public concerned consultation on the post-closure land use,</td>
</tr>
<tr>
<td>▪ Ongoing consultation with local and central government regarding planning and zoning requirements.</td>
</tr>
</tbody>
</table>
Box 5.3 Consultation concerning resettlement and relocation

An Example of RMP Consultation – Resettlement and Relocation

Public Consultation and Disclosure

One of the key facets of a well-developed project is the involvement of Affected-Persons in the development of the project. However, it is recognized that not all methods of consultation and disclosure are effective for all people. In order not to miss any sections of the community, a variety of consultation and disclosure tools was employed. The development of the Resettlement and Relocation Action Plan (RRAP) made use of the following:

- Household interviews;
- Household (socio-economic and livelihood) and local business surveys;
- RMP fact sheets;
- Technical information sessions and public meetings;
- Regular meetings with the mayor, Local Councils of Roșia Montană and Abrud, and local leaders;
- Operation of a Community Information Centre in Roșia Montană; and,
- Open houses in resettlement model houses.

Resettlement versus Relocation

As a result of early public consultation, it was determined that given the choice, some residents would prefer to stay near Roșia Montană in a resettlement site developed by RMGC, while others would prefer to move from the area altogether. As a result, RMGC incorporated both options into the RRAP. The RRAP provides for equal compensation for Project-Affected People whether they choose to resettle or to relocate. Affected People can either use this compensation to resettle on a resettlement site at Piatra Alba (in Roșia Montană commune) or in Alba Iulia, or receive the compensation in cash and relocate to a location of their choice. The locations of the resettlement sites were also arrived at through extensive consultation, which determined that some settlers wished to build their replacement housing themselves.

Revising Company Policy as a Result of Public Consultation

From the end of 2002 through May 2004, RMGC had been purchasing houses and relocating residents in accordance the RRAP. However, through a variety of consultations with the public, it was determined that the company’s strategy regarding compensation of buildings was causing discontent, in particular that compensation was based on the number of inhabitants in the home and the Romanian minimum dwelling size standard - for example, a household of 4 should live in 115 m², thus compensation would be calculated for a surface of 115 m². This rewarded people with large families or small houses and caused resentment among owners of larger houses.

As a result of this discontent, RMGC stopped purchasing houses in May 2004 and re-evaluated the RRAP in consultation with community representatives, with support from external consultation specialists. This process eventually led to the whole compensation and resettlement package being revisited, including changes to the compensation basis.
6 The Roșia Montană Project (RMP) setting

As discussed previously, the EIA includes extensive baseline studies of the natural and human environment on and around the RMP site carried out by Romanian and international expert teams. These are documented in a series of very detailed reports that form Appendices to the main EIA report. The following section provides an overview of the RMP setting, encompassing the existing natural and human environment.

The RMP is situated near the village of Roșia Montană in Albă County, approximately 50km (80km by road) northwest of the county capital of Albă Iulia in west-central Romania.

Figure 6.1 Location of Roșia Montană Mine Project
6.1 The Natural Environment

The RMP site is located within a region known as the Golden Quadrilateral in the Metaliferi Mountains, which are part of the larger regional mountain area called the Apuseni Mountains of Transylvania.

Landscape

The RMP is located in an upland area that includes portions of the Roșia, Corna and Sâliște Valleys and is centred on the village Roșia Montană. The topography of the RMP area dominated by the main south to north valley of the Abrud River, into which the three valleys connect from the east. The ridges between these valleys and the peaks to the east effectively form a natural bowl around Roșia Montană, isolating it from the wider landscape to the east, north and south. The western ridgeline of the Abrud Valley provides further isolation of the RMP area to the west.

In Roșia Valley, the existing landscape is degraded by the historic and current mining activity and to a lesser extent so too is the Corna Valley. Both valleys have been significantly and permanently altered by previous mining operations, and will be subject to further alterations resulting from the construction and operation of the proposed mine and associated facilities.

Figure 6.2 shows a view of Roșia Montană towards the existing Roșiamin mine.

Figure 6.2 View over Roșia Montană village towards the Roșiamin mine

Soils and Land Use

The steep V-shaped valleys and the thin, acidic nature of the soils limit agricultural use. Besides mining the only other significant land use is subsistence agriculture. Agricultural
land uses include cattle grazing on the higher slopes and cultivation of root crops such as potatoes and orchards on the lower slopes such as the floor of Corna valley.

Semi-natural forests surrounding the settlements are used for collection of firewood and forest fruit such as berries. These forest remnants have been degraded through over-use and poor or lack of management.

The land area where the mine is to be situated comprises largely of land that is directly affected by past, recent or current mining activities. The waste rock piles have not been remediated and include extensive unstable slopes and are one of the main sources of water pollution. Apart from current mining operation there is no productive use of this mined land.

**Water**

The two principal surface watercourses in the RMP area are the Roșia and Corna Streams. Both drain into the Abrud River which subsequently flows into the Aries River near Câmpeni (see figure 6.4). The water quality of the streams in the RMP area is poor as a result of polluted water (“Acid Rock Drainage” – See Box 6.1) discharging from the old underground mines, drainage from mine waste and tailings, and other discharges from farms, dwellings, and other industrial operations.

The surface waters affected by historical mining including the Abrud River are so polluted that they are of no use to communities, nor are they capable of supporting fish or diverse aquatic life. However, downstream of the proposed RMP site, water quality in the Aries River is generally good, although impacted by mining-related contamination.

Some groundwater exists in shallow superficial unconsolidated rock deposits across the RMP area and this may feed springs and surface water flow. No evidence has been found of any significant deep groundwater movement. Private drinking water sources are either from tapped springs on the sides of the valleys, or from shallow hand-dug wells. Overall, the groundwater quality is below several Romanian and EU drinking water quality standards and may be of concern for public health with respect to heavy metal content.

The lakes in the area are artificial and were mainly built in the 18th century as water storage ponds for gold mining activities. They do not play a significant role in the local hydrology. Substantial concentrations of mercury have been detected in some of the lakes but it is not commonly detected in other waters associated with the RMP area. It is most likely that the mercury stems from historic gold processing activities where it would have been used to extract gold.
Box 6.1 Acid Rock Drainage

Acid Rock Drainage (“ARD”)

When rock that contains sulphide minerals (usually pyrite or iron sulphide) comes in contact with air in the presence of water and bacteria, the sulphide materials undergo a chemical change which can result in the creation of an effluent, commonly known as acid rock drainage or ARD, which contains sulphuric acid and sulphate. This can impact streams by making them more acidic and in sufficient concentrations, can kill aquatic plants, fish, and other aquatic life.

In addition to making streams acidic, the ARD can also dissolve minerals present in the rock. When these dissolved minerals come in contact with water, from rain for example, they are carried into the surface water and groundwater. Some metals like zinc, copper, arsenic, cadmium, mercury, selenium and lead, in sufficient concentrations, can pollute drinking water, and seriously affect aquatic wildlife and habitat as well as rendering the water unfit for human and animal consumption without relatively complex treatment.

Historic mining in Roşia Montană has resulted in highly ARD-polluted water in both the Roşia and Corna Streams, which also continuously contributes to the pollution of the Abrud River. The results of ARD are visibly demonstrated by the red colour of Roşia Stream.

The photo in figure 6.3 shows the existing Acid Rock Drainage in Roşia Montană. The red colour is largely from the high iron content. Environmental monitoring of this site has been conducted by RMGC since 1998. This data has supplemented that provided by the authorities for the EIA study. This data has also been used as a basis for the development of the RMP’s Environmental and Social Management Plans.

Figure 6.3 Existing ARD in Roşia Montană due to past mining practices
Figure 6.4  Map of river systems of the RMP area

Air
A comprehensive air-monitoring programme showed that there are no major industrial pollution sources on the RMP area. Air quality in the area is good and all parameters fall within legislative requirements.
Biodiversity
The RMP area contains no nationally or internationally designated wildlife or biodiversity areas. It comprises a wide range of landscape, soil and vegetation types. The soils and vegetation are a direct reflection of the topography, geology and climate of the area. As a result vegetation patterns generally follow the linear arrangement of valleys and ridges.

Baseline studies show that both the landscape and natural habitats have been significantly influenced by human activities. Their deterioration is due to a range of factors including:

- Former and current mining activities and related pollution, including ARD;
- Transformation of natural systems to meadows;
- Establishment and development of human settlements and planted forests;
- Development of semi-natural systems, such as man-made lakes.

The existing operational Roșiamin mining site and Tailings Management Facility (“TMF”) in the Săliște Valley are highly-impacted areas with complete habitat loss.

Human activities over a long period of time have resulted in significant changes to the local flora. Consequently, the number of habitats of ecological interest is low. Three sites within or adjacent to the RMP industrial zone contain environmental features that can be considered significant as outlined below.

Box 6.2 Location of points of ecological interest near the RMP

<table>
<thead>
<tr>
<th>Nearest Locations of Ecological Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tăul Mare Rock Outcrops</strong></td>
</tr>
<tr>
<td>Located northeast of Roșia Montană, on the high points of land immediately outside the RMP industrial zone. This area is comprises of a mixture of habitats, including open cliff habitats that are not found elsewhere within the RMP Area. The rock outcrops provide habitat for several species of herbs, grasses and lichens, small mammals and birds such as buzzards. Although man-made, Tăul Mare Lake provides habitat for a number of aquatic species, including crayfish, frogs and toads, as well as serving as a source of water for local wildlife. From a biodiversity and landscape perspective, this area represents the most significant ecological feature in the RMP Area.</td>
</tr>
</tbody>
</table>

| **Virtop Valley Forest** |
| Located adjacent to the northwest section of the Roșia Valley and well outside the RMP area. This complex of diverse vegetation communities includes some of the best examples of mixed deciduous forest in the general RMP Area as well as a Norway spruce plantation. The forest provides habitat for resident woodpeckers such as white-backed woodpecker, middle-spotted woodpecker, black woodpecker, grey-headed woodpecker and green woodpecker, as well as amphibian species such as fire salamanders. |

| **Săliște Valley Beech Forest** |
| The upper catchment of this valley contains the largest contiguous blocks of Beech forest. Whilst adjacent to the RMP area, it lies outside the industrial zone of the RMP. These blocks contain most of the flora and fauna species associated with the Beech forest community, and represents the best examples of this climax forest type in the RMP Area. |
7 Alternatives for and within the Roşia Montană Project

Under Romanian and EU requirements for an EIA, the consideration of alternative options for development for an entire project as well as specific aspects of a project is a requirement of the EIA process. These options must be viable and subject to a sufficient level of environmental analysis to assist in deciding upon the appropriateness of the proposed project design.

Typically, development options include the location of the project and the technology or processes that may be used. Uniquely, the location of a mining project is dictated by geology and the presence of a mineral resource to be exploited. Therefore alternative options are also limited by geology.

Geological investigations are followed by studies to outline the mine project design and mine plan. These studies structure the mineral resources into an economically viable mining operation. The feasibility study includes an initial overview of potential environmental and social issues to assist in deciding whether or not to proceed with the project.

The feasibility study also includes the identification, evaluation and selection of a number of alternative project designs. It also provides a basis for the development of the EIA and the detailed engineering design.

The EIA considers project alternatives from a broader perspective than the strictly technical focus used in the preparation of an engineering feasibility study. The EIA includes assessments of alternatives to the RMP, including a “no project” alternative and other economic initiatives. Analysis showed that the range and scale of socio-economic, cultural, and environmental benefits brought by the RMP are not able to be delivered by realistic alternative development possibilities.

However, the socio-economic and even environmental benefits of the RMP have to be compared against the risks and disadvantages. This includes the use of cyanide, the scale of the infrastructure change, and the resettlement or relocation of residents of Roşia Montană and Corna.

The evaluation of alternatives was also used to determine the best mining technology, duration and staging of the project, mining and processing technologies, environmental management practices, options for siting waste management facilities, transportation routes, and in general, measures to prevent or minimize potential environmental and social impacts during construction, operation, closure and post-closure.
Box 7.1 Key project alternatives considered under the EIA

**Ore extraction using open pits**
A comparative evaluation was conducted between ore exploitation via underground and open pits.

**The use of cyanide as a processing chemical**
Cyanide is one of the few substances which will dissolve gold. The gold is predominantly contained within the ore as microscopic particles and to minimise gold being lost in the waste, it must be dissolved out of the ore. A range of alternatives to cyanide was considered.

**The cyanide destruction technology** for the tailings slurry before discharging into the Tailings Management Facility (TMF) in order to meet the EU Mine Waste Directive.

**The location of the Tailings Management Facility (TMF)**
A number of alternative locations were considered before the selection of the current proposed site in the Corna Valley.

Under the EIA options for location of key facilities, such as the TMF were considered, discussed in Box 7.2.

Box 7.2 Alternative options for locations of key facilities

- Most favourable option for the Tailings Management Facility (TMF) is in Corna valley, although nine locations in different valleys in the area were also examined;
- All viable options for disposal and storage of waste rock were examined and the selected option represents an optimal combination of methods;
- Various routes were examined to provide access to and around the RMP site and the selected options combine consideration of practical constraints and environmental impact.

The RMP uses chemicals such as cyanide and hydrochloric acid, toxic reagents that require careful management. The RMP, therefore, needs to employs technologies and management practices that have been selected on the basis of “Best Available Techniques” (BAT) as recognised under EU and international guidance. The use of BAT is a requirement under Romanian and EU regulations. Box 7.3 discusses the alternative mining technology options considered.
Box 7.3  Alternative mining technology options considered for preventing / reducing pollution

**Technological options:**

- The option to adopt underground mining methods rather than the proposed open pit scheme is examined and rejected as non-viable due to safety, economic and environmental reasons;
- Alternatives to use of cyanide in gold extraction – other methods are potentially more hazardous (e.g. mercury) or unproven/uneconomic;
- Options for reduction of cyanide levels in the wastes discharged to the TMF – only the selected option is BAT, and represents the most commonly used technology in the modern mining sector;
- Treatment of water for discharge to nature will be made according to BAT and the most advanced techniques that ensure the purification of water to the quality standards stipulated by NTPA001/2005.

It is also required that the “no project” option is analysed, i.e., a forecast of the environmental and socio-economic state should the RMP not proceed. The “no project” option is discussed in Box 7.4.

Box 7.4  Alternative to the RMP options

**The “No-Project” Option:**

The "no project" option was considered, and the benefits of the RMP were compared with potential benefits of other development paths.

- In the case that the RMP does not go ahead, the existing pollution problems and socio-economic decline will continue, if significant alternative investments do not occur, including for closing down the existing mine, the rehabilitation of the impacted area, and the establishment of an alternative means of livelihood for the population.
- The possibility for introduction of alternative industries that might have a similar beneficial socio-economic impact as the proposed RMP was examined. There are significant disincentives working against attracting alternative industries, unless there was significant additional inward investment to improve the development potential and investment climate of the area. The RMP does not preclude the establishment of other industries and is instead forecast to remove some of the existing impediments to this.

A full analysis of these alternative options is provided in the EIA and it is concluded that the selected options for the RMP are the most appropriate having regard to economic, technical and environmental constraints and opportunities and also represent BAT, where that is relevant.

The “no project” options fail to capitalize on the natural resource assets available to the Community, such as the ore deposit and remediation of the significant environmental and socio-economic problems would require inward investment over and above anything that could be reasonably expected from non-mining developments, if they could be attracted to the area.
Chapter 8

8 Roșia Montană Project (RMP) description

The Roșia Montană Project (RMP) comprises the development, operation, closure and post-closure phases.

The mining exploitation will consist of four open pits with processing of the excavated ore being conducted on-site. The four pits correspond to four main deposits known as Cetate, Cîrnic, Orlea and Jig.

Once the EIA has been completed and the RMP has been approved, the RMP comprises three distinct phases as follows:

1. Construction;
2. Operation;
3. Closure and after-care.

8.1 Construction Phase

It is anticipated that a specialist engineering, procurement and construction management contractor (referred to as an “EPCM Contractor”) would be appointed by RMGC on the basis of a competitive tender to develop and construct the RMP. Any EPCM Contractor would be required to follow the legal obligations of the RMP and any other relevant commitments made by RMGC under the terms of its environmental and other permits.

The proposed construction period of the RMP is approximately two to three years. Activities will commence with the establishment of site offices, site construction facilities, and the mobilization of principal contractors. The main activities during this period are:

- Construction of the resettlement infrastructure such as housing, churches, commercial premises, municipal and county administrative offices, using Romanian contractors and suppliers as much as possible;
- Resettlement of project affected local residents;
- Preparation of mine operational areas such as removal and storage of surface soils;
- Development of quarries for construction materials such as for roads, concrete production etc;
- Working with Minvest on redevelopment and permanent or temporary closure of Minvest operations, and redeveloping the existing exploitations on the current mine site;
- Connection to the national high voltage electrical power network;
- Construction of a water supply pipeline from the Aries River;
- Construction of the access road to the process facilities from the Abrud Valley;
- Construction of the process facilities, including the cyanide destruction installation;
- Construction of a new access road to Roșia Poieni;
- Construction in Corna Valley of the tailings management facility (TMF), including the starter rock dam gradually being built up over the mine life to become the final Corna TMF dam.
Section 8: Roșia Montană Project (RMP) description

8.1 Construction Phase

- Construction of a secondary containment dam in the Corna Valley to capture all seepage;
- Construction of Cetate dam in the Roșia Valley in order to collect acid water;
- Construction of the acid rock drainage treatment plant;
- Construction of infrastructure;
- Construction of other water control containment structures and clean water drainage channels;
- Construction of a potable water treatment plant;
- Construction of a domestic sewage treatment plant; and,
- Testing at pilot scale of proposed alternatives for environmental technologies – e.g. secondary treatment system of waste water with low cyanide concentration and the advanced treatment for removal of calcium and sulphates from mine waters.

This phase will involve significant activity and the creation of a range of permanent structures and facilities. At the end of construction, the RMP will be commissioned and be handed over to the RMP management team as an operational business.

8.2 Operational Phase

The proposed mining activities at Roșia Montană are planned for a 16-year period. Operations will consist of conventional open-pit mining techniques including: drilling, blasting, loading of ore by hydraulic shovels, and transport of ore by haul trucks.

Four open pits, named: Cetate, Cîrnic, Orlea, and Jig pits, will be mined. The four pits form a single mine operation, which will feed ore to an on-site processing plant. Mining will start at Cîrnic closely followed by Cetate. Mining at Orlea will start in year 7 and at Jig in year 9.

The Cîrnic pit will finish by year 9, whilst the Cetate pit will continue through the entire mine life. The number of years of actual mining is 14.

During the first six years of operation, a low-grade ore stockpile will be developed. The higher-grade ore will selectively processed first. The low-grade ore stockpile will be processed after the mining has finished in year 14 and will take nearly three years to process, finishing in year 16, or approximately year 2024. Figure 8.1 shows the pits and the year in which they will be mined.
Figure 8.1 The pits to be mined and in which year
The proposed ore preparation and processing systems incorporate the following key elements:

### Table 8.1 Proposed ore preparation and processing steps

<table>
<thead>
<tr>
<th>Order</th>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Crushing and Stockpiling</td>
<td>Ore is crushed using a gyratory crusher and then stockpiled</td>
</tr>
<tr>
<td>2</td>
<td>Wet grinding</td>
<td>Stockpiled ore is further ground by wet grinding</td>
</tr>
<tr>
<td>3</td>
<td>Leaching and Adsorption</td>
<td>Cyanide is added to the solution of water and ore within a closed system before passing through a series of tanks, which agitate the solution. The gold and silver is attached to carbon in these tanks and separated from the rest of the solution</td>
</tr>
<tr>
<td>4</td>
<td>Electrowinning</td>
<td>Gold and silver are extracted by passing an electrical current through the solution, which separates the gold from the carbon</td>
</tr>
<tr>
<td>5</td>
<td>Smelting</td>
<td>The gold and silver is then heated and formed into ingots</td>
</tr>
<tr>
<td>6</td>
<td>Cyanide detoxification</td>
<td>After gold and silver is extracted and the cyanide solution is recovered to be reused in the process, a cyanide detoxification plant will process the residual cyanide in the waste slurry (tailings). Detoxification is required under Romanian and EU law and the level of residual cyanide will be lower than the 10mg/l WAD cyanide required by the EU the mine waste directive (2006/21/EC)</td>
</tr>
<tr>
<td>7</td>
<td>Tailings disposal</td>
<td>The tailings are transported by pipeline and deposited in the TMF</td>
</tr>
<tr>
<td>8</td>
<td>Water recirculation and reuse</td>
<td>The solids in the slurry will settle and the clarified water will be re-circulated from the TMF pond to the processing plant and be re-used to avoid the need to discharge effluent to the environment and to minimise use of fresh water resources</td>
</tr>
</tbody>
</table>

### Figure 8.2 Schematic of proposed ore preparation and processing systems
Visually the most significant RMP features will be:

- In Roșia Valley: the open pits, waste rock stockpiles and the Cetate Water Catchment Pond;
- In Corna Valley: the Tailings Management Facility.

The Cetate Water Catchment Pond on the Roșia Stream will ensure that contaminated runoff from historic mines no longer enters watercourses and runoff from the new mine is also intercepted. Water will be pumped from this pond to an on-site water treatment facility. The treated and clean water will then be released to maintain stream-flow in the Roșia and Corna Streams. This management scheme will result in a significant improvement in water quality in the local streams compared with the current situation.

The TMF includes a dam that will be constructed out of selected quarry aggregates and waste rock and heightened progressively through the life of the mine to accommodate the deposition of tailings arriving from the cyanide detoxification plant. The TMF will also include a secondary containment dam further downstream to contain water that is designed to seep from the TMF through the Corna TMF dam to assist in tailings stabilisation and control water pressures. This water will then be pumped back to the reclaim pond behind the Corna dam.

Box 8.1 discusses the permeable tailings embankment design; and Figure 8.2 shows the build up of the TMF over the years. Boxes 8.2 and 8.3 discuss cyanide management and dam safety respectively.
Why has a permeable tailings embankment been chosen as the preferred option?

**Why a permeable tailings embankment?**

The two main types of embankment dams are earthfill dams and rockfill dams. Earthfill dams are made up mostly from compacted earth, while rockfill dams are made up mainly from dumped and compacted stone. The main tailings embankment for the RMP will be a rockfill dam and will use material excavated from both the open pits and the aggregate quarries for its construction. A cross-section (or slice) through an embankment dam shows that it is shaped like a bank, or hill.

Most embankment dams have a central section or core, which is frequently made from an impermeable material to stop water passing through the dam. This is the case for the starter dam of the TMF, which needs to store water for RMP start-up. However, the final Corna dam at Roșia Montană will allow some water to pass through it before being captured by a second dam called the secondary containment dam. This allows the tailings to drain and consolidate, improving stability and enabling the creation of a well-drained vegetated surface following closure. Unlike the main tailings embankment, the secondary containment dam will be impermeable and constructed of non-acid-generating material. Water stored behind the secondary containment dam will be pumped back into the tailings basin to be recycled for use in the processing plant.

It is important to note that the valley floor of the Corna Valley is made up of very low permeability soil and bedrock. Water tends to follow the path of least resistance, and therefore, water stored behind the dam will preferentially flow through the main dam instead of seeping through the valley floor into the groundwater.
Figure 8.3  Schematic staged development and filling of the TMF over the years

Final extent of the flat area created by the deposition of tailings that will build up behind the rock embankment at the bottom of the Corna Valley.
Box 8.2 Cyanide Management

Cyanide Management

The old miners took most of the coarse gold and the majority of the gold remaining in the Roșia Montană mine site is contained within the ore as microscopic particles that are not large enough to be recovered using only physical means. The gold therefore to be dissolved out of the ore after it is crushed and ground. Cyanide is one of the few substances which will dissolve gold. A range of alternatives to cyanide was considered but none has the same mix of proven removal efficiency, proven safety and cost-effectiveness.

Cyanide is a toxic substance which means that it must be carefully managed. A RMP specific Cyanide Management Plan (the "CMP") for Roșia Montană has been prepared in accordance with the International Cyanide Management Code¹ (the "Code") for the gold mining industry and Cefic EU guidelines². The Code was developed under the auspices of the United Nations Environmental Program ("UNEP"), to assist the mining industry in improving cyanide management, thereby minimizing risks to workers, communities and the environment from the use of cyanide in gold mining, and reducing community concerns about its use.

A company certified to EU standards will transport cyanide to the RMP site in solid form and inside specially reinforced and sealed containers. These special containers are designed for transferring cyanide and will transport it directly from the cyanide manufacturing plant to the Roșia Montană process plant. A state-of-the-industry cyanide detoxification facility will be incorporated into the process plant for the RMP. This technology will reduce cyanide levels in the waste stream to levels which are well below the maximum level that Romanian, EU and North American guidelines designate as safe, before the tailings are released from the process plant to the dam in Corna valley (the TMF).

This proven cyanide detoxification technology has been successfully used in more than 80 gold mines worldwide and continues to replace older technologies.

The technology of treating the tailings slurry in order to destroy cyanide that would be implemented by the RMP would present the introduction of Best Available Techniques (BAT) in this domain for the Romanian mining industry.

Also important to remember is that cyanide, unlike heavy metals, does not bioaccumulate and that it naturally degrades under atmospheric conditions.

Despite this, provision has been made for additional active cyanide detoxification should that be required for any reason or circumstance, for example, to allow discharge to the environment in accordance with quality standards if such discharge became necessary or desirable.

The RMP monitoring plan includes the continuous monitoring of cyanides throughout the process as well as in the surrounding environment.

¹ www.cyanidecode.org/
² www.cefic.org/
Box 8.3 Dam Safety

**Dam Safety**

The TMF is rigorously designed to strictly comply with Romanian and international standards to provide safe and environmentally acceptable containment of detoxified tailings. From a statistical perspective, the two main dangers with dams are:

1. overtopping, where dam height and storage capacity are not sufficient to hold back water, and
2. dam failure, where a portion of the dam collapses.

The TMF has been designed with a number of engineered precautions to address both of these concerns – Box 15.1 provides a listing of these.

Addressed here, however, is the normal concern of overtopping. In order to ensure sufficient capacity to avoid overtopping, the elevation of each stage of the facility through the life of the RMP is determined as the sum of the design volume required to:

- Store process water and tailings for the maximum normal operation volume of tailings and the average decant pond volume (i.e. the volume assessed from the predicted monthly water balance);
- Store run-off resulting from two Probable Maximum Precipitation ("PMP") storms*, based on estimates for this event specified for the Roșia Montană area (the PMP storm generates a Probable Maximum Flood ("PMF") volume, which is dependent on the receiving catchment area); and,
- Provide a tailings beach and additional freeboard for wave protection to the tailings volume at each stage during operations; a conservative freeboard criterion is based on the PMF storage plus 1 metre of wave run-up.

* **Romanian guidelines dictate that the TMF must store a storm event over a 24-hour period having a magnitude that is expected to occur only once every 10,000 years. This corresponds to 211 mm of rainfall at Roșia Montană. The PMP is over twice this magnitude, whether it corresponds to an event of 450 mm for summer or 440 mm for winter (combined with snowmelt).**

To be conservative, the more stringent PMP event has been selected as the design criterion for the TMF. Furthermore, in order to ensure that the TMF can store a full PMF volume at all times, it is actually designed to safely hold the flood waters from two consecutive PMP events. The Roșia Montană TMF is therefore designed to hold a total flood volume over four times greater than the Romanian guidelines. An emergency spillway for the dam will be constructed in the unlikely event that pumps fail due to malfunction or power interruption at the same time as the second PMP event. The design of the TMF therefore very significantly exceeds required standards for safety. This has been done to ensure that the risks involved in using Corna valley for Tailings storage are well below what is considered safe in everyday life.
8.3 Closure and After-Care Phase

The Mine Rehabilitation and Closure Management Plan ("Mine Closure Plan") being developed for the RMP outlines a plan for decommissioning the facility, rehabilitating the site and implementing a long-term programme of after-care to ensure that Mine Closure Plan objectives are met. As part of the EIA and permitting process, a mine closure process, schedule and financial guarantee structure will be defined and agreed to. The preparation of a decommissioning and rehabilitation strategy before the development of the RMP is an integral part of the process.

According to the Mine Waste Directive 2006/21/EC of the European Union, closure and rehabilitation means "the treatment of the land affected……..in such a way as to restore the land to a satisfactory state with particular regard to……..appropriate beneficial uses."

For the various parts of the site affected by the mining operations, the Mine Closure Plan defines beneficial uses. These uses determine how the sites are rehabilitated, which targets will have to be achieved and which technologies will be used. Although in the current version of the Mine Closure Plan, the principal closure strategy and technologies are defined, the Mine Closure Plan is a living document and will evolve via revisions and updates, depending on such as the following:

- future technological advances
- changing public interests with respect to the future usage scenarios of the rehabilitated sites
- improved knowledge of environmental impacts by mining wastes, effluents etc.

This approach to mine planning recognizes that mining, while permanently changing some surface topography represents a temporary use of the land and that appropriate closure of the operation is in accordance with the sustainable use of mineral resources.

The principal objective of the Mine Closure Plan and design process is to ensure that the potential environmental, safety and health impacts associated with a decommissioned mine together with their associated financial and legal liabilities are identified at an early stage and thus minimised as a consequence of actions taken during planning, design and operational phases of the RMP.

Objectives for rehabilitation need to address suggestions and opinions of the Community, regulatory requirements, site-specific aspects, RMGC policies and industry best practice, and include:

- Protection of public health and welfare;
- Achievement of agreed goals for post closure land use;
- Geotechnical stabilization of mine-related structures (pit slopes, rock stockpiles etc);
- Reclamation of landscape to minimise sedimentation, erosion, and potential environmental harm;
- Water quality protection.

Based on these goals, the objectives of the RMP Mine Rehabilitation and Closure Plan are to:
Assist management in ensuring the protection of public health and safety during and following closure of the mine and associated facilities;

To allow progressive closure activities to commence before production ceases;

Reduce or eliminate long-term environmental impacts;

Restore disturbed land to a productive condition as soon as practical;

Minimise, to the extent possible, sterilisation of any remaining mineral resources;

To assist RMGC in specific budget and schedule planning activities.

The mine closure process starts during the operations phase by optimizing the technologies with respect to later closure activities such as the segregation of potentially polluting from non-polluting wastes, and by starting and completing the rehabilitation of mining wastes (Cîrnic waste rock dump) as soon as possible.

Towards the end of the operations phase, the production and waste deposition technologies will increasingly be adapted to the requirements of closure and rehabilitation. For example,

- the tailings deposition regime will be changed so that the resulting inclination of the tailings surface (and of the cover placed on the tailings) assists the runoff of undisturbed surface water and minimizes the infiltration into the tailings body,
- potentially polluting wastes will be encapsulated by non-polluting wastes,
- open pits which are already completely mined out will be backfilled with waste rock material from other pits.

In year 14, at the end of the mining operations when only the low grade ore stockpile is still to be processed, the active closure phase begins. The fully or partially backfilled open pits and the waste rock heaps will be landscaped, covered with fertile and chemically inert soil and vegetated with grass and trees.

In year 16, following the reprocessing of the low grade ore, the consolidation of the cover on the tailings impoundment will begin. The cover is designed to isolate potentially polluting tailings material within a stable and consolidated tailings deposit.

Cetate, the last open pit to be completed, will be flooded. In order to minimize the oxidation of minerals in the pit walls which may lead to the generation of acid water in the pit lake, the flooding process will be accelerated by pumping tailings pond water into the pits. Before this is done, the water will be treated as necessary to ensure that its quality is in compliance with the Romanian standard for release to the environment.

Semi-passive water treatment installations which will be constructed and tested during the operations phase will continue to treat mine effluents in the Roșia and Corna valley. If their treatment efficiency is insufficient, active treatment systems will continue to operate so that effluent standards can always be achieved.

The existing monitoring system will be adapted to the requirements of the closure and post-closure phase, in particular to demonstrate the success of the rehabilitation measures or, if required, to implement mitigation measures.
9   Environmental Issues

This section explains the key environmental issues related to the RMP in terms of impacts and the mitigation measures proposed to minimise them (and for beneficial impacts, measures to maximise the impact). This covers the following:

- Water resources (surface water and groundwater);
- Air quality;
- Noise and vibration;
- Soil resources;
- Wildlife; and,
- Visual landscape.

9.1   Water Resources

Water is one of the most important environmental resources related to the RMP. Not only is water essential for ore processing, but also effective water management is critical to the protection and improvement of local river systems and their users (including wildlife), and for the safe operation of the TMF.

The existing situation is characterised by unmanaged highly polluted effluent from historic and current mining activities entering natural watercourses significantly reducing the value and usability of these streams from both a human and natural perspective. In the section 6 RMP Setting: water, there is a discussion on Acid Rock Drainage and the state of the water environment in Roşia Montană.

The RMP provides the opportunity for significant long-term benefits to the water environment by the implementation of the first comprehensive water management system in the Roşia and Corna valleys. The guiding principle involved in the water management strategy is to keep clean water clean and intercept any contaminated water for treatment.

The construction phase will involve a variety of earth-moving, excavation and construction activities. Construction activities typically lead to the disturbance of soil and rock, leading to the possibility of muddy water and sediments being discharged into local streams. A range of management tools, such as run-off interception and settling and grassing of engineered slopes will ensure that water discharged from the site meets the required quality standards. The construction of the Corna Dam in the Corna Valley, and the Cetate Water Catchment Dam in the Roşia Valley, will act as the major drainage control features and prevent water that comes into contact with disturbed areas from entering streams.

One of the most profound and permanent impacts of the RMP that will occur during construction relates to the alteration of the water flow systems within the Roşia and Corna valleys. Clean run-off and uncontaminated streams flowing from further up the valleys will be diverted around the RMP area by engineered channels. Other channels will capture contaminated or potentially contaminated water for treatment before discharging the clean effluent downstream.

As such the RMP will therefore impose a significant positive impact on water quality by collecting and treating contaminated water flowing from existing and abandoned mine workings. Flows in the Roşia and Corna streams will also be supported to promote conditions leading to ecological recovery.
During the operational phase of the RMP, water will be a key component of the ore treatment and tailings disposal process. Crushed ore will be mixed with water to form a slurry from which gold and silver will be chemically extracted. The tailings slurry will then be disposed of within the TMF. The liquid nature of the tailings slurry will allow it to be moved efficiently by pipeline.

Before being deposited in the TMF, the tailings slurry will be ‘detoxified’ by the destruction of cyanide to reduce any cyanide concentrations to below the levels set down in the Mine Waste Directive 2006/21/EC that entered into force in the EU in May 2006. The standards stipulated in this Directive are designed to maintain a tailings pond that poses a minimal hazard for humans and wildlife. For example, waterfowl and wading birds will be able to use the facility safely because the EU limit on free cyanide concentration in the TMF is five times lower than the level proven to be the limit of safety for birds. Box 9.1 sets out the TMF mitigation strategy.

**Box 9.1 Summary of the principle measures to minimise impacts from the TMF**

<table>
<thead>
<tr>
<th>Principle measures to minimise impacts from the TMF</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ A cyanide detoxification plant will effectively reduce cyanide concentrations in the TMF to levels at which they comply with the EU mine waste directive 2006/21/EC;</td>
</tr>
<tr>
<td>▪ Hydrogeological conditions prevent the flow of groundwater from under the TMF to adjacent catchments;</td>
</tr>
<tr>
<td>▪ Exploitation of an in-situ low permeability layer that forms a permanent natural ‘liner’ to the basin with additional engineering to create low permeability conditions where the natural liner is absent, e.g., in bedrock areas and in areas of soils;</td>
</tr>
<tr>
<td>▪ Tailings water that seeps (by design) through the TMF dam is directed behind the Secondary Containment Dam to be pumped back to the TMF;</td>
</tr>
<tr>
<td>▪ A system of monitoring wells located across the valley downstream of the Secondary Containment Dam can be converted into pumping and recovery wells should TMF constituents bypass the Secondary Containment System;</td>
</tr>
<tr>
<td>▪ Final treatment will be provided which is capable of reducing residual cyanide still further to concentrations compliant with Romanian standards. This will enable safe discharge to the environment when required for the following 2 circumstances: 1) after two extreme rainfalls (each one equal to the maximum that can be predicted on a scientific basis – maximum probable precipitation) and if the natural dilution does not ensure a water quality that meets the discharge standards, and 2) during the flooding of Cetate quarry at the end of mine life if the water in the pond at that time has not reached the quality limits required by NTPA001/2005 through natural degradation of cyanide. In addition, semi-passive treatment lagoons will be developed for mine closure and post-closure to replace the active treatment systems for removal of dissolved salts and cyanide degradation products such as ammonia.</td>
</tr>
</tbody>
</table>

Process water will be recovered from the tailings stream for re-use within the ore processing system, avoiding the need to discharge process water into the environment. At the same time this minimises the demand for make-up water from natural resources.

The wastewater from RMP kitchens and toilets will be collected and treated and the clean effluent discharged into the TMF.
Box 9.2 summarise water discharges by the RMP to the environment.

Box 9.2  Water discharges by the RMP to the environment

**Water discharges management:**

- Any water released from the RMP will comply with the Romanian industrial effluent standards NTPA001/2005. This standard is generally more comprehensive than equivalent EU requirements. It comprises a large number of indicators and, unlike the quality standards in most EU member states, is not different depending on the type on industrial activity or the geographical area. The RMP design includes provision for primary and secondary wastewater treatment to meet the standard for all the required parameters as specified by NTPA001/2005.

- Water affected by acid rock drainage will be intercepted by the Cetate Water Catchment Dam and Pond. This water will then be treated in the wastewater plant to meet the Romanian standards NTPA001/2005 for discharge to the environment. Treated water can also be recycled to the processing plant or discharged to either the Corna or Roșia Valleys to maintain environmental baseflows or to reduce the overall storage of water at the site.

- Seepage water from the TMF will be collected in the Secondary Containment System and pumped back to the TMF reclaim pond. During the normal operational phase of the RMP mining operation there will be no discharge from the TMF to the environment, all available water will be re-cycled to the processing system so as to minimise water required from the Aries River. Controlled discharge would take place, however, after two maximum probable rainfalls. In this case, if the natural dilution does not ensure the discharge quality conditions a secondary treatment of the industrial waters will be used to ensure that NTPA001/2005 limits are respected for all parameters. During the closure and post-closure period the semi-passive treatment lagoons shall be functional in Corna and Roșia Montană valleys (the semi-passive treatment system shall be developed and tested during operation. If this semi-passive treatment system does not meet the quality imposed by NTPA001/2005, depending on the nature of the residual pollutants, the waters shall be redirected for advanced treatment either to the ARD treatment plant or to the secondary treatment plant for the waters with low cyanide content; the active treatment installations shall remain functional over the closure period until no longer required.

- Storm water will be routed around waste facilities and disturbance areas to the maximum extent possible. Storm water runoff that cannot be diverted around facilities will be collected and managed within either the TMF or the Cetate Water Catchment Dam and Pond.

At closure, a lake will be developed in the Cetate pit to manage remaining ARD. The Cetate Water Catchment Pond forms a part of the closure water management system. Remaining, treated water in the TMF reclaim pond will be pumped to the pit lake. Removal of the TMF reclaim pond will speed up the process of drying and stabilising the tailings prior to restoration of the TMF site.

Over the closure period, acid generating potential for the RMP site will be reduced substantially by surface cover restoration, revegetation and installation of additional permanent diversion channels. However, some acid rock seepage is still expected. Therefore, continued wastewater treatment is planned for the Cetate pit lake at closure, and a semi-passive treatment lagoon system in the Corna Valley will be maintained for treatment.
of residual TMF seepage. There is also stipulated an in situ treatment of the water from the Cetate quarry pond, with limestone from the ARD water treatment maintained on the original spot or repositioned near the quarry. In this way, the positive impact on water quality from the operational RMP will be sustained after closure.

Most of the water for the RMP will be supplied from precipitation falling within the RMP limits and recycling of process waters. Fresh water that is needed by the RMP will be supplied from the Arieş River for reagent mixing and other non-process requirements such as potable water, fire fighting water, etc. The demand for water for the RMP from the Arieş will not significantly affect existing users, nor the aquatic ecology.

The water need in the operational stage of the mine shall be covered from different sources, as follows:

- 80% of process water demand will be reclaimed from the TMF;
- 14% will come from the fresh water supply for uses that specifically require fresh water;
- 5% from the Wastewater Treatment Plant effluent,
- 1% from runoff captured by the plant site pond.

Boxes 9.3 summarises water use under the RMP.

Box 9.3  Summary of water use by the RMP

<table>
<thead>
<tr>
<th>Summary of water use by the RMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average fresh water requirements will include approximately 207 m$^3$/hr for processing and 31 m$^3$/hr for non-processing demands, totalling 238 m$^3$/hr.</td>
</tr>
<tr>
<td>The fresh water pumping station has been designed to allow for a maximum abstraction rate of 350 m$^3$/hr to allow for a contingency.</td>
</tr>
<tr>
<td>The flow in the Arieş River is able to supply the required 350 m$^3$/hr for the RMP 96% of the time, whilst still providing for an environmental flow of three times the minimum requirement, and allowing existing users to abstract at their maximum allowed rate. The remaining 4% of the time represents periods of extreme low flow. If all licensed users utilised their full allotment, there may be a few days when withdrawals from the Arieş River may have to be reduced. The processing plant has a storage tank that would provide up to three days of water supply without the need for any withdrawals from the Arieş River.</td>
</tr>
<tr>
<td>Cessation of current mining activities will partially offset the RMP water requirements – reducing the impacts on stream flows in the Arieş River.</td>
</tr>
</tbody>
</table>

Figure 9.1 provides an illustration of the overall RMP water management system.
Figure 9.1  RMP water management system
Box 9.4 below provides a summary of the impacts on water resources from the RMP.

**Box 9.4  Summary of RMP impacts on the water environment**

<table>
<thead>
<tr>
<th>Summary of RMP impacts on the water environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>The current degraded and poor water quality in the RMP area will be improved by the RMP, resulting in long-term benefits. Potential negative impacts are forecast to be insignificant. The impacts are summarised below:</td>
</tr>
<tr>
<td>ƒ Improvement in surface water quality in Roşia and Corna Streams and the Abrud and Arieş Rivers by collection and treatment of existing acidic runoff from historic and existing mine workings and uncontrolled waste rock piles in the area;</td>
</tr>
<tr>
<td>ƒ Collection and containment of impacted sediments within the RMP area in contrast to the uncontrolled release of these sediments in the current conditions;</td>
</tr>
<tr>
<td>ƒ Elimination of uncontrolled disposal of rubbish and household waste into streams across the RMP site;</td>
</tr>
<tr>
<td>ƒ Long-term water quality improvements due to the elimination or treatment of mine wastes and acid rock drainage sources in the RMP area as part of a comprehensive Closure Plan;</td>
</tr>
<tr>
<td>ƒ Changes in the hydrological and hydrogeological conditions at the site as a result of the RMP development will be mitigated by the diversion of clean water around RMP disturbance areas and discharge of treated water back into the Roşia or Corna Valleys;</td>
</tr>
<tr>
<td>ƒ Impact on water supply systems and on quantities of water in the streams and rivers in the area, including Arieş River will be mitigated by utilising recycled water to the maximum extent possible. Fresh water from the Arieş River will be relied on only for non-process requirements. The fresh water pumping system will always ensure that base flow and existing user requirements in the Arieş River will be met.</td>
</tr>
</tbody>
</table>
9.2 Air Quality

Air quality within the RMP area is generally good, reflecting the rural nature of the area and the small scale of existing industry. Existing pollution sources include emissions from domestic heating and vehicles. Mining and mineral processing operations typically do not generate significant levels of gaseous air pollution, but dust is frequently an issue that requires active management because of the large-scale moving of earth.

The potential RMP impacts on air quality summarised in Box 9.5.

Box 9.5 Potential RMP impacts on air quality

<table>
<thead>
<tr>
<th>Potential RMP impacts on air quality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mining Activities and Waste Rock Disposal</strong></td>
</tr>
<tr>
<td>Open pit mining operations give rise to potential dust emissions. The principal sources of dust emissions include clearing and topsoil stripping operations in dry conditions, heavy vehicles travelling on unsealed roads; wind erosion of non-vegetated and loose surfaces; drilling and blasting operations; and loading, unloading and stockpiling operations. Impacts during closure will occur during backfilling and site levelling operations and from wind erosion of the exposed soil before vegetation becomes established.</td>
</tr>
</tbody>
</table>

| **Process Plant Emissions** |
| The initial stages of ore preparation involve crushing of the dry ore. Modern crushing plants are fitted with dust abatement equipment (filters and sprays). The final stages of ore preparation and the ore processing itself is essentially a wet process with no significant potential for dust generation. Processing beyond the primary crushing stage will result in limited emissions of gases, mists and fumes, all of which are subject to strict emission controls and release in compliance with air quality standards to protect workers and the community. Very rigorous controls apply to the supply, storage and use of cyanide and these are included within a separate Cyanide Management Plan prepared in accordance with a UN code. |

| **Tailings Impoundment** |
| Disposal of tailings to an impoundment that is open to the elements creates potential for wind erosion of the material as it dries. The tailings deposits will contain process reagent residues and residual metal-containing minerals. Generation of gas from residual cyanide in the tailings water has been modelled, and in line with operational experience and monitoring worldwide, poses no hazard to workers or communities. During decommissioning, emissions will occur as a result of backfilling and grading and from wind erosion of the exposed soil. Dust control for all such non-vegetated surfaces is described below. |

| **Mobile Plant Exhaust Emissions** |
| Off-road moving equipment will generate engine exhaust gases, but modelling indicates that this will not create a pollution problem. All engines and motors will comply with the relevant emission standards. |

A variety of mitigation measures will be employed to control dust and exhaust-emission based impact including:

- Staggering traffic/mobile equipment operations to minimise the potential for compounding the impacts from such sources;
- Specification of engines to meet regulated emission standards for all mobile and stationary equipment;
- Implementing a maintenance programme on all stationary and mobile equipment to ensure continued operation within manufacturer’s specifications;
- Monitor acidic content of particulates deposited in the protected zone, implementing additional corrective/preventative action as warranted;
- Regular watering of the construction roads and of the TMF during potential emission conditions;
- Apply chemical stabilisers on heavily travelled roadways if conditions justify this;
- Reduce mobile source speeds during high potential emission conditions;
- Minimise dust from blasting operations through use of modern dust-minimising blasting technologies; and;
- Continuously monitor air quality and stakeholder concerns and implement corrective/preventative measures as warranted.

Air modelling suggests that overall, the air impacts associated with RMP construction, operation, and closure are manageable and exceedances of legislated limits are not anticipated. No air quality impacts across any of Romania’s national boundaries are forecast.

### 9.3 Noise and Vibration

Rock blasting within the mining pits, as well as operation of heavy machinery and equipment will represent the main sources noise and vibrations that result from the RMP. Blasting will be carried out using modern techniques to avoid blast-induced vibration damage even to vulnerable buildings. Although many people will be relocated or resettled from the area, residents at the southern end of the Corna Valley and in the Protected Zone may experience noise disturbance from the RMP at certain times. In order to minimise noise and vibration, the RMP will implement the following mitigation measures:

- Consultation with local residents with regard to noise/vibration aspects of the RMP, advising the community of activities that may occur closer to dwellings and receiving any complaints so that remedial actions may be taken;
- Establishment and enforcement of standard operating procedures for vehicle/equipment maintenance and operation, including engine silencer;
- Scheduling/staggering major deliveries to occur during daylight hours;
- Enforcement of access and mine road speed limits;
- Use of employee bus or rideshare programmes;
- Implementation of controlled blasting procedures that incorporate millisecond delay techniques and minimising the use of high explosives in combination with ammonium nitrate fuel oil (“ANFO”) blasting agents;
- Restricting quarry blasting to daylight hours; and,
- Monitoring noise and vibration and implementing corrective or preventative action where required.

Additionally, RMGC will ensure the protection of their workforce from hearing damage by implementing standard operating procedures that require workers to use personal protective equipment and ensure proper training.
9.4 Soil Resources

The most significant impact on soil resources will be the amount of land required to be cleared for construction. Other potential impacts such as compaction, erosion, and pollution resulting from RMP activities are anticipated to be relatively minor.

In order to ensure that impacts on soil resources are minimised, soils will be stripped and stockpiled for use in rehabilitation of operational areas at closure. Appropriate soil erosion measures such as silt fencing will ensure that this resource is preserved.

The site includes areas that have little or no existing soil cover either due to past mining or natural conditions. This means that there will be insufficient natural soil material to use in rehabilitation. The closure plan therefore includes use of soil-forming materials (such as crushed, clean rock) that with appropriate preparation and addition of nutrients and organic matter, will form an effective growth medium. This approach is well documented, and will be further tested prior to closure with establishment of trial plots designed to identify the most effective materials, methods, additives, plants and aftercare.

Additionally, a variety of pollution prevention measures will be implemented including:

- Installing concrete foundations and berms for chemical/fuel unloading, fuelling, and vehicle maintenance areas;
- Constructing spill containment structures;
- The process plant site will be designed to drain to a lined stormwater runoff and spill contingency pond;
- Used absorbent and other routine spill cleanup waste will be managed as a hazardous waste;
- Field fuelling and maintenance operations will employ portable drip trays or protective devices and automatic shutoff valves; and,
- Operations staff will be trained in proper field fuelling and maintenance procedures.

9.5 Vegetation and Wildlife

No endangered or protected plants or wildlife species\(^1\) were found in the RMP Area.

The development of the RMP will, however, require land take over a relatively large area and will affect local biodiversity. Habitat loss, modification, and fragmentation as a result of land take for RMP development will locally impact bird breeding and bird, mammal, reptile, and amphibian habitats. Also, although few mammals were noted during surveys of the RMP area, there is the potential for increased vehicular mortalities from the increase in RMP-related traffic.

Against this risk, it should however be noted that the RMP provides an opportunity to increase biodiversity in the area as a whole. Firstly, as a result of the significant improvement of water quality due to the implementation of the RMP water management system, there will be a significant improvement in aquatic habitat conditions. The local streams will see a return of water life that is currently not sustainable in the existing polluted environment. Secondly, the biodiversity management plan allows for the enhancement of existing areas of biodiversity interest and for the creation of a biodiversity curtain around the

\(^1\) See biodiversity chapter of the EIA study report for lists and references.
mine site. It also allows for the re-establishment of biodiversity in the mine site and on the waste dumps once the RMP’s mining operation is complete.

Specifically, in order to minimise negative impacts on vegetation and wildlife, and to enable the positive impacts to be realised, the following mitigation measures need to be implemented:

- Establish Environmental Protection Zones (“EPZs”);
- Establish a network of vegetated corridors, where appropriate, within and between EPZs that allow for species migration;
- Minimise tree cutting and minimise disturbance during the breeding bird season (April – July);
- Install microhabitat facilities for birds, small mammals, reptiles and amphibians: i.e.: bird boxes, roosting boxes, decaying logs, pond coverage and basking areas;
- Collect occurrence records of rare species, although none are found to date;
- Install stream rehabilitation/improvement facilities, i.e.: riffles, runs and pools;
- Plant native species along degraded stream banks and other watercourses to provide breeding habitat and migration corridors for wildlife, and provide shade and nutrients to enhance stream quality;
- Enforce speed limits; and,
- Undertake progressive rehabilitation of the mine.

The closure plan identifies opportunities for improving biodiversity through establishment of unique habitats, including lakes and cliff faces and encouragement of native species through appropriate planting/seeding and soil preparation and aftercare.

During the life of the mine a program of re-forestation will take place around the fragmented forest remnants to increase the extent of forested areas. Corridors will also be planted joining these forested areas to promote biodiversity by creating links between the forested areas for animals to move along.

9.6 Visual Appearance

The visual appearance of Roșia Montană will change significantly as a result of the RMP, although this will only be apparent from a limited number of vantage points. The landscape of the Roșia and Corna Valleys will be altered as a result of changes to existing land use, which is predominantly pasture land, residential areas, and a patchy network of forests. The current land use pattern is heavily dictated by the topography and geology of the area of Roșia Montană.

The largest changes to the landscape will be the creation of the TMF in the Corna valley and the excavation of four large open pits. The other RMP features will result in a temporary change in visual appearance throughout the life of the mine, but will be rehabilitated to blend with the natural landscape at the end of the mine’s life. The TMF will also be vegetated to blend in with the landscape but will nonetheless result in a significant change to the topography of the Comăna Valley.

Three of the open pits will be backfilled with waste rock and Cetate pit will be flooded to create a lake. The pit remnants will therefore remain a locally prominent feature, a symbol of the valley’s mining heritage and a valuable ecological resource with unique habitats and micro-climate.
Alba County Council Decision No. 20, issued on October 27, 1995, established and nominated as protected areas, certain complex landscape, geological, speleological, palaeontological and botanical reserves, as well as flora and fauna species protected in the County. The only geological reserves, which lie in the RMP Area, are two rock outcrops, as follows:

- Piatra Despicata - a block of andesite rock on the interfluve between the Roşia and Corna Valley, and
- Piatra Corbului - an outcrop of altered dacite on a hillock between Ghergheleu and Curmatura Hill.

These rock outcrops are not prominent in the overall landscape and their setting on the degraded slopes of Cetate and Cînric, which is characterised by excavations and waste rock, minimizes their aesthetic quality. Site development will result in the approved relocation of Piatra Despicata and in-place conservation of Piatra Corbului.
10 Socio-economic aspects of Roşia Montană

Invariably an investment of the scale and type of the RMP will cause social and economic impacts. Most will be beneficial, such as increased employment and income in the Community. Some will be detrimental, such as people having to move or impacts on existing lifestyles. Identification of these impacts and the design of appropriate impact management strategies are extremely important to reduce or mitigate negative impacts and maximise the positive benefits.

Under Impacts of the RMP in Section 2 The Roşia Montană Project there is a discussion regarding the scale of the investment in Roşia Montană, as well as employment and job creation factors. There is also a discussion on the difference between resettlement and relocation.

This section discusses the social and economic circumstances in Roşia Montană. This includes current conditions, as well as possible impacts and effects because of the RMP. It ends with a discussion on what strategies and measures RMGC intends to take to mitigate the negative impacts whilst maximising the positive ones.

Roşia Montană has pre-modern industrial activities in a rural setting, and as a result livelihoods are derived from jobs in the mining sector or pensions, and from some small scale agricultural activities. Occupations in the mining sector are essential in global terms. Subsistence-oriented agricultural activities are critical as a “safety net” especially for the poorest in the community, predominantly female pensioners.

Poverty and higher health risks significantly lower the standard of living in the Community. Investment opportunities and incentives outside of mining including in tourism and agriculture are limited because of the geographical and topographical isolation of Roşia Montană, demographics, existing industrial character including pollution and poor utilities, housing and transport infrastructure.

10.1 Potential social and economic impacts

The Community includes the people directly affected by the RMP, as well as the people who will be indirectly influenced by it either socially, economically or both. Thereby the Community includes Roşia Montană village and commune and the towns of Abrud and Câmpeni because of their close socio-economic links. Socio-economic impacts resulting from the RMP can be divided into two types:

- Direct impacts. Impacts related with land acquisition (physical and economic displacement). These are addressed in the Resettlement and Relocation Action Plan;
- Indirect impacts. Other impacts not related with land acquisition and are addressed in the Community Sustainable Development Programme.

Identifying, predicting and designing mitigation and impact management strategies included compiling information on and understanding the following:

- The local context of Roşia Montană and surrounding areas;
- Demographics;
- The present mining operations and plans concerning them;
- Present economic activities and investment inflows;
- The social and political / administrative organization;
- The status of civil society;
Available best practice documentation in relation to social impact assessments and resettlement planning, particularly that issued by the World Bank Group.

Complexity regarding the RMP, assessment of the socio-economic impacts (both negative and positive) and mitigation strategies have been amplified by the lack of a precedent in Romania for a major extractive project implemented in conformance with Romanian regulations and transposed EU legislation and standards and a major extractive project implemented in conformance with International Finance Institutions’ and the Equator Principles’ requirements.

10.2 Overview of the Baseline socio-economic Conditions

General Outlines
Listed below are the main social and economic characteristics of Roșia Montană:
- The Comuna (rural commune) of Roșia Montană, with about 3,8651 people;
- The population is ageing and decreasing at Roșia Montană and regional level;
- Out-migration of job seekers and young, capable people are in part responsible for the ageing population;
- Large-scale mining redundancies have had a significant negative impact on Roșia Montană;
- Health risk is high and attendance at schools is in decline in Roșia Montană, and related infrastructure is sub-standard;
- The mining sector remains the main source of employment;
- The two existing state-operated mining operations in Roșia Montană are planned to close in 2007;
- More than 50% of the people in Roșia Montană receive government support;
- The proportion of income earners in the population below the poverty line in Roșia Montană is high;
- Investment inflows are low, except in mining;
- The condition of built infrastructure – roads, water supply, waste, energy - and housing in Roșia Montană is very poor;
- The environmental condition is very poor with significant pollution and ongoing environmental risks and impacts.

Geographical Situation
The above is also relevant for other administrative entities, all within Judet Alba (Alba County) as follows:
- Very similar at both a social and economical level: the town of Abrud 6,213 inhabitants;
- Economically connected with Roșia Montană: the town of Câmpeni, with some 8,096 inhabitants;
- Less directly connected but still influenced: the surrounding communities such as Bucium and Bistra and the county town of Alba Iulia.

10.3 Characteristics of the population in the impact zone

History
The history of Roșia Montană is closely related to gold, with documented history of mining of almost 2000 years dating back to the Roman conquest of Dacia. The progression of mining technology from that age to the present represents a valuable chronology of industrial mining heritage, in particular the role it has played in the formation of Roșia Montană’s cultural heritage.

1 Population numbers in this section are from the 2002 National census
Ethnic characteristics and Religion
According to the Alba County statistical department\(^1\) about 90% of the population regard themselves as ethnic Romanian, 1.5% as ethnic Hungarians and 7.5% Roma. The main religion is Romanian Orthodox Christian. Other denominations include: Greek Catholics, Roman Catholics, Protestants, Unitarian Christians, Baptists, and Pentecostals.

Demographics
The population is ageing and decreasing in the Community. Massive mining redundancies are in part responsible, plus low birth rate and out-migration. This trend is observable in Roşia Montană, Abrud and Câmpeni, indicative of a regional trend, see figure 10.1.

Education
The majority of people in Roşia Montană have an education of at least high school level. However, school attendance shows a marked decline in the Community, see figure 10.2.

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\(^1\) 2002 National census
10.4 Local economical conditions and labour market

Mining is the predominant source of employment in Roşia Montană and Abrud, in contrast to Câmpeni, which is dominated by processing industries. See Figure 10.3. The percentage of the population employed in Roşia Montană has increased (decreasing unemployment). This is specifically related to the activities and presence of RMGC in conjunction with the general population decline. See Figure 10.4

Figure 10.3 Roşia Montană employment structure: number of employees
The two state owned mining companies Roșiamin in Roșia Montană and Cuprumin in Abrud remain the main sources of income for those localities, with 1002 and 1286 employees respectively in 2004\(^1\) (Alba Iulia Statistical Department, 2005). Roșiamin however will close ahead of the EU Accession, planned for January 2007 and Cuprumin will lay off more workers during 2006 (sources: Romania Libera, Transilvania, Banat, 13 March 2006). Closure of RoșiaMin will significantly increase unemployment in Roșia Montană to approximately 60%.

RMGC currently employs an average of up to 450 people per year including casual, temporary, part and full time employees. Should RMGC cease operations, for example not receiving permit to commence mining works, then unemployment will exceed 90%.

Some 60% of the population in Roșia Montană, so-called inactive\(^2\) population, do not take part in the formal or active economy (Alba County statistical department 2006). This reduces tax revenue to local authorities and restricts people investing in improvements to their economic capacity and/or quality of life, such as health care, education, and home improvements.

### 10.5 Economic activities

**Industry**

Mining is the predominant industry in Roșia Montană and Abrud, as Figure 10.3 shows, and accounted in 2004 for some 90% of income to people in Roșia Montană (Alba Iulia Statistical Department 2005).

Historically, a result of the income provided by gold mining in Roșia Montană, meant that many products were bought mostly from surrounding areas and local trades have not formed a dominant part of the village’s income. This contrasts with the situation in Câmpeni and other areas in the Apuseni Mountains which rely on specialization in a variety of trades.

The Romanian state has declared the mining area of Apuseni, Alba county a depressed area\(^3\). According to Ordinance No. 24/30.09.1998 a depressed area is defined as a region with a strictly delimited territory that meets at least one of the following conditions:

- It is a mono-industrial area;

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\(^1\) Note that these are sharply in decline.

\(^2\) People or group of people who are not contributing directly to the registered economy. They are not registered as unemployed, do not have official employment, do not pay tax, do not receive unemployment benefits, may receive pensions or sickness-benefits, and may be involved in unregistered economic activity.

- An area where 25% of the total workforce has been made redundant;
- Unemployment exceeds the national average by more than by 30%;
- And/or is an isolated under-developed area.

**Agriculture**
Crop production in Roșia Montană is mainly subsistence with little produce sold. The main crops are fruit trees, animal forage and nut trees. Land suitable for small scale agriculture is low, some 7% in Roșia Montană, 6% in Abrud and 7% in Câmpeni. Soil quality is at best moderate, suitable for cattle grazing but very poor concerning potato and vegetables production. Access for farm machinery is severely limited due to the terrain and most work is done by hand with transport by horse drawn cart.

**Tourism**
Apart from a number of small convenience shops (9) and bars (5) there is no tourist-related infrastructure available in Roșia Montană, such as cafes, restaurants, supermarkets, hotels, pensions, car rental facilities, petrol stations, entertainment providers, or activities and services. There is a mining museum and an initiative concerning walking tours.

The economic impact on tourism on the economy Roșia Montană cannot be adequately estimated due the lack of tourist records or proxy indicators because of the absence of tourism infrastructure in Roșia Montană.

**Investments**
Investments in the area are concentrated in Câmpeni, whereas in Roșia Montană there is a lack of investment inflows except in mining. Table 10.1 describes the principle reasons why investment in Roșia Montană is low:

Table 10.1  **Main investment disincentives concerning Roșia Montană**

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic</td>
<td>Aging population dominated by elderly women</td>
</tr>
<tr>
<td>Financial</td>
<td>Significant poverty &amp; lack financial capacity to develop businesses</td>
</tr>
<tr>
<td>Skills</td>
<td>Population skills set dominated by mining and subsistence agriculture</td>
</tr>
<tr>
<td>Isolation</td>
<td>Roșia Montană is relatively remote, situated in a small valley at the end of a road</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Utility &amp; transport infrastructure are poorly developed and/or in poor condition; the condition of buildings is generally poor</td>
</tr>
<tr>
<td>Environment</td>
<td>Roșia Montană’s environment suffers from considerable historical mining impacts</td>
</tr>
<tr>
<td>Development costs</td>
<td>Costs, including environmental, infrastructure, buildings, etc, are high, in particular to deal with existing pollution legacies</td>
</tr>
<tr>
<td>Other centres</td>
<td>Other centres, both urban and rural are better positioned regarding the above issues and (would) attract investments over Roșia Montană, such as Câmpeni</td>
</tr>
</tbody>
</table>

Applicable development funding which Roșia Montană may benefit from comes from the Romanian government, the EU and the World Bank. However, their development priorities do not favour nor particularly support socio-economic development in Roșia Montană. The principal reasons are as follows:
- World Bank and EU funding are designed to close unprofitable mines, reduce government direct involvement in mining activities, and provide only a limited duration of social support. Additionally their policy is to seek private investors for potentially profitable operations;
- Romanian government development priorities do not include Roșia Montană;
- Government, EU and the World Bank would prefer private sector investment to address development in Roșia Montană based on the presence of an economically viable mineral resource in Roșia Montană, in compliance with all relevant legislation.
The initial investment cost of upgrading infrastructure to a quality suitable for tourism, such as museums, attractions, roads, utilities and waste management, accommodation, food and beverage outlets, etc, is unlikely to be returned by income generated from tourism. Additionally tourism numbers are unlikely to cover upkeep and maintenance costs on an annual basis.

10.6 Living conditions in the area

Environmentally the area is of low conservation value – water resources (streams, etc) are polluted, habitats fragmented, landscape scarred, and on-going anthropogenic impacts occur. Environmental management systems (waste, wastewater, water) are still very weak, poorly developed and sometimes even non-existent. All these affect the living conditions of the population in the Roșia Montana area.

Home ownership
Since 2000 the number of homes owned in Roșia Montana and Abrud has decreased, whilst in Câmpeni it has increased (Alba Iulia statistical department, 2005). Possibly due to the out-migration of (young) people pursuing employment opportunities and improved living conditions in other areas, such as Câmpeni. This explanation is supported by the demographic profile in Roșia Montana which shows elderly women to be the dominant population group.

Dwellings – living conditions
Current living conditions in the Community are far below EU standards. Basic services such as potable water supply, waste water collection & treatment, reliable energy supply, waste collection and treatment are all poorly developed, if at all, especially in Roșia Montana & Abrud, though less in Câmpeni.

Very few households have an inside bathroom and toilet. Electricity is present in almost all households but inhabitants cannot afford to use it for heating. Even in Abrud and Câmpeni, the vast majority of the population uses wood for heating.

Many households in Roșia Montana are connected to the national telephone network which is in the process of being upgraded to a fibre optic system. The whole area receives cellular phone signals and mobile phones are widely used.

Internet is not well established, though an Internet Information Centre has been recently established by RMGC (December 2005) allowing free access to internet for the Community.

Health status
According to a socio-economic survey in 2002, 62% of households interviewed in Roșia Montana had one or more members who sought medical attention for serious illnesses in 2001. Causes of health problems include occupational hazards (particularly mining), as well as a high fat diet, and stress and alcoholism. Also, existing mining and ore processing facilities are in poor condition and pose safety hazards to workers and risks to the environment.

A health baseline study conducted in Dec 2005 and Jan 2006 concluded that the health status of the population living in Roșia Montana is worse compared to that of people living

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1 RMGC Socio-economic survey, 2002.
2 Strajan Planning Office,(2002): Physical & cadastral survey – Census of affected household
3 Environmental Health Centre, Cluj Napoca, Romania.
other areas both in the vicinity and regionally. For some diseases risks are higher for people in Barium and Cortège. See Figure 10.5.

**Figure 10.5** Ischaemic heart disease in Roșia Montană and regionally

![Graph showing ischaemic heart disease in Roșia Montană and regionally.](image)

*Roads and transport*

The density of roads varies according to topography and resulting land capability and settlement patterns and the quality also varies considerably from dirt tracks, gravel as well as asphalt. Access to the Community is via small National (DN) roads from centres such as Cluj-Napoca, Deva and Alba Iulia. These roads are narrow, generally in poor condition and winding.

There is no railway network in the area. The nearest rail stations are at Deva (90 - 120 minutes drive) and Alba Iulia (75 – 90 minutes drive). There is no direct public transport to Roșia Montană. Buses connect Abrud and Câmpeni with other important towns. However, frequency is low. The nearest airport is in Cluj Napoca, at least two hours drive away.

From Roșia Montană village to the main (DN) road (about 6.4 Km), to Câmpeni (16 Km) or to Abrud (12 Km) there is no public transport.

**10.7 Institutional background**

*Local and Regional Government*

The main responsibilities of the Local Council (*comuna* in rural areas and *orasul* in urban ones) as a part of Local Public Administration include¹:

- Socio-economic development, urban and territorial planning, and administration;
- Transport and utilities infrastructure management;
- Public institutions and services (education, health, culture, sports, public security, civil protection, social assistance);

*Regional Development Agency*

Each of Romania’s eight development regions has a Regional Development Agency (ADR) dealing with a variety of government sponsored development issues. The Community is part of the “Centre” Region, based in Alba Iulia. The Centre Region ADR operates as an NGO and implements European Union (PHARE) funds and other monies, amongst other duties.

Civil society
Several small associations are active in Abrud or in Roşia Montană in the fields of social assistance, sport sponsoring, and environment. In addition to these, parents’ associations and religious congregations are active throughout the Community.

Two NGOs are currently active in Roşia Montană in reaction to the RMP:

- Alburnus Maior\(^1\) set up in Roşia Montană village in 2000 and is clearly and consistently opposed to the investment of the RMP.

- The Pro Roşia Montană association appeared later as a reaction to Alburnus Maior, and supports the RMP, in particular the jobs it creates.

10.8 Community Sustainable Development Programme

RMGC has prepared a Community Sustainable Development Programme (CSDP) to provide a framework leading to the ongoing social and economic development of the Community under the principles of Sustainable Development. The CSDP contains measures to aid in the mitigation of negative social impacts caused or may be caused by the RMP, as well as to maximise social welfare opportunities.

The overall objectives of the CSDP are:

- To maximise the Community benefit from the RMP;
- To ensure a viable investment climate remains following cessation and closure of the RMP;
- To develop the social, environmental and economic aspects of Roşia Montană and the Community such that there are continuous net welfare gains independent of RMGC and which continue beyond the life of the RMP.

Specific objectives under the CSDP include, though are not restricted to:

- Capacity building concerning business entrepreneurship;
- Promotion from within Community of employment in the Roşia Montană Project;
- Stimulating socio-economic development;
- Diversification of the industrial and economic base;
- Management of Roşia Montană’s cultural heritage;
- Strengthening of local authorities;
- Mitigation of social and economic impacts;
- Management of Community sustainable development initiatives;
- Health awareness and education.

To implement the CSDP, thereby achieving its objectives, RMGC will set up a development Foundation as a legal, independent and not-for-profit entity. RMGC would like the Foundation to be the vehicle that will manage the majority of initiatives concerned with the CSDP and will work with it and the community to prepare for a future beyond mining.

The Mission of the Foundation is:

- To ensure and to maximise continual social and cultural, environmental and economic development of the Roşia Montană Community.

\(^1\) Registered name is the “Alburnus Maior Goldminers Association” and was originally setup to avoid any change to the status of the current mine.
The overall objectives of the Foundation are:

- To ensure that mining activities result in sustainable socio-economic development in the Roşia Montană Community and continue indefinitely following cessation and closure of RMP;
- To promote the sustainable development of the Roşia Montană Community independent of the Roşia Montană Project;
- To ensure that RMGC meets its social and community sustainable development commitments under both Romanian and European Union legislation, and the Equator Principles of the IFC as described in Section 2 of the CSDP;
- To ensure that RMGC conducts its business in cooperation and harmony with the Community;
- To be a Community voice to provide effective representation in all aspects of interaction with mining companies.

Activities under the Foundation are grouped into Business and/or Social aspects. There are strong synergies between two. Environmental aspects form an integral part of these activities and all business initiatives stimulated under the Foundation will need to demonstrate how sustainable development principles are integrated into the business plans and activities.

Business orientated activities include:

- Business incubator;
- Business advisory centre;
- Micro-finance facility.

Social orientated activities include:

- Education and training centre and Skills enhancement fund;
- Management of RMP accommodation services;
- Tourist information bureau;
- Cultural centre and mining museum.

10.9 Anticipated outcomes

During the life of the mine the economy and social fabric of Roşia Montană and the surrounding regions will undergo dynamic development that shall lead to community development. This includes: jobs, increased income, demand for products and services by RMGC; demand for recreational and commercial activities by the people working for the mine and the many service industries necessary to support the mine. All will drive the development of Roşia Montană.

More directly RMGC has committed itself to an ambitious programme of development related to the mine, such as:

- A Cultural Centre and Mining Museum centred around Roşia Montană’s cultural heritage and mining history;
- Renovation of the buildings in the Protected Zone;
- The development of a modern residential and commercial area in Piatra Alba;
- Upgrading utilities and transport infrastructure\(^1\);
- Upgrading health and education facilities.

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\(^1\) Utilities include: water supply, waste water treatment, electricity (+/- gas) supply, waste collection and appropriate disposal; transport includes upgrading road quality in Roşia Montană as well as logistics and distribution.
RMGC also has commitments concerning improvements to the environment, including:

- Establishing a comprehensive water management scheme that will improve water quality in local streams;
- Commencing the progressive and imaginative rehabilitation of the site, including past environmental damage;
- Enhancing biodiversity and ecology;
- Improving forest management.

The RMP will also introduce negative impacts for local communities, including increased traffic on local highways, and possibility of noise and dust nuisance. RMGC has also committed to mitigating such impacts using methods that are tried and tested on modern mine sites around the world. RMGC will communicate on a frequent basis with local people to detect any problems in environmental management and to take action to solve them.

These kinds of commitments and investments by RMGC assist the community of Roșia Montană and the local authorities by covering much of necessary development costs to bring Roșia Montană up to a competitive standard with other small villages in the Apuseni Mountains and to maintain and improve people’s quality of life.

Other indirect benefits of the RMP include:

- A change in the demographic structure resulting in more people of working age with higher skills base and education;
- An increase in the proportion of the population engaged in the formal economy;
- Increase in Community wealth allowing for more investments in business and development.

These result in incentives to remain in the Community based on:

- Better living conditions;
- High quality health and education facilities;
- A natural environment of good status that does not cause social or health problems;
- Well ingrained social & Community culture with well developed social networks.

The RMP also provides the unique opportunity to develop and promote Roșia Montană as a Centre of Excellence in four areas:

1. Mining technologies and practices;
2. Construction and building;
3. Community and sustainable development practices;
4. Cultural heritage and archaeology research and management.

Local and regional authorities and key organisations such as universities and vocational schools need to cooperate with RMGC to achieve this. The end result could be living examples of best practice in no less than four highly topical and sought after knowledge areas that could underwrite educational facilities which exports its experts to other areas of Eastern Europe, the EU and even internationally. Cooperation is steadily increasing each year since 2001 but there is still scope for much more.

For the life of the mine, the RMP underwrites the social and economic welfare of the Community. What happens afterwards requires RMGC to meet all its commitments concerning improving the social and environmental condition in the Community. It relies even more on the people and the local authorities of the Community to create the vision of how they want to see their Community post-RMP, and develop and implement the means to achieve that vision.
11 Cultural Heritage

Since mining has been an integral part of the development of Roşia Montană for more than 2000 years, it represents an important example of the cultural landscape of a mining community in the Carpathian Mountains and in Romania. However, the decreasing population in Roşia Montană has resulted in significant modifications to both the economy of the village and to the village’s appearance. Many houses of both common and patrimonial value are in states of disrepair or have collapsed.

Box 11.1 Key cultural heritage interest sites

<table>
<thead>
<tr>
<th>Key cultural heritage interest sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining shafts and galleries of Roman construction that are almost 2000 years old;</td>
</tr>
<tr>
<td>Two Roman dated buildings: a burial structure (precinct) and an administrative building;</td>
</tr>
<tr>
<td>41 buildings considered under Romanian legislation to be “Historical Monuments”;</td>
</tr>
<tr>
<td>A variety of artefacts from the Roman period including pottery shards, coins, and tools;</td>
</tr>
<tr>
<td>10 churches and 12 cemeteries; and,</td>
</tr>
<tr>
<td>The oral history of a community shaped by an extensive mining history.</td>
</tr>
</tbody>
</table>

Law 5/2000 recognises that Roşia Montană possesses areas of cultural value, although this law does not result in the creation of a protected area, but rather requires that these areas be taken into account during zoning and planning efforts.

Forty-one buildings in Roşia Montană are classified as historical monuments under Law 422/2001, including a Roman Catholic Church and a Greek Catholic Church. Recently, the archaeological vestiges on Carpeni Hill, the Roman galleries from Piatra Corbului, the Roman funerary enclosure from Tâu Găuri and the Cătălina Gallery - were zoned as protected areas. According to the legal regulations, the Historical Centre Roşia Montană is classified as a protected area, under site category (figure 11.1).

In order to acquire a comprehensive understanding of the cultural heritage in Roşia Montană, RMGC as required by law, contracted a team of Romanian and international experts from diverse backgrounds to perform the archaeological, architectural, oral history and ethnological investigations of the RMP-affected area as the first archaeological programme of this scale in România in the last decade (figure 11.2).

Following these investigations a RMGC has therefore achieved a good understanding of the nature and location of artefacts and structures that contribute to the cultural heritage of the area. Proposed creation of new open pits and construction of operational areas and mining and processing waste stockpiles will result in land take that had potential to directly and indirectly affect cultural heritage, thus an extensive preventive archaeological program was undertaken. Design of the RMP has therefore taken into account various methods to limit land take and establish working limits to protect these features were an archaeological discharge was not granted.
In order to preserve the most valuable features of Roșia Montană’s cultural heritage, a Protected Zone has been designated, comprising the area of Roșia Piata and the eastern part of the Roșia Montană locality. The Protected Zone includes the main town square and a concentration of buildings declared as having architectural value, in addition to churches and accesses to ancient and more recent mine workings. No industrial activities are permitted in this Protected Zone.
The Protected Zone also includes 35 of the 41 historical monuments in Roșia Montană. Furthermore, the RMP design has been developed such that the remaining 6 historical monuments located outside of the Protected Zone will not be directly affected by the RMP and will be preserved in-situ.

Significant effort during the RMP design phase has ensured that the Churches of Roșia Montană will not be directly impacted by the RMP. However, the Orthodox Church, Greek Catholic Church, and two Baptist prayer houses in Corna will be affected by the RMP.

Some of the 410 graves will have to be moved to a location specified by the family of the deceased. Unknown graves will be relocated to new cemeteries in the resettlement areas. RMGC will also fund services for the reburial as required.

The existing RoșiaMin museum will be replaced by a new, modern museum. The new museum will have regular hours of operation, regular staff and will include a programme of other cultural heritage features in Roșia Montană, all contributing to forming a picture of the nearly 2000 of mining history in the locality. The entire open air exhibition of the existing mining museum will be relocated in the Protected Zone, according to legal provisions.

Public access to certain areas of the Roman-era mining networks will be developed and promoted. An example is the Cătălina Monulești, located in the Protected Zone, that will be dewatered and supported to allow safe public access. The opening of this gallery will offer the advantage of complying with modern safety requirements not entirely present in the gallery under the Orlea Massif. In addition, the Cătălina Monulești is of particular historical significance as it is the location where most of the Roman waxed tablets were found during the late-18th and mid-19th centuries (figure 11.3).

Figure 11.3  Cătălina Monulești Underground Mining Network (Prior to Renovation)

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1 The extent of this public access is to be defined in line with the requirements of safety legislation in both Romania and the EU (e.g. safe secondary evacuation routes, air circulation, safety of structures, etc.).
To ensure that the cultural heritage initiatives are managed independently from the mining company, and in a way that is sustainable after mine closure, RMGC will establish a development Foundation via a 100 % grant, as described in the Section 10 on socio-economics. RMGC will transfer the historical monuments and buildings it owns in the Protected Zone to the Foundation and will then rent these buildings for office space and mining construction workers and personnel. RMGC will continue to contribute to the cost of maintaining these buildings throughout the life of the mine.
12 Monitoring

Monitoring of environmental conditions commenced in 1999 and a great deal of information on aspects such as water quality and flows, air quality, soils, wildlife, and archaeology has already been collected and forms the basis for impact assessment.

Environmental management of the construction, operation and closure of the RMP will also require reference to information on environmental conditions. Such information will enable the operator to judge the performance of the RMP against the forecast objectives and also demonstrate compliance with regulatory limits, as will be required under Romanian Law. An effective and comprehensive monitoring database will allow the operator to apply any necessary remedial actions before environmental problems arise.

Based on the assessment of environmental impacts, the EIA report presents a recommended monitoring plan for all environmental media that cover the following:

- Parameters to be monitored;
- Location of monitoring points or areas;
- Frequency of sampling and analysis;
- Quality assurance procedures to ensure accuracy;
- Reporting requirements.

The monitoring plan therefore forms an important part of the overall environmental and social management system for the RMP.
13 Risk

13.1 What is risk?

A project the size and complexity of the RMP requires a comprehensive risk assessment conducted on it. The risk assessment conducted on the RMP relied on a well established, internationally accepted methodology\(^1\). Indeed, each country tends to have its own risk assessment guidelines or requirements. Once assessed, however, large infrastructure projects, be they mines, dams, bridges, or major buildings, tend to have similar risk categories regardless of where they are, although of course the specifics of the risk are very much related to location.

Discussing risks requires us first to define the terms we are using, and in particular requires us to define the difference between a risk and a hazard. A hazard is the potential to cause harm; risk on the other hand is the likelihood of harm occurring. It varies under different circumstances where a hazard is present and is dependent on the severity of the harm that a hazard could cause. EU directives have focussed strongly on risk minimization over the past twenty years. For the industries that use chemical substances such as mining, the EU has developed the Seveso Directives and defines risk and hazard as shown in box 13.1.

Box 13.1 The difference between Risk and Hazard

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>shall mean the intrinsic property of a dangerous substance or physical situation, with a potential for creating damage to human health and/or the environment;</td>
<td>shall mean the likelihood of a specific effect occurring within a specified period or in specified circumstances.</td>
</tr>
</tbody>
</table>

Hazards and the risks associated with them are everywhere, but when known and acknowledged, measures can be taken to minimise or eliminate risk. For example, when we go up or down stairs it is possible that we might fall, but the likelihood is that we will not. Stairs are a hazard, the likelihood of injury is known as the risk.

In reality, most things we do in everyday life expose us to hazards. However, it is HOW we do things that determines the risk.

Understanding and managing risks is dependent on understanding the relationship between hazard and risk. This is demonstrated by the two examples in box 13.2.

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\(^1\) Such methodologies (and similar) have been adopted by, and guidelines or pieces of legislation are included under several Romanian (HG 918/2002, OM 860/2002, OM 63/2002, OM 210/2004, HG 95/2003, OUG 195/2005), EU (Seveso II Directive, 05/2003/EC) and other national and international organizations (UK and The Netherlands codes of practice, AICE, ICE, ICOLD, UNEP, ANCOLD, CDA, etc.).
Box 13.2 Two everyday examples of Risk and Hazard

1. **Potassium Dichromate** is a highly toxic carcinogenic chemical. It is used in some techniques to analyse exhaled breath for alcohol content. However, for this purpose it is sealed in a tube, and does not become airborne when air is drawn over it. Therefore although it is a highly hazardous substance, its use as described, does not present any risk to the subject.

2. **Flour** would not be considered by many to be a hazardous substance. A jar of it on a shelf would not have a skull and crossbones depicted on it together with other hazard warnings, as might have been the case for a bottle of potassium dichromate However, if a baker was exposed over a period of time to airborne flour dust and/or dust by skin contact, he/she could develop dermatitis (an inflammation of the skin), conjunctivitis (inflammation of the eyes), rhinitis (information of the nose) and even asthma - an inflammatory disease of the lungs which can cause a great deal of distress and may even by life threatening.

There is an example from a bakery where flour dust was liberally scattered. The baker suffered from occupational asthma, and it was difficult for the employer to appreciate that something as apparently innocuous as flour could cause asthma, especially in conditions of high exposure.

Thus an agent of this relatively low hazard can present substantial risk (while conversely an agent with a high hazard such as potassium Dichromate might present no measurable risk in certain circumstances).

A common point in all risk assessments is that risk is calculated from:

- **Probability**: What is the chance that an accident resulting from the presence of a hazard will occur.
- **Consequence**: What happens if the accident occurs.

Multiplying these two features yields the calculated risk.

Both probability and consequence are generally divided each into five categories (each having a rating from 1 to 5). The risk of an event – the risk rating – is then the probability rating of it occurring multiplied by its consequence rating once it occurs. The smallest risk is 1, resulting from an improbable occurrence rating of 1 multiplied by an insignificant consequence rating of 1. The highest risk is 25, resulting from an almost certain probability of occurrence rating of 5 multiplied by a catastrophic consequence rating of 5.

A rating between 1 and 4 means a very small risk, 5 to 9 represents a small one, 10 to 14 is a moderated risk, 15 to 19 is major and 20 to 25 is extreme (see table 13.4).

For a project such as the RMP, therefore, identifying the hazards and understanding the risks involved is central to the exercise of the project’s design and environmental impact assessment. A summary of the risk assessment for the RMP, an assessment required under EU and Romanian legislation follows.

13.2 Risk in the RMP

The assessment of risk was carried out in respect to both the whole RMP as well as to certain individual components of the RMP.
Table 13.1 summarises the risk categories identified with the RMP, who is at risk by the event, the risk rating, and the RMP mitigation strategies. The risk rating is explained further on in this section. A risk rating between 1–4 is ranked very low and 5–9 is low, see Table 13.3 and 13.4. The identified risk categories of the RMP all rank low or very low.

Table 13.1  Risk events at the RMP and their mitigation strategies

<table>
<thead>
<tr>
<th>Event</th>
<th>Those at risk - receptors</th>
<th>Risk Rating ( [\text{probability} \times \text{consequence}] )</th>
<th>Mitigation strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSTRUCTION PHASE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No major accident scenarios</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPERATION PHASE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating errors in the processing and DETOX plant</td>
<td>Local workforce, Local community</td>
<td>9 [3 x 3]</td>
<td>Automated and laboratory monitoring, operator training, automated detection and warning systems; regular maintenance and calibration of automated control systems.</td>
</tr>
<tr>
<td>Cyanide spillage from plant site storage and operational areas.</td>
<td>Water resources, Wildlife</td>
<td>6 [2 x 3]</td>
<td>Containment dams, detox plant, high level alarms, downstream pollution control dam.</td>
</tr>
<tr>
<td>Accidental release of cyanide contaminated water from the TMF.</td>
<td>Water resources, Wildlife</td>
<td>4 [1 x 4]</td>
<td>Tailings detox plant, automatic plant shut down system, design freeboard within, degradation and dilution of cyanide within the tailing pond.</td>
</tr>
<tr>
<td>Accidental release of cyanide contaminated water due to failure of secondary containment dam recycling.</td>
<td>Water resources, Wildlife</td>
<td>4 [1 x 4]</td>
<td>Design freeboard within dam to store excess flow, preventative maintenance and back up pumps installed, emergency response plans.</td>
</tr>
<tr>
<td>Accidental cyanide spill during ship, road or rail delivery to site associated with rainfall.</td>
<td>Local communities, Water resources, Wildlife</td>
<td>8 [2 x 4]</td>
<td>Adopt cyanide code, detailed operating procedures for handling and transport, load tracking, contractual responsibility on haulier for controls, appropriate route selection.</td>
</tr>
<tr>
<td>Accidental explosion of LPG or fuel storage tanks</td>
<td>Local workforce, RMP facilities, Property damage</td>
<td>8 [2 x 4]</td>
<td>Special tank design and construction, special operator training, regular checks and maintenance</td>
</tr>
<tr>
<td>Corna TMF dam failure</td>
<td>Regional communities, Water resources, Wildlife</td>
<td>5 [1 x 5]</td>
<td>Use of high design standards and, standard operational procedures, tailings detox plant.</td>
</tr>
<tr>
<td>CLOSURE PHASE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accidental cyanide contaminated water discharge from TMF seepage (from secondary containment dam).</td>
<td>Local water resources, Wildlife</td>
<td>4 [2 x 2]</td>
<td>Semi passive treatment plant constructions, design freeboard within secondary containment dam, preventative maintenance, regular monitoring.</td>
</tr>
<tr>
<td>Corna TMF dam failure</td>
<td>Local communities, Water resources, Wildlife</td>
<td>4 [1 x 4]</td>
<td>As operational plus, removal of tailing pond, low level closure spillway design, capping and revegetation of TMF.</td>
</tr>
</tbody>
</table>

\(^{1}\) Risks are low because the structures and technology employed are designed with a high safety factor in order to minimize risk due to the hazards which are present.
The following section goes into more detail as to how the risk ratings for the RMP risk events were determined.

### 13.3 An overview of the risk calculation method used

As part of the assessment, the RMP was first analysed to identify significant hazards associated with both natural and technological processes. These included consideration of natural occurrences such as earthquakes and floods, as well as process and/or man-made induced accidents, including transportation of equipment and materials that could give rise to serious consequences.

The risk assessment includes both a qualitative analysis and a quantitative analysis as follows:

- The qualitative analysis establishes the list of possible hazards, and enables event ranking based on risk. Hazard identification techniques (qualitative analyses) used to identifying hazards arising from the process are based on the intrinsic presence of the hazard, on observations of what is happening, checklists of the observational approach. These are summarized using the HAZOP method – see box 13.3.

**Box 13.3 The HAZOP Method**

HAZOP = HAZard and OPerability Study. A qualitative technique to identify hazards resulting from hardware failures and human error. Often expensive and sometimes based upon brainstorming sessions.

- Hazard evaluation techniques are quantitative analyses, used to decide on how to act to eliminate or reduce them in order to protect the population, the property, and the environment. Hazard evaluation uses intrinsic presence, past experience, and various codes of practice. The quantitative hazard evaluation techniques are summarized under the HAZAN method – see box 13.4.

**Box 13.4 The HAZAN Method**

HAZAN: = HAZard ANalysis. A quantitative approach that looks into the quantity of hazard etc rather than the quality aspect of failure known as HAZOP.

The qualitative measure of consequences has been developed by classification into five levels of seriousness, an internationally accepted methodology used in risk assessment studies. They vary from Insignificant to Catastrophic, and are given a weight factor from 1 to 5, respectively. These range from:

- Rare (or improbable) – having a frequency of occurrence less than $10^{-12}$ (annual probability of occurrence in $10^{12}$ years),

To:

- Almost Certain – having a frequency of occurrence higher than $10^{-4}$ (possibly less than 10000 years).

The quantitative risk assessment is then based on computing the level of risk as a product of the seriousness (consequence) and the probability of occurrence of the event. Using the information obtained from the analysis, the risk of an event can be illustrated in a matrix form, as presented in the following tables.
Table 13.2  Matrix of the risk of an event

<table>
<thead>
<tr>
<th>Probabilities of occurrence</th>
<th>Consequences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Insignificant</td>
</tr>
<tr>
<td>Improbable $&lt; 10^{-12}$</td>
<td>1</td>
</tr>
<tr>
<td>Unlikely $10^{-8}$ to $10^{-12}$</td>
<td>2</td>
</tr>
<tr>
<td>Possible $10^{-4}$ to $10^{-8}$</td>
<td>3</td>
</tr>
<tr>
<td>Probable $10^{-1}$ to $10^{-4}$</td>
<td>4</td>
</tr>
<tr>
<td>Almost certain $&gt; 10^{-3}$</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 13.3  Risk rating definition (per event, scenario)

<table>
<thead>
<tr>
<th>Risk level</th>
<th>Definition</th>
<th>Action to be taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 4</td>
<td>Very low risk</td>
<td>Business as usual; standard operating procedures.</td>
</tr>
<tr>
<td>5 – 9</td>
<td>Low risk</td>
<td></td>
</tr>
<tr>
<td>10 – 14</td>
<td>Moderate risk</td>
<td>Specific standard operations procedures, with the involvement of workplace managers</td>
</tr>
<tr>
<td>15 – 19</td>
<td>High risk</td>
<td>Prompt response action, as quick as the normal management system allows it, with the involvement of the top management</td>
</tr>
<tr>
<td>20 – 25</td>
<td>Extreme risk</td>
<td>Emergency situation requiring immediate action and priority use of available resources</td>
</tr>
</tbody>
</table>

This risk rating definition follows the modelling of an extensive number of accident scenarios to gauge possible impacts. The scenarios were ultimately characterised according to their consequences and likelihood of occurrence. Of these, major accidents were selected – having a probability of occurrence equal or greater than $10^{-6}$ and falling under the EU Seveso Directive remit for major accidents, and assessed in more detail. The major accident scenarios are those presented in Table 13.1. The table demonstrates the low risk rating assigned to all aspects of the RMP.

To again place this in the context of everyday live, the risks of major accidents from the RMP have been drawn on Frequency – Number (FN) diagrams presented by the International Centre for Geohazards – Norwegian Geotechnical Institute, Oslo, Norway. See Figure 13.1 and 13.2. These FN diagrams present frequency against consequence (loss of materials or number of fatalities) and summarize the results of the analyses giving a graphical representation of the RMP specific social risk correlated with the socially acceptable risk. The diagrams present relevant comparisons between the risk levels for the RMP and risks associated with various other industries or human activities. Risk levels for the RMP are situated well within the socially acceptable levels.

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1 Published by Farrokh Nadim and Suzanne Lacasse, International Centre for Geohazards – Norwegian Geotechnical Institute, Oslo, Norway in Terrain and geohazard challenges facing onshore oil and gas pipelines. Thomas Telford, London, 2004
Figure 13.1  Risk levels for various industries and activities

Figure 13.2  Annual probability of occurrence vs. Consequence Diagram for Dams and Socially Acceptable Risk
14 Description of Difficulties

Process complexity
The elaboration of an Environmental Impact Assessment (EIA) study is a complex process in any national context, and it becomes more complex in a transboundary context.

There hasn’t recently been a more complex project than Roșia Montană in Romania. As a result of this fact, complexity is the main characteristic of the EIA study for the Roșia Montană Project (RMP)’s which encompasses not only environmental, but also economic, social and cultural dimensions, as well as the strategies for preventing and/or mitigating the impacts.

Relevant legislation
The complexity of the study has been amplified by the lack of a precedent in Romania concerning the development of a mining exploitation in line with the new European legislation (Mine Waste Directive 2006/21/EC), the relevant reference document concerning the Best Available Techniques specific for mining waste (BREF-MTWR), as well as with the requirements of the international financial institutions (IFI) and with the Equator Principles. However, this didn’t represent a difficulty in elaborating the EIA study – on the contrary. The competent authorities required the RMP to comply with the stipulations of the recently promoted EU legislation ever since defining the scope of the EIA. The approval of the directive 2006/21/EC during the study’s elaboration established the standards required for the Project’s mine waste management. Further, the IFI’s guidelines allowed the identification of the Best Practices when neither the national legislation nor the European one provided specific and concrete guidance (e.g. population relocation and resettlement of population).

Approach
As part of the elaboration of the EIA study, RMGC identified the required areas of professional expertise for the evaluation and recruited the most reputable Romanian and international independent experts for each identified area. The technical project and the detailed studies documenting the initial environmental, economic, social and cultural conditions lasted approximately seven years, and had been undertaken before the evaluation was started. These documents enabled the launch of the EIA study, which has been a dynamic process, and one based on the continuous cooperation with the project designers. This has led to the completion of a well grounded and well documented EIA, and has resulted in the improvement and completion of the project design by identifying solutions aimed at mitigating the potential impacts. The structure of the EIA team and the way the activities were organised led to a stimulating working environment, in which the difficulties were not felt, even though the work was challenging.

Project perception and public consultation
There are, however, difficulties associated with the EIA procedure resulting from the public’s perception of the RMP, a perception influenced by the impact of present and past mining activities in Roșia Montană and by the accidents that have occurred in the precious metals extraction industry. Moreover, the public from outside the area, who are unaware of, and have not seen, the realities of Roșia Montană and the consequences of unsustainable mining exploitation, perceives the project as a potentially irreversible destruction of a traditional rural area, positioned in a fairytale landscape. In reality, not even grazing can occur on barren rocks that generate acid water. Moreover, development of any other activities in the area is not recommended, given the instability of the land due to underground mining activities that have riddled it for 2000 years.
Another category of deformed perceptions of the project is linked with the suspicion that the RMP’s titleholder will not fulfil its commitments, or that the result of the impact evaluation, and especially the risk, is not correct (e.g. the accident of a breach in the tailings management facility is considered as improbable). Even if such an extreme accident situation were to occur, there are solutions for mitigating the impact of such an event, such as retaining the tailings with a physical barrier, organized as part of an external emergency intervention plan. Concerns about cyanide pollution linked to a dam failure are not justified and distract attention from the real impact of the project on the population and the landscape. Unfortunately, at least partially, real impacts such as these cannot be avoided, even if other alternatives to the project were to be pursued for the area’s development, because they would also require the realisation of land stabilization and reclamation procedures.

**Conclusion**

The evaluating experts who participated in the elaboration of the EIA unanimously agreed on the need for a stabilization and reclamation solution for the area affected by present and past mining exploitation in Roșia Montană. Open-pit mining, excavating the existing galleries resulting from previous underground mining works, and followed by the refilling of the quarries with compacted waste rock, ensures ground stability and the closing of the galleries that generate acid water through draining precipitation. In the absence of the open-pit mining solution, the same results could be achieved through expensive works that would also involve controlled collapses of the galleries – an action not without risk. Only after these conditions are satisfied, land reclamation and development projects for the area can be started, projects that would always be limited by the land quality. The area’s reclamation would be expensive and lengthy and would require a cost-benefit analysis of the alternative options, in the context of the three pillars of sustainable development: ENVIRONMENT – ECONOMIC – SOCIAL. Only an option presenting feasible economic development could support the environmental and social costs. This is the reason why the experts support the solution to revitalize the area by developing a modern open-pit mining exploitation based on Best Available Techniques. It is up to the authorities to decide WHO is going to do it.
15 Transboundary Impacts

It has long been recognized that the impacts of industrial projects, for example, water pollution following an accident, may be experienced outside the borders of the country in which the project is located. This creates a potential problem in that while the Environmental Impact Assessment of a project may be administered by a national authority, concerned people outside the jurisdiction of that authority may have no way to be involved in the decision making.

This issue has been recognised in both international and national guidance and in the regulations in Romania. The UN-ECE Convention on Environmental Impact Assessment in a Transboundary Context (the ‘Espoo Convention’), was ratified in law in 2001. According to Espoo convention, all potentially affected parties are notified, and they are able to participate in the public information and consultation process within the EIA procedures.

To facilitate this, the EIA report includes a Chapter on Transboundary Impact that documents the assessment of the RMP considering its potential to affect the environment of neighbouring countries.

Section 9 of the NTS summarises the forecast environmental impacts of the RMP and the great majority of these will only affect the local environmental setting, being experienced well within Romania’s borders and have no relevance to transboundary concerns.

However, certain impacts or activities have a potential for environmental impact that raises important issues for Romania’s neighbours, specifically:

- Impacts on water quality of streams and rivers that feed larger rivers that cross national boundaries;
- The potential transportation of construction materials and chemicals / reagents from outside Romania;
- Employment creating inward migration from outside the country.

Each of these issues is discussed below.

**Water quality**

The RMP area drains directly into the Abrud River, a tributary of the Aries River. The Aries River flows into the River Mureş then continues approximately 400 km before crossing into Hungary. The total distance measured along watercourses from the RMP to the Romanian-Hungarian Border is approximately 550 km. The River Mureş joins the River Tisza just upstream from Szeged after flowing approximately 25 km from the boarder and continues flowing through Hungary for approximately another 15 km before flowing into Serbia and joining the River Danube.

The current water quality within this river system is characterised by pollution from domestic, industrial, farming and waste management activities in Danube’s catchment. The existing and historic mining activities at Roşia Montană currently contribute to this, albeit at a level that is not measurable in a transboundary context. As noted above, it is proposed that the Roşia Montană Project will establish, for the first time, a comprehensive environmental management scheme that will greatly improve local water quality. However, because of the extremely small contribution (in terms of both quantity and therefore quality) of the Abrud River to the quality of water in the River Mureş flowing into Hungary, this positive impact will...
have no significant transboundary effect. The little influence it would have at the boarder, however, is beneficial to water quality.

No effluent will be discharged to streams without treatment to required Romanian standards. Any accidental water pollution from the site would be subject to dilution and only major spillages would have any potential to cause measurable transboundary impacts.

Section 13 of the NTS presents the risk of large-scale industrial accidents related to the RMP. These risks range from very low to low. In relation to potential water-related transboundary impacts, it is the use of sodium cyanide in ore processing that is considered of most importance. This is addressed by a comprehensive set of risk mitigation measures including:

- Management systems and standard operating procedures within the Cyanide Management Plan to implement the requirements of the International Cyanide Management Code\(^1\) (to which Gabriel Resources / RMGC became a signatory in April 2006) and appropriate national and international legislation;
- Leak detection and spill containment systems in line with best practice and the International Cyanide Management Code.

Taking account of the significant distance along water courses from the RMP to the Hungarian border (approximately 550 km) and the relatively small volumes of water held on the RMP, even a direct discharge to surface water would unlikely be significant in a transboundary context.

So as to fully understand the risks, however, the EIA looked at what would happen if a failure scenario with a very low occurrence probability were to happen. Having in view that such a risk is excluded by the RMP’s design criteria only extreme mismanagement could allow such an event. If this were to occur, however, such a large release of tailings and decant water would allowed sediments, heavy metals and low levels of cyanide to discharge into the Corna stream. This would start with a flow of discharged tailings material that could migrate downstream over a distance of less than 1.6 km (before the Corna stream enters the Abrud stream). Under this very remote worse case scenario water quality would be affected by runoff from the tailings flow as far away as the Romanian – Hungarian border. If conservatism is again applied and it is assumed that this accident were to occur during good weather with normal flows in the stream and without any chemical attenuation or loss of cyanide to the atmosphere then possible cyanide concentrations eventually crossing international boundaries would range between 0.03 to 1.3 mg/l depending on the stage of the mining operation.

Transboundary impacts due to mining failures have been experienced in the past between Romania and Hungary. One example was the 2000 environmental disaster, when an embankment failure was experienced at Baia Mare. This resulted in the release of approximately 100 000 m\(^3\) of water with a Weak Acid Dissolvable (WAD) cyanide concentration reportedly between 120 and 400 mg/l\(^2\) - far higher than what is now permissible to store in any new TMF in Romania or in the EU (existing facilities are to respect a 50mg/l upper limit while new facilities are to respect an upper limit of 10mg/l). The Baia Mare cyanide spill travelled approximately 60km in Romania before entering the north of Hungary and travelling all the way down through Hungary. It is suspected that the effect of this spill was made worse by the addition of hypo-chloride to the river system by both the

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\(^1\) [www.cyanidecode.org](http://www.cyanidecode.org)

\(^2\) 1mg/l =1 part per million parts (ppt)
authorities and the mine operator, underlining the need for a comprehensive accident management system. It was this incident that encouraged faster development of the regulation of mining wastes in Europe that resulted in the drafting of the EU mining wastes Directive 2006/21/EC, the EU Seveso Directive 96/82/EC amended by Directive 2003/105/EC (as applied to mining) and the associated Mining Wastes Management Best Reference Document (BREF). Both the Directives and the BREF have been used as key references for the design of the process plant and waste management facilities for Roşia Montană. The measures presented in Box 15.1 are central to the RMP design. Not only do they respect EU directives, BAT (Best available techniques) and BREF’s but they also are the result of a study\textsuperscript{1} of the reasons for historical dam failures as reported by the International Commission on Large Dams (ICOLD)\textsuperscript{2}.

\textbf{Box 15.1 Minimisation of risk from the Tailings Management Facility (TMF)}

- Adoption of a cyanide destruction circuit that reduces the concentration of the environmentally significant fraction (known as weak acid dissociable cyanide or “WAD CN”) in tailings discharged into the Tailings Management Facility (TMF) to below 10 mg/l;
- The use of natural degradation within the TMF to reduce WAD CN concentration still further;
- Construction of the TMF and the Corna TMF dam using design criteria at least in line with the EU BREF as well as international best practice;
- A conservative design of the Corna TMF dam to retain at least a Probable Maximum Flood (PMF) at all times (even immediately following the occurrence of a PMF), thereby presenting an extremely remote chance of being overtopped;
- A spillway will be constructed into each raise to allow a controlled discharge of water without eroding the dam in the very unlikely event that the storage capacity is exceeded;
- A conservative design of the Corna TMF dam to resist an earthquake up to an 8 on the Rector scale – even though this part of Romania is situated in the low earthquake risk zone;
- Construction of the Corna TMF dam from rock using the centreline method, with filters to control seepage and controlled fill placement to ensure strength;
- Construction of downstream face with a gentle slope (3H:1V) made of rockfill and therefore not prone to erosion;
- Construction of a water retention dam downstream of the Corna TMF dam to capture any seepage of water from the TMF dam;
- Implementation of a stringent monitoring system for both the TMF and the Corna dam:
- Adoption of appropriate \textit{Standard Operating Procedures} with accident prevention functions as well as a \textit{Cyanide Management Plan} and an \textit{Emergency Preparedness and Spill Contingency Plan}.
- A comprehensive monitoring system within and around the dam to provide early indication of any potential instability, excessive pressure head build up, and/or excessive reclaim pond volume growth; and
- A comprehensive Construction Quality Assurance program will be implemented during the initial dam construction and subsequent dam raises.

\textsuperscript{1} Tailings Dam Incidents, U.S. Committee on Large Dams - USCOLD, Denver, Colorado, ISBN 1-884575-03-X, 1994, 82 pages [compilation and analysis of 185 tailings dam incidents]

\textsuperscript{2} www.icold-cigb.org
The result of the mitigation measures as presented in Box 15.1 is to reduce the risks posed by the storage and use of sodium cyanide at the plant site to an acceptable level and to reduce the hazard and risk created by storage of tailings materials containing residual cyanide in the TMF. Emergency and Contingency planning is designed to be appropriate to meet the requirements of the Seveso II Directive established for the EU to mitigate against large scale accidents and to minimize their impact.

In summary, only a major accident scenario with a very low probability of occurrence that would result in mass release of tailings fluids during the operational phase has potential to impact upon surface water quality of adjacent states and hence the potential to impact their aquatic wildlife (and animals dependent upon aquatic wildlife and habitat), communities and other water users. The risk of such an incident occurring was assessed as very low.

**Transportation**

During the construction phase, large quantities of equipment, reagents and materials will be transported to the RMP mine site. A majority of these will be basic construction materials for simple fabrication and will be sourced from within Romania. However the RMP will require the importation of some specialised equipment that is not currently available in Romania, leading to transboundary transport requirements. The need for importation of equipment will only occur occasionally during short periods and the total quantity of materials being sourced from outside the country will be relatively small. Established transport networks exist for each of the likely transport modes and the overall impacts on the transboundary shipment of goods for construction will therefore be small.

Chemicals and reagents for the operational phase of the RMP may require importation and hence may present a transboundary risk. An example is sodium cyanide, a toxic material, currently used in many industries in Romania and neighbouring states and throughout the EU and North America. This is currently produced in Romania but there are questions over the reliability of its production and whether its production can meet the terms set by the international cyanide management code. The RMP would require sodium cyanide to be supplied at a rate of around 11,000 to 12,000 tonnes per year.

This transportation presents a hazard of spillage of sodium cyanide onto soils or into water with potential exposure of humans and wildlife to toxic levels of cyanide. The concentration and volume of CN that would need to be transported (20 tonnes/load) could result in a major impact if release of a full load were to occur.

Various route options for this delivery have been identified and one aim of the transport system will be to maximise the use of rail. The risk of accidental spillage to occur will be significantly reduced by adoption of the practices set down in the Cyanide Code, as incorporated on site in the RMGC Cyanide Management Plan.

The basic control system to be employed to maximise safety and reduce risk as much as possible include:

- Sodium cyanide to be transported in state of the art, Hi-tech containerised ISO certified steel tankers that will be resistant to rupture in the event of an accident;
- Cyanide will be in solid briquette form during transportation and not liquid;
- At delivery, the cyanide will be liquefied and pumped to the storage tanks direct from the transport tanker with no intermediate handling or storage;
- All hauliers will be subject to strict control monitoring and audit systems to ensure they comply with the Code;
Full load tanking and communication during transport to allow rapid response to any accidents;
Communication during transportation, in order to insure a prompt reaction in case of accidents.

While a risk of accident remains, the control systems, the route selection and the method of transport combine to reduce risk of any potential transboundary impacts to a minimum.

**Employment**

Employment on the RMP averages from 1200 during construction to 563 during operation and therefore has the potential to attract workers from across the region and potentially across national borders. This has the potential to affect the transboundary labour market as well as impacting the local labour market through the introduction of expatriate labour.

However, the key factor in relation to the RMP is that the proposed RMP is being developed within an existing mining area. When the new RMP mine opens all existing operations (Minvest) will already have ceased\(^1\) and will likely be decommissioned. There will therefore be a large pool of trained labour available within the immediate locality to staff the RMP.

RMGC has developed a hiring policy that aims to maximise local employment giving preference to local people for jobs and providing considerable training to upgrade skills to the requirements of modern, responsible mining. This, combined with the readily available skilled workforces, is likely to significantly reduce any pressure for inward migration of workers to the area. Therefore the mine is unlikely to have any significant transboundary impacts in relation to employment markets. Indeed, through the creation of jobs (both direct as stated above and through the anticipated factor of 10 for indirect jobs), the RMP may provide sufficient economic prosperity to enable a significant reduction in the current outward migration of labour.

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\(^1\) Minvest’s Roșia Montană subsidiary RoșiaMin is due for closure in Autumn 2006
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