

Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	8
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	Alba Iulia, 31.07.2006
RMGC internal unique code	MMGA_0036
Proposal	An estimate of the guarantees and risk sources defined as “natural disasters” – heavy rainfalls, landslides, etc.
Solution	<p>Extreme natural events have been considered throughout the design of the Roşia Montană project. These include but are not limited to extreme rainfalls (including rainfall and snow melt), extreme draught, hurricane and extreme earthquakes. In addition, consideration has been given to climate change factors during the development of the extreme natural events.</p> <p>To illustrate this, special measures have been taken to prevent and mitigate the potential negative effects caused by heavy rainfalls. What is of interest, in view of the project, is the quantity of water flowing over the ground surface as a result of the floods. The measures have been detailed in Chapter (7), <i>Risks</i>, Subchapter (2.4.3), p. (38-42) '<i>Measures to Prevent, Reduce and Remediate the Effects of Floods and High Waters</i>'.</p> <p>Overall, the measures include:</p> <ul style="list-style-type: none"> – the development of structures over almost the entire surface of the Roşia and Corna catchment areas. As a result, runoff on the surface covered by the site will be almost entirely retained (including open pits, waste rock dumps, tailings management facilities and other types of impoundments). The Corna dam was designed to retain the total amount of water resulting from two successive PMPs (450 mm/24 h+450 mm/24 h), so as to avoid overtopping. Estimates indicate that the Probable Maximum Precipitation, defined as “theoretically the greatest depth of precipitation for a given duration that is physically possible over a given size storm area at a particular geographical location at a certain time of year” without taking into consideration long-term climate changes (WMO, 1986) with a chance occurrence of 1 in more than 100 million years [1]. – As a safeguard relating to runoff volume, the project includes construction of diversion channels within both the Roşia and Corna valley drainage basins to route rainfall runoff around the mine waste materials. As an additional measure – and based on the absence of any diversion channels – the design provides ample freeboard in the case that excessive rainfall combines with wind conditions to generate waves. <p>To ensure increased stability, we have also buttressed the dam itself, with a ration of H:V well beyond any existing requirements, as outlined below:</p> <ul style="list-style-type: none"> - The Corna Dam (the main dam) will be a rockfill structure built using the centerline method of construction. The dam will have a downstream slope of 3H:1V. Typically, the slopes for such hydraulic structures range between 1.5H:1V and 1.75H:1V. <p>As for the broader range of extreme events, the following discussion present a summary of the conditions considered in the Rosia Montana Project design.</p> <p>Chapter 4 of “<i>Report on the Environmental Impact Assessment Study</i>” subchapter(4.1) “<i>Water</i>”, p. (20), as well as the <i>Mine Rehabilitation and Closure Plan</i>, p.(123) reflect all future potential changes of the basic climatic parameters and of the extreme events. The Water Management and Erosion Control Plan as well as Mine Rehabilitation and Closure Plan include continuous assessment procedures of learned data and climatic change forecasts, in such a manner that any implications regarding the management and design activities to be immediately identified and managed.</p>

Climatic conditions that have been taken into account during the design activity developed for Corna Tailings Management Facility, with specific reference to extreme precipitations (the main factor that causes failures worldwide), are sufficient, even in the case of summation of forecasted values for extreme events (increase estimated at 15% for the period of project's development, the *Mine Rehabilitation and Closure Plan*, p. (123), subchapter (4.1). "Water", p.(20) from the *Report on Environmental Impact Assessment Study*).

Finally, the probability of major landslides to appear in that specific area is also very low, as a result of the stable petrographic composition that hosts especially compacted rocks, without large volumes of rocks that have an unstable composition. At most, There may appear superficial landslides and rocks fragmentations, generating a minimal influence on the objectives (p.50 subchapter 2.6 Section 7 Risks).

On the issue of liability, a distinction must be made between the conventional liability for property loss and human injury, and environmental damage. The Environmental Liability Directive (ELD) 2004/35/EC only covers the latter type of liability.

The usual way in industrial operations to cope with the conventional liability risk is to take out an insurance policy (or multiple for such a complex project). RMGC is in negotiation with insurance companies for this type of liability. As soon as the details become available, they will be disclosed to the public.

RMGC is also fully aware of the Environmental Liability Directive (ELD) 2004/35/EC.

The ELD encourages the use of appropriate financial instruments such as insurance to cover the risk of liability under the ELD. However, an insurance product does not yet exist because the ELD has not yet been transposed to Romanian legislation. Moreover, some requirements of the ELD still leave room for interpretation and need to be clarified with the European insurance industry before insurance products become available.

Environmental Liability Directive (ELD) cover will be obtained as soon as legally required under Romanian legislation and appropriate products are available.

RMGC is optimistic that it fully satisfies insurability criteria usually applied to operators by insurers.

References:

[1] Figure(4.1.8), p.(18), Chapter (4.1) Water, The EIA Report

Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	14
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	Rosia Montana, 24.07.2006
RMGC internal unique code	MMGA_0071
Proposal	<p>The questioner asks the following questions: How could a transboundary accident that impacts the environment even beyond the boundaries of the country where it occurs be avoided?</p> <p>Avoidance of transboundary impact is achieved by "overbuilding" the Roşia Montana Project to mitigate risk, and constructing project facilities to exacting standards, under monitoring of EU authorities, agents of the banks underwriting the project and other international overseers.</p> <p>As a key element in this effort, the EIA report considered accidents that could occur at the Roşia Montană project that could have possible transboundary impacts. These are presented in Chapter 10 of the EIA report. The accidents considered included:</p> <ul style="list-style-type: none"> - A dam failure with an associated release of tailings water and/or tailings material - An accident involving delivery of Cyanide to the project site via established transportation corridors. <p>A specific evaluation of the impacts associated with an assumed scenario for failure was analyzed to determine whether it would result in transboundary impacts. Based on this analysis it was concluded that the environmental accidents considered will have negative impacts at local/regional level, but will not have a negative transboundary effect.</p> <p>A transboundary accident caused by the Corna dam failure is unlikely, given that its design has involved special safety measures. Some of the design parameters go beyond the recommendations of the Romanian and European design standards for this type of structure. Among other things, the dam was designed to retain runoff resulting from the combined action of two successive extreme rain events of 450 mm/m²/24 h, corresponding to a total of 900 mm/m², a quantity that has never been registered in Romania (the flood volume for each PMP is 2.7 million cubic meters). Also, the dam was designed to withstand an 8 Richter Scale earthquake, with an average return period of 1:475 years [1], with the result that such an earthquake would leave the dam undamaged to the extent that operations could continue as usual. Even after closure, the dam was designed to withstand a 1 in 10,000 year earthquake with minimal damage</p>
Solution	<p>According to the provisions made as part of the technical assessments undertaken for the EIA Report, the PMP will have an average return period ranging from 1:100, 000, 000 to 1:1, 000, 000, 000 years [2]. It should be noted that a return period of more than 1:100, 000 indicates a very low probability of occurrence of this event (a 24 hour rain event). Special safety measures have been taken. The impoundment was designed to withstand any hazardous natural phenomenon that might occur.</p> <p>However, hypothetical scenarios have been imagined, based on the assumption that the construction methodology would not be complied with, thus resulting in dam failure. These scenarios represent the worst case scenarios that could be identified, taking into account the technical characteristics of the TMF. The scenarios are presented in detail in Chapter 7, the EIA Report, subchapter (6.4.3, pages 117-121). This subchapter also includes a presentation of the potential consequences of such an accident. The data concerning the cyanide concentration distribution, presented in the EIA Report, have been obtained using a conservative mixture model, that does not take into account the dispersion and the attenuation that occurs as the plume travels downstream. Later on, a much precise and realist simulation was carried out, based on the INCA, taking into account the dispersion, volatilization and decomposing of cyanide as the cyanide plume travels downstream (Whitehead et al., 2006). The model used is the INCA model developed over the past 10 years to simulate both terrestrial and aquatic systems within the EUROLIMPACS EU research program (www.eurolimpacs.ucl.ac.uk). The model has been used to assess the impacts from future mining, and collection and treatment operations for pollution from past mining at Roşia Montană.</p>

The modelling created for Roşia Montană simulates eight metals (cadmium, lead, zinc, mercury, arsenic, copper, chromium, manganese) as well as Cyanide, Nitrate, Ammonia and dissolved oxygen. The model has been applied to the upper catchments at Roşia Montană as well as the complete Abrud-Arieş-Mureş river system down to the Hungarian Border and on into the Tisa River. The model takes into account the dilution, mixing and physical-chemical processes affecting metals, ammonia and cyanide in the river system and gives estimates of concentrations at key locations along the river, including at the Hungarian Boarder and in the Tisa after the Mureş joins it.

Because of dilution and dispersion in the river system, and of the initial EU BAT-compliant technology adopted for the project (for example, the use of a cyanide destruct process for tailings effluent that reduces cyanide concentration in effluent stored in the TMF to below 6 mg/l), even a large scale unprogrammed release of tailings materials (for example, following failure of the dam) into the river system would not result in transboundary pollution. The model has shown that under worse case dam failure scenario all legal limits for cyanide and heavy metals concentrations would be met in the river water before it crosses into Hungary.

The INCA model has also been used to evaluate the beneficial impacts of the existing mine water collection and treatment and it has shown that substantial improvements in water quality are achieved along the river system under normal operational conditions.

For more information, an information sheet presenting the INCA modelling work is presented under the title of the Mureş River Modelling Program and the full modelling report is presented in Annex (5.1). [3]

By way of summary, the probability of occurrence of a dam failure with potential transboundary impact is less than 10^{-12} , meaning that such an event could occur once every 10^{12} years, which constitutes an extremely low risk. The risk assessment methodology is described in Chapter (7), the EIA Report, subchapter 2.1, p. 15-23.

Cyanide transport will exclusively involve special, ISO certified SLS containers, 16 to each. The container size is ISO compliant, allowing for road and railroad transport and the use of standard container handling devices. The container has a protective frame. For ease of handling, the protective framework is provided with legs, which allows separation from the transport trailer for temporary storage. The collar is 5.17 mm thick, which, together with the protective framework, provides additional protection to the load in case of accident [4]

Chapter 10 in the EIA Report states that the other environmental accidents that might occur will have negative impacts at local/regional level, and will not have transboundary negative effects.

References:

[1] Chapter 7- *Risks*, Subchapter 2.2.2.2., p. 27 and Subchapter 2.4.3., p. 38

[2] Chapter 4.1 *Water*, Figure 4-18, p. 18, The EIA Report

[3] **"A Water Quality Modelling Study of Roşia Montană and the Abrud, Arieş and Mureş River Systems: Assessing Restoration Strategies and the Impacts of Potential Pollution Events"** by Professor Paul Whitehead, Danny Butterfield and Andrew Wade, University of Reading, School of Human and Environmental Sciences, December 2006

[4] Chapter 7 *Risks*, Subchapter 5, page 99

Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	15
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	Rosia Montana, 24.07.2006
RMGC internal unique code	MMGA_0076

Proposal The questioner asks the following questions: What are the measures to be taken in case of a heavy rainfall?

Special measures have been taken to prevent and mitigate the potential negative effects caused by heavy rainfalls. What is of interest, in view of the project, is the quantity of water flowing over the ground surface as a result of the floods. The measures have been detailed in Chapter 7, *Risks*, Subchapter (2.4.3), p. (38-42) '*Measures to Prevent, Reduce and Remediate the Effects of Floods and High Waters*'.

Solution Overall, the measures include:
- the development of structures over almost the entire surface of the Roşia and Corna catchment areas. As a result, runoff on the surface covered by the site will be almost entirely retained (including pits, waste rock dumps, tailing's ponds and other types of impoundments). The Corna dam was designed to retain the total amount of water resulting from two successive PMPs (450 mm/24 h+450 mm/24 h), so as to avoid overtopping. Estimates indicate that the Probable Maximum Precipitation, defined as "theoretically the greatest depth of precipitation for a given duration that is physically possible over a given size storm area at a particular geographical location at a certain time of year" without taking into consideration long-term climate changes (WMO, 1986) with a chance occurrence of 1 in more than 100 million years [1].

- As a safeguard relating to runoff volume, the project includes construction of diversion channels within both the Roşia and Corna valley drainage basins to route rainfall runoff around the mine waste materials. As an additional measure – and based on the absence of any diversion channels – the design provides ample freeboard in the case that excessive rainfall combines with wind conditions to generate waves.

To ensure increased stability, we have also buttressed the dam itself, with a ration of H: V well beyond any existing requirements, as outlined below.

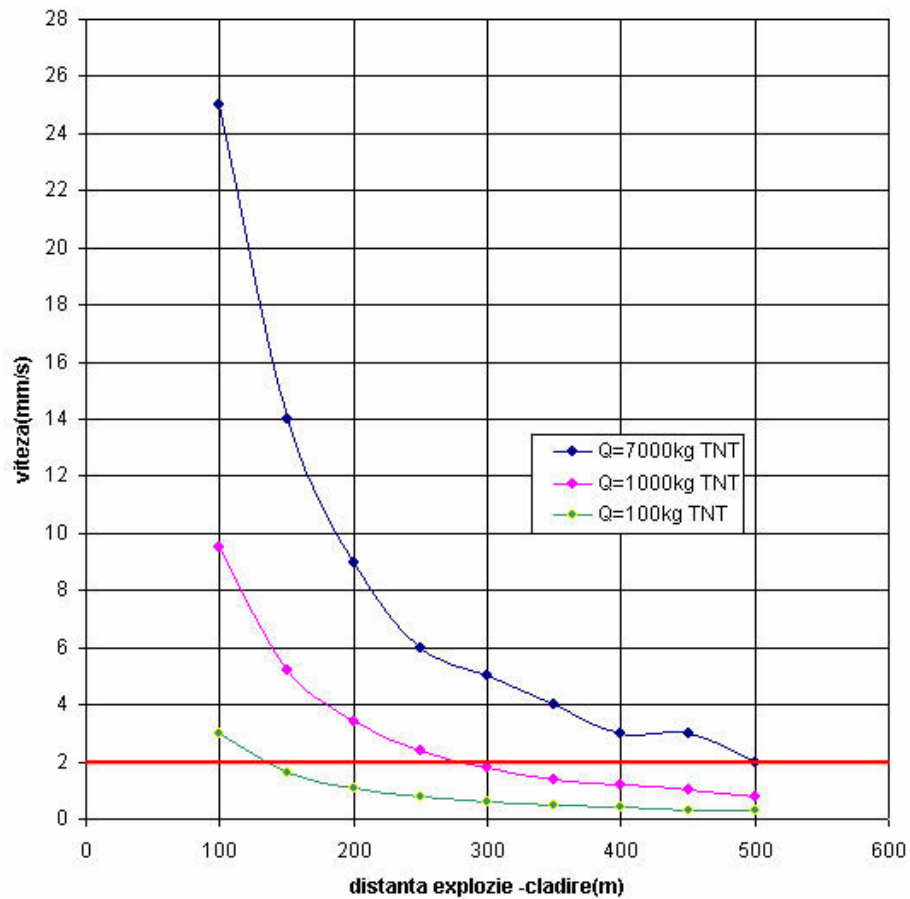
The Corna Dam (the main dam) will be a rockfill structure built using the centerline method of construction. The dam will have a downstream slope of 3H: 1V. Typically, the slopes for such hydraulic structures range between 1.5H: 1V and 1.75H: 1V.

References:

[1] Figure (4.1.8), p.(18), Chapter (4.1) Water, The EIA Report

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MMDD's item no. for the question which includes the observation identified by the RMGC internal code	15
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	Rosia Montana, 24.07.2006
RMGC internal unique code	MMGA_0077
Proposal	<p>In case an accident occurs at the processing plant, what measures will be taken in order to protect the people working within that that facility and the environment?</p>
Solution	<p>The design of the Roşia Montană project has considered the potential for accidents in the processing plant and has incorporated additional containment and monitoring measures to protect people and the environment. Risks, of course, can be mitigated but never eliminated. Therefore in case of an accident taking place at the process plant, measures will be taken in accordance with the emergency plans stipulated by the legislation in force:</p> <ul style="list-style-type: none"> - Internal Emergency Plan; - Emergency Preparedness and Spill Contingency Plan; - External Emergency Plan. <p>The main emergency response actions are summarized. below:</p> <ol style="list-style-type: none"> 1. <u>Potential Hydrogen Cyanide Releases</u> <ul style="list-style-type: none"> - Intervention: Immediate implementation of the plans mentioned above, depending on the potential impact on the areas off site, immediate coordination with the external emergency plan; - Notification and evacuation of areas downwind, emission containment, if possible, followed by immediate medical assistance to the exposed personnel; - Incident investigation and preventive and corrective action; - Implementation of other specific emergency actions. 2. <u>Potential Emissions of Cyanide Solutions from the Process Plant, due to Tanks, Pipes or Valves Failure</u> <ul style="list-style-type: none"> - Intervention: Immediate implementation of the plans mentioned above (depending on the potential impact on the areas off site), immediate coordination with the external emergency plans of the local communities; - Notification and evacuation of areas downwind, emission containment, if possible, followed by immediate medical assistance to the exposed personnel; - Pumping of the solution discharge from the secondary containment back into the cyanidation process; - Use of earth stripping equipment to build emergency containment areas in case of fractures of the secondary containment dams and immediate remediation of areas with contaminated soils; - Incident investigation and preventive and corrective action; - Implementation of other specific emergency actions. 3. <u>Fires or Explosions occurring in the Occupied Buildings or Process Areas</u> <ul style="list-style-type: none"> - Intervention: Immediate evacuation of the areas or buildings and notification of the personnel located downwind and of the fire brigade; - The fire brigade takes part in fire control operations and first aid assistance; - Coordination with the representatives of the relevant legal and military authorities, if there is knowledge or suspicion of intentional anthropogenic action; - Incident investigation and preventive and corrective action; - Implementation of other specific emergency actions. 4. <u>Chemical Spills on the Process/Storage Sites</u> <ul style="list-style-type: none"> - Intervention: Evacuation of the area and notification of the personnel located downwind, followed by the deployment of the intervention team for hazardous substances ("Hazmat") and initiation of spill control actions; - First-aid assistance to the exposed personnel by medical teams. <p>References: Chapter (5)- Security Report</p>

Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	16
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	Rosia Montana, 24.07.2006
RMGC internal unique code	MMGA_0082
Proposal	How can someone talk about the safety of the TMF when its dam is located at 800m away from the pit?
Solution	<p>We assume the questioner refers to the vicinity of the TMF to the open pit due to concerns related to blasting. With that concern in mind, we point out that the TMF dam, which is the critical containment facility for the tailing material, is located approximately 2.4 km from any blasting that will be done for the mining operation. In addition, the TMF dam design has taken into consideration parameters that fully cover the seismic risk existing in the area.</p> <p>The energy from the seismic sources is considered to be substantially greater than the energy from any of the blasting operations in the open pit. A specific discussion of the seismic design basis and the considerations for blasting impact are presented in the following text.</p> <p>The design parameters are as follows:</p> <ul style="list-style-type: none"> – The Operating Basis Earthquake (OBE) <p>It was considered to have a 1 in 475 years return period. This will correspond to a maximum acceleration in the base rock of 0.082 g. The OBE was assumed to have a magnitude of 8, 0 degrees.</p> <ul style="list-style-type: none"> – Maximum Design Earthquake (MDE) <p>It was considered equal to the Maximum credible Earthquake (MCE). The maximum acceleration of the base rock for an MDE is 0.14 g. The MDE event was assigned a magnitude of 8.0 degrees. These seismic design parameters adopted for the TMF meet or exceed the 1.1 safety factor, considered as sufficient according to the national and European standards for designing of such facilities.</p> <p><i>ROȘIA MONTANĂ- A GEOTECHNICAL ASSESSMENT OF THE IMPACTS OF BLASTING ACTIVITIES ON THE BUILDINGS LOCATED IN THE PROTECTED AREA</i>, undertaken by S.C. IPROMIN S.A., aims at assessing the impacts on the buildings located in the protected area of the blasting operations to be carried out at the Roșia Montană open pits. It also aims at identifying technological solutions for the protection of the buildings located in the protected area or for other heritage buildings.</p> <p>In order to avoid the damage or deterioration caused by blasting, of buildings located in the protected area, it has been decided that the maximum oscillation speed should be of maximum 2mm/s as measured in the proximity of the historic building to be protected (this equals a I degree or II degree earthquake measured on the MKS scale) This value was adopted based on the consultation of standards applied in countries with tradition in this field and it meets the requirements of the German DIN 4150/83 standard. In theory, these speeds should not affect the integrity of. the most sensitive and deteriorated historical buildings in Roșia Montană.</p> <p>A chart has been drawn up to indicate the variation of the oscillation speed correlated with the distance to the protected building, for a maximum load of 7,000 kg TNT on a blasting sequence, detonated instantly.</p>



In order to assess the impacts caused by the blasting carried out at Roșia Montană open pits on the buildings located in the protected area or on other heritage buildings, it has been assumed that the seismic impact will be transmitted in a homogenous environment, and that it will be weakened only due to the distance to the detonation core. This hypothesis presents a supplementary safety parameter as it is expected that the geological environment will further attenuate the seismic impact caused by blasting.

The study that has been undertaken has shown that the classical blasting technology with explosives placed in the blasting holes can be used up to maximum 300 meters from the nearest building.

There are more than 2 km from the dam's crest to the nearest open pit, therefore, considering the conclusions of the study mentioned above, the impacts caused by the blasting operations on the tailings dam will be insignificant.

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MMDD's item no. for the question which includes the observation identified by the RMGC internal code	43
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MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	Abrud, 25.07.2006
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RMGC internal unique code	MMGA_0141
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Proposal	The questioner makes the following comments on risks of the investment and asks several questions: The TMF will have a huge surface, will be full of cyanide and one of the highest risks is the one related to the occurrence of an accident similar to Baia Mare accident from 2000. The second high risk is the one related to the fact that cyanide is evaporating at 26°C and that will result in the production of acid rains on a surface comparable to a quarter of Romania. Why is the company endangering the lives of locals, including the Abrud's citizens?
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To respond to the overarching concern expressed by the questioner, we deny categorically that the RMP endangers the lives of locals in Abrud or elsewhere in the Roșia Montană region. The project EIA indicates the extent to which the company has gone to design, build and operate the RMP to the highest standards, whether they are Romanian law, EU directives or international guidelines.

That said, the questioner raises two distinct issues, to which we will respond.

First, the allegation that the Roșia Montană mining project could result in an accident similar to the one experienced at Baia Mare (2000) is unfounded. The following short comparison between the situation at Aurul Baia Mare (in 2000, at the time of the accident) and the Roșia Montană Project should be sufficiently relevant in this respect as it aims to point out the major differences between the two projects:

	Item	Baia Mare TMF ⁽¹⁾	RMGC TMF ⁽²⁾	BAT ⁽³⁾	Comments
Solution	Tailings Pond				
	Cyanide Concentration	CN _t aprox. 400 mg/l CN _{wad} 120-400 mg/l CN _{free} 100-120 mg/l	CN _t aprox. 7-10 mg/l CN _{wad} aprox. 5-7 mg/l	Maximum 10 mg/L WAD	WAD cyanides are the species most significant in terms of potential environmental impact
	Re-use of CN	CN re-use after storage in TMF	CN recovered at plant prior to CN detox facility	Re-use of CN is BAT	Decreases use and storage of NaCN
	Total CN stored in TMF	> 50 tons	7 tons ⁽⁶⁾		
	Capacity to store water in TMF	Capacity to store any event of extreme rain up to 118mm	Capacity for 2 PMP (PMP = 450mm),	1 PMP	The ability to store the PMP is a key issue to minimize potential failure of the dam
	Operational flexibility if discharge of water is necessary	"zero discharge facility", no detoxification (detox) facility for	facility to discharge if necessary including second backup facility to detox	Discharge of water from TMF is BAT if positive water balance exist	Both Baia Mare and Rosia Montana have positive water balance under specific scenarios

	CN	CN		
Embankments	Baia Mare TMF ⁽¹⁾	RMGC TMF ⁽²⁾	BAT ⁽³⁾	Comments
Material of Construction	Coarse fraction of tailings materials	Centerline method of construction using mostly borrowed rockfill and waste rock, with consolidated tailings being used only on the upstream side.	Centerline method of construction is BAT and BEP ⁽⁴⁾	At Rosia Montana, the quality of construction material will be monitored and controlled.
Capacity to increase the height of the embankment	Limited by, and dependent on, the rate of tailings production from processing plant	Very flexible as borrowed material is readily available		The capacity to increase the height of the embankment to ensure appropriate freeboard (storage capacity) is critical. Rosia Montană will maintain capacity for 2 consecutive PMP events.
Protection against overtopping	No protection	Downstream face of the dam made entirely out of rockfill		Risk of structural damage due to overtopping at Roşia Montană is very low
Controlled phreatic surface and seepage	Exfiltrations controlled only through the original tailings deposition method	Free draining structure above starter dam, with specified granular filters zones.	Accelerated consolidation of deposited tailings using under-drains and pumps is BAT.	Seepage waters are controlled and monitored, with collection at the toe of the dam.
Management	Baia Mare TMF ⁽¹⁾	RMGC TMF ⁽²⁾	BAT ⁽³⁾	Comments
Classification of TMF	Category C	Category A		Category C does not require special surveillance and monitoring
Cyanide Management Plan (CMP)	Not mentioned in UNEP Report	CMP complying with International Cyanide Management Code	CMP is BAT	A CMP formalizes best procedures to ensure safe handling and use of cyanide
Emergency preparedness, Emergency response and public communications measures (APELL ⁽⁵⁾)	Not formally	As part of the Environmental and Social Management Plan (ESMP)	APELL is BAT	APELL procedures ensure that in a case of emergency all relevant stakeholders are informed as soon as possible and drilled emergency procedures are site in motion therefore minimizing impacts
Capacity to adapt project to new	Not formally <u>After January</u>	Standard Operating Procedures		Procedures to ensure that if circumstances change, the operation will be changed

circumstances	<u>2000 event has been improved</u>	such as WT-01 Preparation, Review and Update of Project Water Balance	accordingly (commitment to continuous improvement)
<p>(1) Report "Spill of Liquid and Suspended Waste at the Aurul S.A. Retreatment Plant in Baia Mare", United Nations Environment Program (UNEP)/ Office for the Co-ordination of Humanitarian Affairs (OCHA), Assessment Mission Romania, Hungary, Federal Republic of Yugoslavia, (23 February – 6 March 2000), Geneva, March (2000)</p> <p>(2) Feasibility Study, Roşia Montană Gold Corporation</p> <p>(3) Best Available Techniques for Management of Tailings and Waste-Rock in Mining Activities. EUROPEAN COMMISSION, DIRECTORATE-GENERAL JRC JOINT RESEARCH CENTRE, Institute for Prospective Technological Studies, Technologies for Sustainable Development, European IPPC Bureau, Final Report, July 2004 (http://eippcb.jrc.es/pages/FActivities.htm)</p> <p>(4) HELCOM recommendation 13/6: definition of Best Environmental Practice, adopted (6 February 1992), having regard to Article 13, Paragraph b) of the Helsinki Convention</p> <p>(5) APELL is "Guidance for the Mining Industry in Raising Awareness and Preparedness for Emergencies at Local Level" developed by the United Nations Environmental Program (UNEP). See Technical Report 41. The APELL program is a process which helps people prevent, prepare for and respond appropriately to accidents and emergencies.</p> <p>(6) The normal operating volume of the TMF pond is 1 million cubic meters. The normal volume multiply by the concentration of total CN indicates the total tonnage of CN store in the TMF. An increase in the volume of the TMF pond will not lead to an increase in the total tonnage of CN store because the increase in volume is likely to be due to climatic events.</p>			

Another relevant comparison could be drawn, with regard to the impacts of the accident that has occurred at the Aurul Baia Mare tailings pond.

According to the monitoring data for the cyanide plume movement on the Hungarian territory, the cyanide concentration in the Someş river was 18 mg/l at Csenger (1 February, 2000), the cyanide concentration in the Tisa river was 13.5 mg/ at Lonya (3 February. 2000), 12.4 mg/l at Balsa (5 February 2000), 3.0 mg/l at Tiszakeszi (7 February 2000), 2.2 mg/l at Szolnok (9 February 2000),1.5 mg/l at Tiszasziget (11 February 2000).

In the final stage, the total surface covered by the TMF will be 363.12 ha, of which 50 ha at most will be covered by the tailings pond, located in the upstream part of the TMF, away from the dam. Under normal operating conditions, the water volume in the TMF will be approx. 1 million cubic meters and the volume of compacted tailings and pore water will be 153 million cubic meters (the EIA Report , Chapter 3, page 16). Cyanide concentration in the Roşia Montană TMF tailings effluent (undiluted by rainwater and/or by the receiving water body- in case of an accident-the Arieş River) will be in the range of 7 mg/l (no more than 10mg/l WAD CN). Therefore, even in the case of an accidental release of the tailings effluent from the TMF to the receiving body of water (and only if 2 consecutive PMPs occur within 24 hours, followed by a rainfall with a 1 in 10 years return period), the existing plans allow for a controlled release by means of a spillway constructed on top of the dam's crest. However, such a large volume of water will generate a corresponding decrease of the pollutant concentration in the TMF effluent. Consequently, the cyanide concentration measured in the source area will be lower than the one registered in the Baia Mare accident.

As the questioner also raises concerns relating to cyanide used in the Roşia Montana Project, we would also like to clear up some aspects with regard to the risk associated with cyanide volatilization (although this aspect has been detailed in the EIA report).

The term 'cyanide' refers to a singular charged anion with a carbon atom triple-bonded to a nitrogen atom. The most toxic form is free cyanide, which includes the anion itself and hydrogen cyanide (HCN), in gas or liquid form.

We would like to stress the fact that the cyanide is present in the tailings pond in the form of cyanide ions in aqueous solution and in the form of various soluble and insoluble complex cyanides.

Hydrogen cyanide HCN is a colorless toxic liquid with the boiling point at 25.79° C. HCN is miscible with water in any proportion, and soluble in ether. HCN spontaneously polymerizes if not absolutely pure or stabilized. **HCN is a very weak acid**, with a ionization constant in the same order of magnitude as natural amino-acids.

Sodium Cyanide NaCN is a white, crystalline solid, soluble in water (48 g/100 ml at 10°C), with a boiling point (extrapolated) at 1,500 °C.

In aqueous solutions, at 9.3 -9.5 pH CN and HCN exist in equal quantities. At pH 11, more than 99% of the cyanide will exist in the solution in the form of CN, while at pH 7, more than 99% of the cyanide will be present in the form of HCN.

One of the most important reactions affecting the free cyanide concentration in aqueous solutions is HCN volatilization, of key importance with regard to accident hazard. Free cyanide is lost in most surface waters because the pH of such waters is usually less than 8, therefore HCN will volatilize and disperse. The amount of cyanide lost in this way will increase with the decrease of pH and the temperature increase. As a final observation, we note that cyanide leaching is used in gold mines in tropical climates where temperatures routinely reach 40° C, without adverse effects.

Linking hydrogen cyanide emissions with the occurrence of acid rains is completely groundless considering that **HCN is a very weak acid**, (with a ionization constant (pKa= 9.2-9.3) in the same order of magnitude as natural amino-acids.

Acid rain, of course, is caused by entirely different industrial processes than those that will be used in the Roşia Montană Project, involving sulphur dioxide emissions. Cyanide cannot structurally exist in „acid rain.”

Cyanide rains” cannot possibly happen for the following reasons:

- the handling of Sodium cyanide, beginning with the unloading stage and until the tailings’ deposition in the TMF, will involve only liquid sodium cyanide, in the form of alkaline solution with a high pH (> 10.5-11), with different sodium cyanide concentrations. The alkaline nature of the solutions is meant to maintain cyanide in the form of cyanide ions (CN-) and to prevent the formation of hydrogen cyanide HCN.
 - HCN only, and not free cyanide will form as a result of the volatilization of the cyanide present in the solution.
 - handling and storage of sodium cyanide solutions will involve only closed circuits. CIL tanks, DETOX tanks and the tailings thickener, as well as the tailings pond are the only areas prone to the formation and volatilization of HCN (with little chances for HCN to be released in the atmosphere).
 - HCN emissions on the surface area of the aforementioned tanks, as well as on the tailings pond’s surface can occur as a result of the pH decrease in the solutions’ surface area (which can favor the forming of HCN)
 - cyanide concentrations in the solutions used will decrease from approx. 300 mg/l in the CIL tanks, to approx. 7 mg/l (less than 10 mg/l WAD CN) when discharged in the TMF. Cyanide concentrations are drastically reduced before discharge due to the treatment of the solution in the detoxification circuit.
 - based on professional knowledge regarding cyanide chemistry and on previous experience from similar activities, the following potential HCN air emissions have been estimated to occur: 6 t/year from the CIL tanks, 13 t/year from the tailings’ thickener and 30 t/year (22.4 t or 17mg/h/ m² in the summer period and 7.6 t or 11.6 mg/h/ m² in the winter period) from the the tailings pond’s surface. That means that the total daily HCN emission is approx. 134.2 Kg.
 - HCN air emissions undergo chemical reactions in the lower layers of the atmosphere, resulting in the formation of ammonia and carbon oxides.
 - mathematic models suggest that the highest concentrations of HCN in the air will be at ground level, in the operations area, over the tailings pond and near the plant site (assuming that HCN
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does not break down in the atmosphere). The maximum average concentration was estimated to be 382 µg/m³ per hour.

- The maximum HCN air concentrations will be 2.6 times lower than the maximum allowed concentrations under the Romanian occupational health legislation.
- HCN concentrations in the populated areas located near the operations area will measure 4 – 80 µg/m³, that is more than 12.5 times lower than the maximum allowed concentrations under the Romanian occupational health legislation (the EU and national legislation on air quality does not provide for maximum allowable concentrations with respect to the protection of the population's health).
- HCN uptake in precipitation (water vapors and rain drops) is a very minor component of HCN fate in the atmosphere as, at partially reduced pressure, (characteristic for the gases in the atmosphere) HCN is not very soluble in water, and rainout does not effectively reduce atmospheric HCN concentrations (Mudder, et al., 2001, Cicerone și Zellner, 1983).
- It is unlikely that HCN concentrations in rainfall measured in and around the Roşia Montană Project area be significantly higher than base values (0.2 ppb)

Chapter (2), Chapter (4.2) and (4.3) include further details on aspects related to cyanide use in the technological processes, cyanide balance and cyanide impacts on air quality.

References:

The EIA Report, chapter (2), chapter (4.1) and (4.2)

The EIA Report, chapter (7), subchapter (3.1.2), pages (53-57)

The EIA Report, chapter (7), subchapter (6.4.3.7), p. (121)

Cyanure d'hydrogène et solutions aqueuses *Fiche établie par les services techniques et médicaux de l'INRS (N. Bonnard, M. Falcy, D. Jargot)*

Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	43
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	Abrud, 25.07.2006
RMGC internal unique code	MMGA_0142
Proposal	<p>Why aren't people informed with respect to the acid rains and the fact that an accident may take place following dam failure?</p>
Solution	<p>Consideration has been given to the potential for CN volatilization and for dam failure scenarios in the design and in the EIA report. These studies conclude that acid rains will not occur and that the risk of dam failure is low. Specific details to support these conclusions are presented in the EIA report and are summarized in the following discussion.</p> <p>Linking hydrogen cyanide emissions with the occurrence of acid rains is completely groundless considering that HCN is a very weak acid, (with a ionization constant (pKa= 9.2-9.3) in the same order of magnitude as natural amino-acids.</p> <p>Acid rain, of course, is caused by entirely different industrial processes than those that will be used in the Roşia Montana Project, involving sulphur dioxide emissions. Cyanide cannot structurally exist in „acid rain.”</p> <p>„Cyanide rains” cannot possibly happen for the following reasons:</p> <ul style="list-style-type: none"> – the handling of Sodium cyanide, beginning with the unloading stage and until the tailings' deposition in the TMF, will involve only liquid sodium cyanide, in the form of alkaline solution with a high pH (> 10.5-11), with different sodium cyanide concentrations. The alkaline nature of the solutions is meant to maintain cyanide in the form of cyanide ions (CN⁻) and to prevent the formation of hydrogen cyanide HCN. – HCN only, and not free cyanide will form as a result of the volatilization of the cyanide present in the solution. – handling and storage of sodium cyanide solutions will involve only closed circuits. CIL tanks, DETOX tanks and the tailings thickener, as well as the tailings pond are the only areas prone to the formation and volatilization of HCN (with little chances for HCN to be released in the atmosphere). – HCN emissions on the surface area of the aforementioned tanks, as well as on the tailings pond's surface can occur as a result of the pH decrease in the solutions' surface area (which can favor the forming of HCN) – cyanide concentrations in the solutions used will decrease from approx. 300 mg/l in the CIL tanks, to approx. 7 mg/l (less than 10 mg/l WAD CN) when discharged in the TMF. Cyanide concentrations are drastically reduced before discharge due to the treatment of the solution in the detoxification circuit. – based on professional knowledge regarding cyanide chemistry and on previous experience from similar activities, the following potential HCN air emissions have been estimated to occur: 6 t/year from the CIL tanks, 13 t/year from the tailings' thickener and 30 t/year (22.4 t or 17mg/h/ m² in the summer period and 7.6 t or 11.6 mg/h/ m² in the winter period) from the the tailings pond's surface. That means that the total daily HCN emission is approx. 134.2 Kg. – HCN air emissions undergo chemical reactions in the lower layers of the atmosphere, resulting in the formation of ammonia and carbon oxides. – mathematic models suggest that the highest concentrations of HCN in the air will be at ground level, in the operations area, over the tailings pond and near the plant site (assuming that HCN does not break down in the atmosphere). The maximum average concentration was estimated to be 382 µg/m³ per hour.

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- The maximum HCN air concentrations will be 2.6 times lower than the maximum allowed concentrations under the Romanian occupational health legislation.
 - HCN concentrations in the populated areas located near the operations area will measure 4 – 80 $\mu\text{g}/\text{m}^3$, that is more than 12.5 times lower than the maximum allowed concentrations under the Romanian occupational health legislation (the EU and national legislation on air quality does not provide for maximum allowable concentrations with respect to the protection of the population's health).
 - HCN uptake in precipitation (water vapors and rain drops) is a very minor component of HCN fate in the atmosphere as, at partially reduced pressure, (characteristic for the gases in the atmosphere) HCN is not very soluble in water, and rainout does not effectively reduce atmospheric HCN concentrations (Mudder, et al., 2001, Cicerone și Zellner, 1983).
 - It is unlikely that HCN concentrations in rainfall measured in and around the Roșia Montană Project area be significantly higher than base values (0.2 ppb)

Chapter 2, Chapter 4.1 and 4.2 (Section 4.2.3) include further details on aspects related to cyanide use in the technological processes, cyanide balance and cyanide impacts on air quality.

As for the claims relating to dam failure, the proposed construction of the Corna dam, which would retain the tailings material, is based on design criteria that comply with Romanian and international standards. These criteria are meant to ensure maximum safety levels during the construction, operational and closure stages. They include flood control criteria, safety factors for slope stability and seismic design criteria etc

Based on the criteria previously mentioned, the dam has been designed to withstand an earthquake measuring 8 on the Richter scale. No such event has ever been experienced on Romanian territory and it is hard to imagine the mechanism that could cause such an event in the future.

The main design elements that ensure the dam's increased safety include the following:

- the dam has been designed to retain water resulting from 2 PMP
- with each dam rise, a spillway will be constructed to discharge, in a controlled way, the excess water resulting from a potential extreme event. This will eliminate the potential for erosion of the downstream slopes;
- the rockfill starter dam has an impervious core and an embankment slope measuring 2H:1V downstream and 1.75H:1V upstream;
- The main dam –the Corna rockfill dam, of centerline construction and downstream slopes measuring 3H:1V. Usually, the slopes for such hydrotechnical structures range between 1.5H:1V and 1.75H:1V;
- a drainage system at the bottom of the waste rock dump and a filter layer between the rock beds and the waste rock, to reduce water content and consolidate the stored material;
- a monitoring system set up on the dam's crest or on its vicinity, to provide timely information regarding potential instability situations, excessive rise of the groundwater in the dam body, excessive increase of the water volume stored in the decant pond.
- implementation of a strict Quality Assurance program, during the entire construction period.

Under these circumstances, an accident resulting in dam failure is highly unlikely. However, hypothetical dam failure scenarios have been imagined based on the assumption that the technical errors resulting from noncompliance with the construction methodology will lead to dam failure. These scenarios represent the worst case scenarios that could be identified, taking into account the technical characteristics of the TMF. The scenarios are presented in detail in Chapter 7, the EIA Report, subchapter 6.4.3, pages 117-121.

Referred to subchapter 6.4.3.6 we like to mention that a new and much more precise and realistic simulation has been subsequently established based on the INCA Mine model, that considers the dispersion, volatilisation and breakdown of cyanides during the downstream movement of the pollutant flow (Whiteland et al., 2006).

The model used is the INCA model developed over the past 10 years to simulate both terrestrial and aquatic systems within the EUROLIMPACS EU research program (www.eurolimpacs.ucl.ac.uk). The

model has been used to assess the impacts from future mining, and collection and treatment operations for pollution from past mining at Roşia Montană.

The modeling created for Roşia Montană simulates eight metals (cadmium, lead, zinc, mercury, arsenic, copper, chromium, manganese) as well as Cyanide, Nitrate, Ammonia and dissolved oxygen. The model has been applied to the upper catchments at Roşia Montană as well as the complete Abrud-Arieş-Mureş river system down to the Hungarian Border and on into the Tisa River. The model takes into account the dilution, mixing and physical-chemical processes affecting metals, ammonia and cyanide in the river system and gives estimates of concentrations at key locations along the river, including at the Hungarian Boarder and in the Tisa after the Mures joins it.

Because of dilution and dispersion in the river system, and of the initial EU BAT-compliant technology adopted for the project (for example, the use of a cyanide destruct process for tailings effluent that reduces cyanide concentration in effluent stored in the TMF to below 6 mg/l), even a large scale unprogrammed release of tailings materials (for example, following failure of the dam) into the river system would not result in transboundary pollution. The model has shown that under worse case dam failure scenario all legal limits for cyanide and heavy metals concentrations would be met in the river water before it crosses into Hungary.

The INCA model has also been used to evaluate the beneficial impacts of the existing mine water collection and treatment and it has shown that substantial improvements in water quality are achieved along the river system under normal operational conditions.

For more information, an information sheet presenting the INCA modelling work is presented under the title of the Mureş River Modelling Program and the full modelling report is presented in Annex (5.1).

References:

The EIA Report, chapter (2), chapter (4.1) and (4.2)

The EIA Report, chapter (7), subchapter (3.1.2), pages (53-57)

The EIA Report, chapter (7), subchapter (6.4.3.7), p. (121)

Cyanure d'hydrogène et solutions aqueuses *Fiche établie par les services techniques et médicaux de l'INRS*
(N. Bonnard, M. Falcy, D. Jargot)

Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	46
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	Abrud, 25.07.2006
RMGC internal unique code	MMGA_0147
Proposal	<p>The questioner makes several comments with respect to the tailings management facility: The TMF is located 2Km upstream of Abrud, on Corna Valley, will have a few hundreds ha and will have a 185m dam. He is presenting a documentation on 80 cases of dam failures from the last 40 years – from a document posted on www.rosiamontana.ro and in half of these cases deaths have resulted and the content from the tailings facility have traveled for more than 2Km; thus, the distance exceeds the distance between Abrud and tailings facility. That means that in case of dam failure, regardless of the reasons, no one will survive for sure. In the case an 8 degrees earthquake occurs, there is a chance to survive, but if the dam comes on top of this, there are no surviving chances.</p> <p>Who is going to be held liable from the company in case of an accident?</p>
Solution	<p>The design of the Roşia Montană project has incorporated the lessons learned from early tailings dam failures that are mentioned in the question. The proposed construction of the Tailings Management Facility (TMF) dam, which would retain the tailings material, is based on design criteria that comply with Romanian and international standards. These criteria, included in chapter (7), subchapter (3.2.5.1), the EIA Report, are meant to ensure maximum safety levels during the construction, operational and closure stages. The aforementioned subchapter presents the flood control criteria, safety factors for slope stability and seismic design criteria. The structure of the TMF system is also described (the starter dam – subchapter (3.2.5.2), the main dam (3.2.5.3), the secondary containment dam –subchapter (3.2.5.4), TMF diversion works-subchapter (3.2.5.5). The TMF design criteria involve a number of extra safety measures, in addition to the ones characterizing most similar facilities in the world. As a result, the TMF is an extremely robust and safe structure, with an extremely low risk of failure.</p> <p>The centerline method of construction and the pervious dam design concept (subchapter 3.2.5.5) increase the dam's stability and safety level. In the light of all these, risks have been assessed and potential accident scenarios have been imagined, including an assessment of the seriousness of the potential consequences.</p> <p>Between 1975 and 2000 there have been more than 30 major accidents associated with all types of mining operations. Table 7.4 [1] only shows the 15 accidents associated with gold mining operations. Given that there are about 875 gold and silver operations in the world, of which about 460 utilize cyanide [2], the fact that most accidents are associated with cyanide should not have been a surprise. As only <i>major accidents</i> have been included (the ones that involve the use of hazardous substances-as stipulated by the Seveso Directive), it is only natural that all cyanide accidents should be listed and only a part of the other types of accidents.</p> <p>According to the documentary data referring to major tailings dam failures throughout the world (<i>Chronology of major tailings dam failures</i>), 25 such accidents have been reported in the last ten years, of which 6 involve gold mining operations (four of them also involve cyanide). It should be noted that since the Baia Mare accident (2000), no other accident has been reported until April 2006 (when an accident happened at Zhen'an County Gold Mining Co. Ltd. Shangluo, Shaanxi Province, China).</p> <p>Compared to other tailings dams in the world, where accidents have happened, the proposed TMF on the Corna Valley is much more robust and has various safety elements. Unlike many other similar structures in the world, the tailings dam will be semi permeable, which will ensure the reduction of water content in the tailings slurry. In the extremely unlikely event of an accident, the tailings slurry will travel for a relatively short distance (compared to other similar cases), owing to the reduced water content of the tailings slurry and to the method of deposition of the tailings waste, in accordance with the tailings' grain size: thicker tailings near the dam and finer tailings upstream.</p>

Based on the criteria previously mentioned, the dam has been designed to withstand an earthquake measuring 8 on the Richter scale. No such event has ever been experienced on the Romanian territory and it is hard to imagine the mechanism that could cause such an event in the future.

The main design elements that ensure the dam's increased safety include the following:

- the dam has been designed to retain water resulting from 2 PMP
- with each dam rise, a spillway will be constructed to discharge, in a controlled way, the excess water resulting from a potential extreme event. This will eliminate the potential for erosion of the downstream slopes;
- the rockfill starter dam has an impervious core and an embankment slope measuring 2H:1V downstream and 1.75H:1V upstream;
- The main TMF dam will be constructed using the centerline and downstream construction method. The downstream slopes will measure 3H: 1V. Usually, the slopes for such hydrotechnical structures range between 1.5H:1V and 1.75H:1V;
- a drainage system is planned at the bottom of the waste rock dump to reduce water levels in the waste materials ;
- a monitoring system set up on the dam's crest or on its vicinity, to provide timely information regarding potential instability situations, excessive rise of the groundwater in the dam body, excessive increase of the water volume stored in the decant pond.
- implementation of a strict Quality Assurance program, during the entire construction period.

In order to simulate the tailings discharge in case of dam failure, the Jeyapalan model was used, of internationally acknowledged reliability. This model has been exclusively developed to simulate the flow of non-Newtonian fluids (tailings, slurries etc). Due to the inherent limitations of the model, (resulting from a simplification of real-life conditions by using a limited number of input parameters) the effects of the accident have been overestimated. The Jeyapalan model does not take into account the shape of the dam or that of the breach, the site topography, discharge of the receiving body of water, the friction coefficients or other physical parameters. Therefore, in most cases, the results will indicate the "worst case" scenario.

Starter Dam Failure (elevation:739 m)

Accident description

It is assumed that a fracture will occur and extend 40 m down from the crest, affecting one third of the length of the dam. In order to measure the distance covered by the tailings released, we used the Jeyapalan model, of internationally acknowledged reliability. The model does not consider the fact that rockfill material downstream of the affected area will be carried along, thus reducing the distance covered by the tailings.

The input parameters for the tailings material:

- yield strength 4.08 kPa
- plastic viscosity 2.45 kPa*s

(these are estimated average values based on minimum and maximum values indicated by Jeyapalan)

- Weight 13.5 kN/m³

Slope gradient: 0.7% and the estimated volume of the tailings release 5.3 Mm³

Modeling results and potential consequences

The modeling indicates that the flow slide will advance up to 0.6 km downstream of the tailings dam. Under these circumstances, the flow slide will advance up to 0.8 km downstream of the starter dam and upstream of the confluence with the Abrud river. The tailings material movement will be, for the most part, stopped by the secondary containment dam.

Failure of the main dam (elevation: 840 m)

Accident description

It is assumed that a fracture will form and extend 40 m down from the crest. For simulation purposes the Jeyapalan model was used. The model does not take into consideration the dislodged rockfill material, which would slow down the flow and will reduce the distance covered by the tailings material.

The input parameters used for the tailings material:

- yield strength 4.08 kPa
- plastic viscosity 2.45 kPa*s

(these are estimated average values based on minimum and maximum values indicated by Jeyapalan)

- Weight 13.5 kN/m³

Slope gradient : 0.7% the estimated volume of the tailings release 27.7 Mm³

Modeling results and potential consequences

The modeling indicates that the flow slide will advance up to 1.6 km downstream of the dam toe. The flow slide will get near the confluence with the Abrud River.

References

[1] Chapter (7), page (19), The EIA Report

[2] *A Global Perspective of Cyanide*, Dr. T. I. Mudder and Mr. Mike Botz, M.S., P.E.

“A GLOBAL PERSPECTIVE OF CYANIDE” By Dr. T. I. Mudder and Mr. Mike Botz, M.S., P.E. -
www.mineralresourcesforum.org

„Chronology of major tailings dam failures” - www.wise-uranium.org/mdaf.html

MWH, 2006. **“Technical Memorandum, Dam Break Analyses Jeyapalan Model”**, February (2006).

Jeyapalan, J.K., Duncan, J.M., Seed, B.H., **“Analysis of Flow Failures of Mine Tailings Dams”**, Journal of Geotechnical Engineering, ASCE, Vol.(109), No. GT2, Feb., (1983), pp. (150-171)

Jeyapalan, J.K., Duncan, J.M., Seed, B.H., 1982, **“Investigation of Flow Failures of Mine Tailings Dams.”**

EIA, chapter (7), subchapter (2.13), pages (17-19)

EIA, Chapter (7) subchapter (6.4.3.1), pages (117-119)

Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	78
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	Campeni, 26.07.2006
RMGC internal unique code	MMGA_0193
<p data-bbox="97 539 422 629">Proposal</p> <p data-bbox="97 629 422 1122"></p> <p data-bbox="97 1122 422 1825">Solution</p>	<p data-bbox="422 539 1406 629">The questioner states the following comments, remarks, and questions: The Romanian Academy and the Church are opposing the Project and that means that something is wrong with people's safety.</p> <hr/> <p data-bbox="422 629 1406 943">The EIA process has attempted to establish an open dialogue with all concerned stakeholders to discuss the technical merits of the project and the specific technical design details. Public meetings have been held throughout Romania in an attempt to understand concerns regarding the project and to communicate the specific details of designs. As part of those efforts, RMGC has communicated that human safety is ensured by a global safety management system, in accordance with the international standards ISO, EU Directives Seveso II and Seveso III on the control of major accident hazards involving dangerous substances, the EU Directive on the management of waste from extractive industries and the International Cyanide Management Code. The Project includes essential elements, specific to its development.</p> <p data-bbox="422 943 1406 1055">The most recent position of the Romanian Academy regarding the Roşia Montană project was made public on February 27, 2006, almost three months before the submission of the report to the Environmental Impact Assessment Study to the Ministry of Environment and Water Management.</p> <p data-bbox="422 1055 1406 1122">Thus the position does not reflect an analysis of the EIA that was actually submitted to the Ministry.</p> <p data-bbox="422 1122 1406 1323">RMGC had previously changed various parts of the proposal, notably a reduction in the size of several proposed pits as well as enhancing sustainable development activities, and a stronger commitment to preservation of cultural patrimony including a reduced impact on local churches, in response to stakeholder consultations, including with members of the Academy, before submission of the EIA. RMGC would be happy to meet with the Academy to answer any questions regarding the project.</p> <p data-bbox="422 1323 1406 1547">Similarly, the objections of the Romanian Orthodox Patriarchate and other churches were all dated prior to the submission of the environmental impact assessment study. This redesign is significant: it actually lowers the total yield of the mine by 900,000 ounces of gold. Thus the EIA as submitted does not reflect the project as the churches objected to it at the time. The Project is more favourable now from the point of view of both preservation of cultural patrimony, including churches, and environmental protection. RMGC would be happy to meet with the Romanian Orthodox Patriarchate and other religious leaders to answer any questions regarding the Project.</p> <p data-bbox="422 1547 1406 1749">Contrary to what the opponents of the mining project claim, no one wants to destroy churches or cemeteries. Only two of Roşia Montană's seven churches and two houses of prayer of the existing three, must be relocated or restored under the mine plan. Those churches will be moved in accordance with the wishes of the congregation, at the expense of RMGC. Church construction is a central element in the new community of Piatra Albă being built by the company.</p> <p data-bbox="422 1749 1406 1825">The risk analysis and assessment presented in Chapter (7)-Conclusions (page 166) shows that the project has a medium level of risk and therefore acceptable under all international regulations in the field.</p>

Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	82
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	Campeni, 26.07.2006
RMGC internal unique code	MMGA_0204
Proposal	<p>The questioner makes the following remarks and comments: Campeni is not a mining area, but it is within the impact area of the Project and this will make the locality to lose tourists.</p>
Solution	<p>The qualitative and quantitative analysis and assessments undertaken and presented in Chapter 7 <i>Risks</i> in The Environmental Impact Assessment show quite clearly that Cămpeni town will not be impacted by the risk factors associated with the development of the project. For that reason, we see no negative effect on Cămpeni's attractiveness as a tourist destination. [1]</p> <p>On the contrary, it is estimated that the number of tourists in the area will increase, following the enhancement of the historic centre of the Roşia Montană locality and of some segments of Roman mining galleries and their development as tourism attractions.</p> <p>Moreover, in the last years the Cămpeni town has experienced an infusion of capital as companies associated with the development of the Roşia Montană project have established their administrative headquarters in Cămpeni and have used local direct services.</p> <p>The most important transport paths of the substances released as a result of the operations developed by RMGC are as follows:</p> <ul style="list-style-type: none"> - the water system Corna-Abrud-Arieş, and Roşia-Abrud-Arieş, situated downstream of the Cămpeni town; - the air, with a high capacity and dynamics for self-purification (no winds in the area-17.7 % of the time). The main directions for the transfer of any possible pollutants (SW and NE , for almost half of the year) do not cross the Cămpeni town (the meteorological data have been taken from the Annex) 'Average meteorological data, Roşia Montană weather station, (1988-2005)'. <p>References: [1] Subchapter (4.9), The EIA Report</p>

Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	87
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	Campeni, 26.07.2006
RMGC internal unique code	MMGA_0214
Proposal	<p>The questioner makes the following remarks and comments: Greenpeace is not opposing mining, but is opposing mining development by using cyanide, especially due to the fact that this project is developed at such a large scale and it is a hazard to this area.</p>
Solution	<p>Most gold extraction operations worldwide – more than 400 mines around the world – use cyanide as a filtration agent. It is a proven process, with known risks and well-established risk management and mitigation measures.</p> <p>At Roşia Montană, the Tailings Management Facility will be constructed to the highest international standards. The facility will be constructed to be an environmentally safe location for the permanent deposit of detoxified tailings resulting from ore processing. Sophisticated equipment will be used for geotechnical and water level monitoring. Because detoxification will take place before the tailings are deposited to the TMF, they will contain very low concentrations of cyanide – 5-7 ppm, well below the regulatory limit of 10 ppm recently adopted by the EU in the Mine Waste Directive.</p> <p>RMGC assessed alternatives to cyanide, but determined that these alternatives are generally less efficient, require more sophisticated operating conditions (e.g. high temperatures and low pH), and require higher concentrations and higher volumes of extraction agents. Because of these factors, RMGC believes that these alternatives pose an increased risk of accidents, due to the large quantities that would need to be handled and stored, while creating health and environmental risks that are similar or sometimes higher than those of cyanide. Moreover, the use of such technologies does not preclude the building of the tailings management facility nor the risks associated with its existence [1].</p> <p>[Chapter (5) <i>Alternatives</i>, Subchapter (4) in the EIA Report presents an in-depth assessment of the gold mining alternatives.]</p> <p>References: [1] The EIA Report, Chapter (8.2), p. (162-164)</p>

Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	139
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	Alba Iulia, 31.07.2006
RMGC internal unique code	MMGA_0314
Proposal	<p>The questioner draws the attention on the fact that climatic changes represent a real hazard both at international level and on local level. Taking into account this context, which are the guarantees offered by the company that no accidents will occur within the dam? If floods and land slides will take place the risk is catastrophic.</p>
Solution	<p>Extreme natural events have been considered throughout the design of the Roşia Montană project. These include but are not limited to extreme rainfalls (including rainfall and snow melt), extreme draught, and extreme earthquakes. In addition, consideration has been given to climate change factors during the development of the extreme natural events.</p> <p>To illustrate this, special measures have been taken to prevent and mitigate the potential negative effects caused by heavy rainfalls. What is of interest, in view of the project, is the quantity of water flowing over the ground surface as a result of the floods. The measures have been detailed in Chapter (7), <i>Risks</i>, Subchapter (2.4.3), p. (38-42) '<i>Measures to Prevent, Reduce and Remediate the Effects of Floods and High Waters</i>'.</p> <p>Overall, the measures include:</p> <ul style="list-style-type: none"> – the development of structures over almost the entire surface of the Roşia and Corna catchment areas. As a result, runoff on the surface covered by the site will be almost entirely retained (including pits, waste rock dumps, tailing's ponds and other types of impoundments). The Corna dam was designed to retain the total amount of water resulting from two successive PMPs (450 mm/24 h+450 mm/24 h), so as to avoid overtopping. Estimates indicate that the Probable Maximum Precipitation, defined as "theoretically the greatest depth of precipitation for a given duration that is physically possible over a given size storm area at a particular geographical location at a certain time of year" without taking into consideration long-term climate changes (WMO, 1986) with a chance occurrence of 1 in more than 100 million years [1]. – As a safeguard relating to runoff volume, the project includes construction of diversion channels within both the Roşia and Corna valley drainage basins to route rainfall runoff around the mine waste materials. As an additional measure – and based on the absence of any diversion channels – the design provides ample freeboard in the case that excessive rainfall combines with wind conditions to generate waves. <p>To ensure increased stability, we have also buttressed the dam itself, with a ration of H:V well beyond any existing requirements, as outlined below:</p> <p>The Corna Dam (the main dam) will be a rockfill structure built using the centerline method of construction. The dam will have a downstream slope of 3H:1V. Typically, the slopes for such hydraulic structures range between 1.5H:1V and 1.75H:1V.</p> <p>As for the broader range of extreme events, the following discussion present a summary of the conditions considered in the Rosia Montana Project design.</p> <p>Chapter 4 of "<i>Report on the Environmental Impact Assessment Study</i>" subchapter (4.1) "<i>Water</i>", p. (20), as well as the <i>Mine Rehabilitation and Closure Plan</i>, p. (123) reflect all future potential changes of the basic climatic parameters and of the extreme events. The Water Management and Erosion Control Plan as well as Mine Rehabilitation and Closure Plan include continuous assessment procedures of learned data and climatic</p>

change forecasts, in such a manner that any implications regarding the management and design activities to be immediately identified and managed.

Climatic conditions that have been taken into account during the design activity developed for Corna Tailings Management Facility, with specific reference to extreme precipitations (the main factor that causes failures worldwide), are sufficient, even in the case of summation of forecasted values for extreme events (increase estimated at 15% for the period of project's development, the *Mine Rehabilitation and Closure Plan*, p. (123), subchapter (4.1). "Water", p. (20) from the *Report on Environmental Impact Assessment Study*).

Finally, the probability of major landslides to appear in that specific area is also very low, as a result of the stable petrographic composition that hosts especially compacted rocks, without large volumes of rocks that have an unstable composition. At most, There may appear superficial landslides and rocks fragmentations, generating a minimal influence on the objectives (p.50) subchapter (2.6) Section (7) Risks.

References:

[1] Figure (4.1.8), p.(18), Chapter (4.1) Water, The EIA Report

Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	193
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	Cluj Napoca, 07.08.2006
RMGC internal unique code	MMGA_0372
Proposal	<p data-bbox="268 539 1407 622">Was the “climate change” within Romania taken into account (tornados, floods, and desert) during the development of EIA report?</p> <p data-bbox="268 629 1407 763">Climate change was considered in the development of extreme natural events as a design basis for the Roşia Montană project. These include but are not limited to extreme rainfalls (including rainfall and snow melt), extreme draught, and extreme earthquakes. The following discuss present a summary of the conditions considered in the design.</p> <p data-bbox="268 786 1407 920">Chapter (4) of “<i>Report on the Environmental Impact Assessment Study</i>” subchapter(4.1) “<i>Water</i>”, p. (20), as well as the <i>Mine Rehabilitation and Closure Plan</i>, p. (123) reflect all future potential changes of the basic climatic parameters and of the extreme events, these data being or could be used in different sections of the project.</p> <p data-bbox="268 943 1407 1077">The Water Management and Erosion Control Plan as well as Mine Rehabilitation and Closure Plan include continuous assessment procedures of learned data and climatic change prognosis, in such a manner that any implications regarding the management and design activities to be immediately identified and managed.</p> <p data-bbox="268 1099 1407 1357">Along the same line, <i>tornados</i> are defined as violently rotating columns of air, located under the cumulonimbus clouds, that touch the surface of the earth, and which are specific to open spaces, plain lands, that allow direct contact between two air-masses having very different thermo baric proprieties, and which are not specific to mountain areas with hilly terrains, having no extended internal plateaux, as it is the case for Apuseni Mountains. Moreover, all over Romania, the number of such events reported by the National Institute of Meteorology and Hydrology do not exceed 20, having low intensity (a maximum of 2 degrees on Fujita scale and 30 m in diameter), none of these events has been reported to have ever occurred in the mountain area (http://www2.inmh.ro/index.php?id=29).</p> <p data-bbox="268 1379 1407 1581">Taking into account the fact that tornados, considering the aforementioned aspect, are not characteristic to mountain regions having a high fragmentation of the relief, the occurrence probability for such events in the area of the site may be considered to be equal to zero. At the most, on the site may occur transitory low scale air swirls, (having several meters in diameter), that are specific to the hot season of the year, which have occurred as an effect of the differentiated heating levels of the surfaces having different albedos (reflective power).</p> <p data-bbox="268 1603 1407 1984">There is a very low probability for major flooding to occur within the project’s footprint, even if the precipitations increased in magnitude (15% represent the increase that has been predicted for period of the project’s lifetime; see chapter 4 of “<i>Report on Environmental Impact Assessment Study</i>” subchapter (4.1). “<i>Water</i>”, p. (20), as a result of enforcing several measures in order to prevent and mitigate these events:</p> <ul data-bbox="268 1727 1407 1984" style="list-style-type: none"> - the development of certain structures that will impact approximately the entire catchment area between Roşia and Corna Valleys that won’t allow, except for a too little extent, the circulation of water on the site (pits, waste facilities, dams, containment dams, etc.); - the construction of hydro technical drainage structures (diversion channels) for on site pluvial waters, some of which having a discharge capacity of 5-8 m³/s; - the natural and rather elevated slope of the terrain and water streams (an average of 38-68 m/km) from the site specific to mountain areas, and which doesn’t allow the stagnation and accumulation of water, favouring its rapid drainage (p. 31-32, 38-39, subchapter 2.4section 7 Risks).
Solution	

Moreover, the accumulations that are going to be generated on Corna and Roşia Valleys will mitigate the risk of flooding the downstream part of these valleys, by controlling a part of the watershed of Abrud River.

Climatic conditions that have been taken into account during the design activity developed for Corna Tailings Management Facility, with specific reference to extreme precipitations (the main factor that causes failures worldwide), are sufficient, even in the case of summation of predicted values for extreme events (increase estimated at 15% for the period of project's development). With respect to the aforementioned information, the design of Corna Tailings Management Facility has been developed so as to store water runoffs resulted from two successive Probable Maximum Precipitations events of 450 mm/24h each. According to the estimates included within specific studies that have been commissioned by RMGC, the PMP ("the potential elevation of precipitation which might be collected in a given period of time, in a location or within an area from a specific geographic region, in a certain moment of the year, without taking into consideration long-term climatic changes", WMO, 1986) has been estimated to have an average recovering period between 1:100, 000, 000 and 1:1, 000, 000, 000 years (*exhibit 4.1.8, p.18, Chapter 4.1). Water from the Report on Environmental Impact Assessment Study*).

In the case of several major changes of the predicted values with respect to extreme events, the Water Management Plan includes immediate management procedures for solving any implications that may appear with regard to the design and management activities for the Tailings Management Facility (*Mine Rehabilitation and Closure Plan, p. 124*)

Given these conditions, the risk of flooding the areas that are located downstream the Corna dam, that is expressed as a multiplication result between the probability of exceeding for a certain parameter (for instance 24 h heavy rainfalls) and consequences, stays low, as a consequence of the improbable case that some climatic events might lead to the dam's failure (*p.38-41, subchapter (2.4.3), p.(67) subchapter(3.2.5). Section(7) Risks*

According to the most recent international reports regarding the development of a global desertification, the studied site is not located within the vulnerable and so is the entire country (the exception is represented by several areas from Dobrogea, Campia Română (Romanian Plain) and Podișul Moldovei (Moldavian Plateau)). Moreover, Apuseni Mountains, that host the site in discussion, are being characterized, by an excess of humidity following the effect of a surplus of the ratio between average precipitation and average evaporation. (<http://soils.usda.gov/use/worldsoils/mapindex/desert.html>).

Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	193
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	Cluj Napoca, 07.08.2006
RMGC internal unique code	MMGA_0377
Proposal	If, for example, a tornado occurred in that specific area, what would happen, how many million of m3 of tailing will be taken out the dam? Who does the company want to kill?
Solution	<p><i>Tornados</i> are defined as violently rotating columns of air, located under the cumulonimbus clouds (<i>Cumulonimbus mamma</i>), that touch the surface of the earth, and which are specific to open spaces, plain lands, that allow direct contact between two air-masses having very different thermo baric proprieties. Such events are not specific to mountain regions with hilly terrains, having no extended internal plateau, as it is the case for Romanian Carpathians and of course, the region that hosts the site and which is located in the very centre of Apuseni Mountains. Moreover, all over Romania, the number of such events reported by the National Institute of Meteorology and Hydrology do not exceed 20, having low magnitude (the majority of these events recording levels under 2 degrees on Fujita scale and having under 30 m in diameter), none of them has been reported to have ever occurred in the mountain area (http://www2.inmh.ro/index.php?id=29).</p> <p>Taking into account the fact that tornados, considering the aforementioned aspect, are not characteristic to mountain regions having a high fragmentation of the relief, the occurrence probability for such events in the area of the site may be considered to be equal to zero. At the most, on the site may occur transitory low scale air swirls, (having several meters in diameter), that are specific to the hot season of the year, which have occurred as an effect of the differentiated heating levels of the surfaces having different albedos.</p> <p>As far as high wind velocity is concerned, the tailings beach is going to be permanently kept moistened, in order to avoid deflation (drifting) of fine particles.</p>

Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	229
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	Cluj Napoca, 07.08.2006
RMGC internal unique code	MMGA_0461
Proposal	The questioner asks for the references that have been used for the assessment of risk factors, because in the summary of the impact study he didn't find any references.
Solution	<p>The bibliography that has been used to prepare chapter 7 - Risks from the Environmental Impact Assessment is stated at page 173-176 of this chapter and includes the following references:</p> <ul style="list-style-type: none"> -Carson, M.A., Kirkby, Hillslope Form Processes, Cambridge University Press, M.Y., 1972; - ESG et al., Roşia Montană Project Environmental Impact Assessment, 2005; - Gligor, V., Relieful vulcanic din nord-estul Munţilor Metaliferi, Teză de doctorat, Facultatea de Geografie, UBB, Cluj-Napoca, 2005; - Muntean, O.L., Baci, N., Rus, R., Surdeanu, V., Relieful antropoc din regiunea minieră Abrud-Câmpeni, Studia U.B.B., Geographia, 2, Cluj-Napoca, 1998; - MWH, MWH Engineering Review Report, 2005; - MWH, Roşia Montană Project Engineering Review Reports "Geotechnical Design Parameters", 2005; - Powell, G., Discussion "Landslide risk management concepts and Guidelines", in Australian Geomechanics, Volume 35, No 1, March 2000; - Selby, M.J., Hillslope Materials and Processes, 2nd Edition, Oxford University Press, Oxford, 1993; - SNC Lavalin, TMF Design Report, Appendix E: Stability Analysis, 2003; - SNC-Lavalin; Basic Engineering Executive Summary and Supporting Deliverables, Report No. 334318-30RA-0003 for Rosia Montana Project, January 27, 2003; - Surdeanu, V., Corelaţii între alunecări de teren şi alte procese denudaţionale, Studia Univ. „Babeş-Bolyai”, Geographia, Cluj-Napoca, 1992; -Ministry of Forest and Range, Mapping and Assessing Terrain Stability Guidebook, Second Edition, British Columbia, Canada, 1999; - Bălţeanu, D., Rădiţa, A., Hazarde naturale şi antropogene, Ed. Corint, Bucureşti, 2001; - Bogdan, Octavia, Niculescu Elena, Riscurile climatice din România, Ed. Sega Internaţional, Bucureşti, 1999; - Diaconu, Gheorghita, Rojanschi, V., Bran, Florina, Urgenţele şi riscurile de mediu pentru agenţii economici, Ed. Economică, Bucureşti, 1997; -MWH, Assessment of rainfall intensity, frequency and runoff for the Roşia Montană Project, prepared by Radu Drobot, May 2004; ***Geografia României, geografie fizică, vol.1., Ed. Academiei, Bucureşti, 1983; ***Date meteorologice şi climatice de la staţiile Băișoara, Câmpeni (1961-2000) și Roşia Montană (1984-2000); - Alan, C.E., Good practice in emergency preparedness and response, September 2005; - Diaconu, C., Şerban, P., Sinteze şi regionalizări hidrologice, Ed. Tehnică, Bucureşti, 1994; - MWH, Assessment of rainfall intensity, frequency and runoff for the Roşia Montană Project, prepared by Radu Drobot, May 2004; - MWH, Biological Compensation Flows, December 2003; - MWH, Cetate Dambreak Report, March 2005; - MWH, Engineering Review Report, March 2005; - MWH, Rainfall-Runoff Routing, March, 2005; - MWH, Roşia Montană TMF Dambreak Study, January 2006; - MWH, Tailings and Water Management Dams Design Criteria, February 2006; - MWH, TMF Dambreak Report, March 2005; - MWH, TMF Dam break scenarios for use in Rosia Montană EIA, February 2006; - Pandi, G., Moldovan, Fl., Importanţa prognozelor în diminuarea riscurilor meteorologice şi hidrologice, în volumul "Riscuri şi Catastrofe", Editor V. Sorocovschi, Ed. Casa Cărţii de Ştiinţă, Cluj-Napoca, 2003;

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 - ***Date climatice și hidrometrice furnizate de RMGC;
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Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	241
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	Cluj Napoca, 07.08.2006
RMGC internal unique code	MMGA_0488
Proposal	<p>The questioner wants to know which the negative consequences of this project are, as established in the assessment made by the authors of the studies included in the EIA. The questioner wants them to be presented one by one and assessed in time until they disappear.</p>
Solution	<p>To the questioner's last point, it is the nature of risk that it can be mitigated and diminished; it cannot be made to disappear. In order to put this into context, the common action of walking on the street or developing everyday activities have an accident potential. This accident potential is twice higher than within the framework of industrial activities that use hazardous substances.</p> <p>In the larger sense, the entire EIA report is focused on the assessment of impacts and their associated mitigation. Specifically, Chapter 4 of the EIA presents that impact assessment of the project. The following discussion presents a summary of the impact discussed in the EIA.</p> <p>As far as natural and technological risks assessments are concerned, Chapter 7, "Risk Cases", from the Report on Environmental Impact Assessment, emphasizes the fact that safety and prevention measures, the implementation of the environmental management and risk systems are mitigating the consequences to acceptable levels as compared to the most restrictive norms, standards, the best practices or national and international recommendations in the field. The risk level has been established as moderate and so, socially acceptable. The extension of the risk assessment and the intensity of the prevention and mitigation measures of the consequences should be proportionate to the risk involved. Selection of a specific mitigation technique is depends on the analyzed accident scenario.</p> <p>More detailed assessments are conducted for accident scenarios that, based on the qualitative assessment are found to be potentially major, of probability more than 10^{-6} (reduced recovery periods of 1/1,000,000) meaning that they could have major consequences therefore, elevated associated risk, a higher risk level than 9 to 12 (on a scale of 1-25). To put this in context, simply living in southern Florida rates a 25 on the risk scale.</p> <p>A global assessment of the risks associated with the Roşia Montană Project is obtained by the quick environmental and health risk assessment methodology initially developed by the Italian Ministry of the Environment and the World Health Organization. Natural hazard and risk identification and analysis presents key data and information in assessing potential technological accidents. Thus:</p> <ul style="list-style-type: none"> - In designing the Tailings Management Facility, the design parameters were chosen to fully cover the characteristic seismic risk of the area. These seismic design parameters adopted for the TMF and other facilities on the proposed site result in a safety factor much greater than the minimum accepted under the Romanian and European design standards for such facilities; - in the sector physically impacted by the Project, the risk of floods will remain very low due to the small catchments (controlled by the Roşia and Corna Streams) the area affected by the operation, and the creation of containment, diversion and drainage hydro-technical structures for storm waters on the site, and in the Abrud catchment in general; - risks caused by meteorological events have been reviewed and used in assessing the hazards of the affected technological processes. <p>From the analysis of morphometrical parameters and their correlation with other sets of information on the natural slopes on and near the site shows that the (qualitatively estimated) landslide occurrence risk is low to moderate and its consequences will not cause major impacts on the structural components of the Project.</p>

There is no significant risk associated with resource depletion. Mining activities are planned judiciously, so as to extract only the profitable gold and silver resources and only the necessary construction rock for the Project. The management of the mining concession site will minimize reserve "sterilization" (limitation of future access to the reserves).

In assessing technological hazards and risks, the quantity of hazardous substances on the site was calculated as a total and by category, as provided by the *Notification Procedure* approved by Ministry of Agriculture, Forestry, Water and Environment (MAFWE) Order 1084/2003. Based on an evaluation of hazardous substances in stock on the Project site in relation to the relevant quantities provided by the Government Decision 95/2003 which transposes the Seveso Directive, the Project ranges between the upper and the lower limits, and therefore S.C. Roşia Montană Gold Corporation S.A. is required to prepare a Report on Environmental Impact Assessment Study to be sent to the local environmental authority and the local civilian protection authority a *Safety Report* on its operations to prevent major accident risks.

In assessing the consequences of major accidents involving dangerous substances, physical-mathematical models accepted internationally and especially at EU level, and the current version of the SLAB (Canada) software have been used, the latter for the atmospheric dispersion of denser than air gases, that may handle a multitude of situations and scenarios. Similarly, the EFFECTSGis 5.5 (Netherlands) software, developed for the analysis of the effects of industrial accidents and of consequences. Several scenarios were considered in response to the internal legislative requirements, especially related to the implementation of the Internal Emergency Plans (GD 647/2005). The conclusions of the risk assessment for major accidents were:

- The total destruction of plant facilities may only be caused by terrorist attack with classic or nuclear weapons. Simultaneous damage to the HCl tank (including containment) and to the NaCN solution tank, the tanks containing enriched solution, to one or more leaching tanks, having as a result HCN dispersion into the air. At the same time, under certain situations and weather conditions unfavorable for dispersion, people within 40 m of the emission source, surprised by the toxic cloud for more than 1 minute without respiratory protection equipment, will most certainly die. It may also be considered that, on a radius of about 310 m, persons exposed for more than 10 minutes may suffer serious intoxications that may also lead to death. Toxic effects may occur in persons up to about 2 km downwind of the process plant;

- Operating errors and/or failures in the measurement and control devices, resulting in a lower pH in the leaching tank, thickener and/or DETOX slurry and accidental emissions of hydrocyanic acid. The area affected by concentrations of 290 ppm over a 10 min exposure time is within a circle of 36 m radius and the 50 ppm IDLH threshold for 30 min exposure will be reached over an area of 157.5 m radius. The center of these circles is the middle of the CIL tanks platform;

- Accidental HCN emission from the decanter. The accident may be caused by a drop of pH in the CIL tanks combined with an overdose of flocculent solution and faulty pH monitoring systems. The area affected by concentrations of 300 ppm over a 10 min exposure time is within a circle of 65 m radius and the 50 ppm IDLH threshold for 30 min exposure will be reached over an area of 104 m radius. The center of these circles is mid-distance between the two DETOX facilities;

- Accidental HCN emission from the DETOX facility. The accident may be caused by a drop of pH in the reactors generated by an overdose of metabisulfite solution and/or copper sulphate combined with faulty pH monitoring systems. The area affected by high 1900 ppm concentrations for a 1 min exposure time is located within a 10 m radius circle. The area affected by concentrations of 300 ppm over a 10 min exposure time is within a circle of 27 m radius and the 50 ppm IDLH threshold for 30 min exposure will be reached over an area of 33 m radius. The center of these circles is mid-distance between the two DETOX facilities;

- Explosion of the LPG storage tank. The LPG storage tank has a 50 ton capacity and is located outdoors, near the heating plant. The simulation was conducted for the worst case scenario, considering an explosion of the full tank. Threshold I with heat 12.5 kW/m² is within a 10.5 m radius circle and Threshold II, of heat radiation 5 kW/m² is within a circle of 15 m radius;

- Damage and/or fire at the fuel tanks. Simulations were conducted for the worst case scenarios, considering ignition and combustion of all the diesel (fire in the tank, or in the containment vat, when full of diesel);

- Corna Dam break and breach development. Two credible accident scenarios were considered in simulating tailings flow out of the Tailings Management Facility, and six credible scenarios for the flow of decant water and tailings pore water, with significant effects on the terrestrial and aquatic ecosystems, in different weather conditions;

- Tailings flow may occur along Corna Valley, on a 800 m (starter dam break) or over 1,600 m reach should the Corna dam break in its final stage;

- In regard to water quality impacts, cyanide concentrations in the water in the shape of a pollution plume may reach Arad, near the Romanian-Hungarian border on the Mureş River, in concentrations ranging between 0.03 and 0.5 mg/L. Due to inherent mathematical limitations in the models, these values and the accident effects are considered overestimated. Therefore, the results describe the “worst case scenario” based on extreme dam break assumptions for the Corna Dam.

A new and much more precise and realistic simulation has been subsequently established based on the INCA Mine model, that considers the dispersion, volatilization and breakdown of cyanides during the downstream movement of the pollutant flow (Whitehead et al., 2006).

The model used is the INCA model developed over the past 10 years to simulate both terrestrial and aquatic systems within the EUROLIMPACS EU research program (www.eurolimpacs.ucl.ac.uk). The model has been used to assess the impacts from future mining, and collection and treatment operations for pollution from past mining at Roşia Montană.

The modeling created for Roşia Montană simulates eight metals (cadmium, lead, zinc, mercury, arsenic, copper, chromium, manganese) as well as Cyanide, Nitrate, Ammonia and dissolved oxygen. The model has been applied to the upper catchments at Roşia Montană as well as the complete Abrud-Arieş-Mureş river system down to the Hungarian Border and on into the Tisa River. The model takes into account the dilution, mixing and physical-chemical processes affecting metals, ammonia and cyanide in the river system and gives estimates of concentrations at key locations along the river, including at the Hungarian Boarder and in the Tisa after the Mureş joins it.

Because of dilution and dispersion in the river system, and of the initial EU BAT-compliant technology adopted for the project (for example, the use of a cyanide destruct process for tailings effluent that reduces cyanide concentration in effluent stored in the TMF to below 6 mg/l), even a large scale unprogrammed release of tailings materials (for example, following failure of the dam) into the river system would not result in transboundary pollution. The model has shown that under worse case dam failure scenario all legal limits for cyanide and heavy metals concentrations would be met in the river water before it crosses into Hungary.

The INCA model has also been used to evaluate the beneficial impacts of the existing mine water collection and treatment and it has shown that substantial improvements in water quality are achieved along the river system under normal operational conditions.

For more information, an information sheet presenting the INCA modeling work is presented under the title of the Mureş River Modeling Program and the full modeling report is presented in Annex 5.1:

- Development of HCN on the tailings pond surface. Simulated emissions of HCN from the Tailings Management Facility pond surface and of their dispersion into the ambient air show that the level of $400\mu\text{ g/m}^3$ hourly average and $179\mu\text{ g/m}^3$ 8hr average will not be exceeded. These HCN concentrations are only slightly over the odor threshold (0.17ppm) and much below potentially dangerous concentrations;

- Cetate Dam break and breach development. Flood modeling was in case of a break in Cetate dam was based on the design parameters obtained from the hydrometeorological study “Assessment of rainfall intensity, frequency and runoff for the Roşia Montană Project - Radu Drobot”. The breach characteristics were predicted using the BREACH model, and the maximum height of the flood wave in various flow sections was modeled using the FLDWAV software. The assumptions included a total $800,000\text{ m}^3$ discharge for one hour, when the peak of the flood hydrograph is about 4.9 m above base flow immediately below the dam and in the narrow Abrud valley 5.9-7.5 km downstream of the dam, while in the last section considered (10.5 km) water depth is about 2.3 m above base flow and the maximum flow rate $877\text{ m}^3/\text{s}$. Further, the broader Aries valley allows the flood wave to propagate on a significantly wider bed, which results in a highly attenuated hydrograph. These results describe the “worst case scenario” based on extreme dam break assumptions;

- Accidents during cyanide transportation. Due to the large quantities of cyanide transported (about 30t /day) the risks associated to this activity were assessed in detail using the ZHA- Zurich Hazard Analysis method. As a consequence, the optimum transport route was selected from the manufacturer to the Process Plant.

Cyanide transport (in solid state) will exclusively involve special SLS (Solid to Liquid System) containers, 16 tons each. The ISO compliant container will be protected by a framework with legs, which allows separation from the transport trailer for temporary storage. The wall is 5.17 mm thick, which, together with the protective framework, provides additional protection to the load in case of accident. This system is considered BAT and is currently one of the safest cyanide transportation options.

It is being mentioned the fact that the study develops the occurrence possibility of these scenarios (pages 166-171, Conclusions).

As regards the cyanides management, there is a baseline study named “Roşia Montană Golden Project, Cyanides Management Plan” prepared in compliance with the “International Management Code for the Manufacture, Transport and Use of Cyanide in the Production of Gold (International Cyanide management Institute) May 2002”. S.C. Roşia Montană Gold Corporation is signatory to this code.

Bibliographical references for Chapter 7 “Risk Cases” are listed at page173-176.

Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	262
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	Cluj Napoca, 07.08.2006
RMGC internal unique code	MMGA_0545
Proposal	<p>The company claims that the TMF is designed to withhold an 8° earthquake on Richter scale, but the ground cracks in case an earthquake of such magnitude occurs.</p> <p>We note in the first case that no active faults have been identified in the vicinity of Roşia Montană, so the risk raised by the questioner are overstated, for the reasons set forth below:</p> <p>As for the design of the RMP, the TMF dam is designed for a Richter magnitude 8 earthquake with a bedrock acceleration of 0.14g. As part of the final design, studies for the facility a specific displacement analysis will be conducted to confirm that displacements in the structure will not result in tailings or tailings water release that would result in overtopping the dam.</p> <p>In comparison to general worldwide situation, the Romanian territory is considered to be a moderate seismicity area, except for the Vrancea region, where earthquakes occur at a relatively high magnitude, at intermediary depth, with a frequency of 2-3 major events per century. The most recent and powerful seismic events from Vrancea region, occurred in 1940 of M 7.7 and in 1977 of M 7.5. Another area of relatively significant seismic activity is located South - West of the Roşia Montană Project site, in the Banatului region (Timiș County). Earthquakes recorded in this area are superficial events of the joint of low or moderate magnitude (M4-6). A major earthquake occurred in Timiș area in 1887, with an estimated magnitude of 7.0.</p> <p>Earthquakes recorded within the Timiș area, even if they can reach quite elevated magnitudes in some cases, they are superficial earthquakes that could be felt on highly restricted areas around the epicentre, without impacting the project's site.</p>
Solution	<p>According to the design criteria for the tailings management facility, the construction withstands earthquakes of 8 degrees on Richter scale. Even if the project's site is located in an area having low seismicity, among the lowest in the country, according to the zoning of the seismic hazard within Romania (the Report on Environmental Impact Assessment Study vol. 7, page 27, fig. 7.6), it has been taken into consideration the 8.0th degree from the Richter scale, a level that overpasses any earthquake ever registered on the territory of Romania. In this way, effects of seismic events on the dam are being anticipated.</p> <p>The parameters that have been used for the design were as follows:</p> <ul style="list-style-type: none"> - Operating Basis Earthquake (OBE) – considered as having a cyclic activity of 1 to 475 years and corresponding to a maximum acceleration of base rock of 0.082 g and having a magnitude of 8.0 degrees; - Maximum Design Earthquake (MDE) - is considered to be the equivalent of the maximum credible earthquake, corresponding to an acceleration of the base rock of 0.14 g and having a magnitude of 8.0 degrees. <p>These seismic design parameters adopted for the TMF design equal or even exceed the safety factor of 1.1, which is considered sufficient, under the Romanian and European design standards for such facilities.</p> <p>It is anticipated that the Tailings Management Facility is going to work within normal parameters even after the occurrence of an OBE event. Design principles that have been established acknowledge the fact that a possible failure of the dam structure if a MDE event occurred, but maintaining its stability and the integrity without discharging the tailings or the waste waters from the contingency dam.</p>

In the case of very powerful earthquakes, there may appear soil fractures or cracks, but such events happen at small distances from the epicenter. As far as Romania is concerned, Vrancea is the main active zone from seismic point of view, and it is situated at about 275 km away from the location of Roşia Montană Project. Very powerful earthquakes that occurred during the last century, in 1940 and 1977, have been weakly felt in the area of Apuseni Mountains.

References:

- EIA chapter 7, subchapter 2.2 p. 23-27§
 - EIA chapter 7 subchapter 6.4.3.1 p. 117 – 120.
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Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	268
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	Cluj Napoca, 07.08.2006
RMGC internal unique code	MMGA_0566
Proposal	If the pollution settles on the top of the mountains, then what happens on the hill and plain levels?
	<p>As part of the EIA report specific modelling of water discharges from the site has been conducted. In addition, air modelling has been conducted to determine the impacts air borne contaminates. The results of these modelling studies all indicate that both Romanian and EU standards will be achieved by the operations. Specific details of the modelling studies and some of the associated mitigation measures that will be implemented by the project to achieve compliance are discussed in the following text.</p> <p>Section 4.1 <i>Water, from the Report on Environmental Impact Assessment Study</i> assesses the impact of the implementation of Roşia Montană mining Project on both surface and underground water. The Project is based on a close system principle, where polluted waters are being recovered, treated and reused. The surplus of the used waters will be discharged in the environment only after performing a water treatment process that will provide adequate qualitative parameters for water. In order to anticipate the negative impacts of the mining activities on water resources, it has been prepared a <i>Prevention and Mitigation Plan</i>, based on a series of <i>Management Plans</i> (section 4.1 Water, table 4.1-21, p. 82-83). The residual impact, which may appear after performing all these actions, is very low. It must be brought into the attention the fact that without developing all adequate actions necessary for environmental protection there is the possibility of creating a continuous degradation process of aquatic reserves due to the development of previous mining activities. As arguments within the section 4.1 Water, of the Report on Environmental Impact Assessment Study state, the implementation of the Roşia Montană Project is going to have a positive impact, by controlling the pollution sources that are currently active, collecting and treating contaminated waters.</p>
Solution	<p>If an accident occurred major negative impacts would happen near the source, decreasing in their intensity as they travel away from it.</p> <p>The only impacts within the hilly and low land regions might appear after the Corna and Cetate dams failed a case where the pollution wave might move away on large distances.</p> <p>There have been established hypothetical dam failure scenarios that were caused by some technical issues, supposing that the construction methodology wouldn't be observed. These scenarios represent the worst cases that could have been identified, taking into account the technical features of the Tailings Management Facility. A detailed view on the scenarios can be found in chapter 7 of the Report on Environmental Impact Assessment Study subchapter 6.4.3 p 117-121. Potential impacts of such accident are described within the same subchapter. Results on the distribution of cyanides concentrations that have been presented within the Report on Environmental Impact Assessment were obtained by using a model of a traditional combination, which ignores the dispersion that occurs as long as the pollutant wave moves downstream and the mitigation events. A new and much more precise and realistic simulation has been established subsequently based on the INCA Mine model, that considers the dispersion, volatilisation and breakdown of cyanides during the downstream movement of the pollutant wave (Whiteland et al., 2006). The model used is the INCA model developed over the past 10 years to simulate both terrestrial and aquatic systems within the EUROLIMPACS EU research program (www.eurolimpacs.ucl.ac.uk). The model has been used to assess the impacts from future mining, and collection and treatment operations for pollution from past mining at Roşia Montană.</p> <p>The modeling created for Roşia Montană simulates eight metals (cadmium, lead, zinc, mercury, arsenic,</p>

copper, chromium, manganese) as well as Cyanide, Nitrate, Ammonia and dissolved oxygen. The model has been applied to the upper catchments at Roşia Montană as well as the complete Abrud-Arieş-Mureş river system down to the Hungarian Border and on into the Tisa River. The model takes into account the dilution, mixing and physical-chemical processes affecting metals, ammonia and cyanide in the river system and gives estimates of concentrations at key locations along the river, including at the Hungarian Boarder and in the Tisa after the Mureş joins it.

Because of dilution and dispersion in the river system, and of the initial EU BAT-compliant technology adopted for the project (for example, the use of a cyanide destruct process for tailings effluent that reduces cyanide concentration in effluent stored in the TMF to below 6 mg/l), even a large scale unprogrammed release of tailings materials (for example, following failure of the dam) into the river system would not result in transboundary pollution. The model has shown that under worse case dam failure scenario all legal limits for cyanide and heavy metals concentrations would be met in the river water before it crosses into Hungary.

The INCA model has also been used to evaluate the beneficial impacts of the existing mine water collection and treatment and it has shown that substantial improvements in water quality are achieved along the river system under normal operational conditions.

For more information, an information sheet presenting the INCA modeling work is presented under the title of the Mureş River Modeling Program and the full modeling report is presented in **Annex 5.1**.

As a final point, we note that the dam failure probability is lower than 10^{-12} that is, the fact that such an event might occur once in 1 billion years. The methodology used to assess risks is detailed within chapter 7 of the Report on Environmental Impact Assessment Study, subchapter 2.1, p. 15-23.

References:

- **“A Water Quality Modelling Study of Roşia Montană and the Abrud, Arieş and Mureş River Systems: Assessing Restoration Strategies and the Impacts of Potential Pollution Events”** by Professor Paul Whitehead, Danny Butterfield and Andrew Wade, University of Reading, School of Human and Environmental Sciences, December 2006.

Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	419
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	Bucuresti, 21.08.2006
RMGC internal unique code	MMGA_0896
<p data-bbox="97 589 183 633">Proposal</p> <p data-bbox="97 1305 183 1350">Solution</p>	<p data-bbox="268 544 1409 678">The questioner also disagrees to the statements made on point 6.4.3.4. of the EIA: the potential effects upon terrestrial and aquatic ecosystems, according to which this flood wave may have physical effects upon certain forms of..... The questioner indicates that such statements are made in relation to at least 20 aspects, in the din EIA.</p> <p data-bbox="268 678 1409 712">RMP has been built to prevent release of water even under the most extreme weather conditions.</p> <p data-bbox="268 734 1409 869">Special measures have been taken to prevent and mitigate the potential negative effects caused by heavy rainfalls. What is of interest, in view of the project, is the quantity of water flowing over the ground surface as a result of the floods. The measures have been detailed in Chapter 7, <i>Risks</i>, Subchapter 2.4.3, p. 38-42 '<i>Measures to Prevent, Reduce and Remediate the Effects of Floods and High Waters</i>'.</p> <p data-bbox="268 891 1409 925">Overall, the measures include:</p> <ul data-bbox="268 925 1409 1373" style="list-style-type: none"> <li data-bbox="268 925 1409 1216">– the development of structures over almost the entire surface of the Roşia and Corna catchment areas. As a result, runoff on the surface covered by the site will be almost entirely retained (including pits, waste rock dumps, tailing's ponds and other types of impoundments). The Corna dam was designed to retain the total amount of water resulting from two successive PMPs (450 mm/24 h + 450 mm/24 h), so as to avoid overtopping. Estimates indicate that the Probable Maximum Precipitation, defined as "<i>theoretically the greatest depth of precipitation for a given duration that is physically possible over a given size storm area at a particular geographical location at a certain time of year, without taking into consideration long-term climate changes</i>" (WMO, 1986) with a chance occurrence of 1 in more than 100 million years [1]; <li data-bbox="268 1216 1409 1373">– as a safeguard relating to runoff volume, the project includes construction of diversion channels within both the Roşia and Corna valley drainage basins to route rainfall runoff around the mine waste materials. As an additional measure – and based on the absence of any diversion channels – the design provides ample freeboard in the case that excessive rainfall combines with wind conditions to generate waves. <p data-bbox="268 1395 1409 1473">To ensure increased stability, we have also buttressed the dam itself, with a ration of H:V well beyond any existing requirements, as outlined below:</p> <p data-bbox="268 1496 1409 1597">The Corna Dam (the main dam) will be a rockfill structure built using the centerline method of construction. The dam will have a downstream slope of 3H:1V. Typically, the slopes for such hydraulic structures range between 1.5H:1V and 1.75H:1V.</p> <p data-bbox="268 1619 1409 1720">To assess possible transboundary impacts, a new and much more precise and realistic simulation has been subsequently established based on the INCA Mine model, that considers the dispersion, volatilization and breakdown of cyanides during the downstream movement of the pollutant flow (Whiteland et al., 2006).</p> <p data-bbox="268 1742 1409 1877">The INCA model has been developed over the past 10 years to simulate both terrestrial and aquatic systems within the EUROLIMPACS EU research program (www.eurolimpacs.ucl.ac.uk). The model has been used to assess the impacts from future mining, and collection and treatment operations for pollution from past mining at Roşia Montană.</p> <p data-bbox="268 1899 1409 2000">The modeling created for Roşia Montană simulates eight metals (cadmium, lead, zinc, mercury, arsenic, copper, chromium, manganese) as well as Cyanide, Nitrate, Ammonia and dissolved oxygen. The model has been applied to the upper catchments at Roşia Montană as well as the complete Abrud-Arieş-Mureş</p>

river system down to the Hungarian Border and on into the Tisa River. The model takes into account the dilution, mixing and physical-chemical processes affecting metals, ammonia and cyanide in the river system and gives estimates of concentrations at key locations along the river, including at the Hungarian Boarder and in the Tisa after the Mureş joins it.

Because of dilution and dispersion in the river system, and of the initial EU BAT-compliant technology adopted for the project (for example, the use of a cyanide destruct process for tailings effluent that reduces cyanide concentration in effluent stored in the TMF to below 6 mg/l), even a large scale unprogrammed release of tailings materials (for example, following failure of the dam) into the river system would not result in transboundary pollution. The model has shown that under worse case dam failure scenario all legal limits for cyanide and heavy metals concentrations would be met in the river water before it crosses into Hungary.

The INCA model has also been used to evaluate the beneficial impacts of the existing mine water collection and treatment and it has shown that substantial improvements in water quality are achieved along the river system under normal operational conditions.

For more information, an information sheet presenting the INCA modeling work is presented under the title of the Mureş River Modeling Program and the full modeling report is presented in Annex 5.1.

References:

[1] Figure 4.1.8, p.18, Chapter 4.1 Water, The EIA Report.

Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	1496
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	No. 110627/25.08.2006
RMGC internal unique code	MMGA_1204
Proposal	The lack of the Safety report;
Solution	The Security Report has been made available for public access by being posted at the following Internet address http://www.mmediu.ro/dep_mediu/rosia_montana_securitate.htm as well as through the printed version which could have been found at several information locations established for public hearings.

Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	1791, 1792, 1793, 1795, 1796, 1797, 1800, 1801, 1802, 1803, 1804, 1805, 1806, 1807, 1808, 1809, 1810, 1811, 1812, 1813, 1814, 1815, 1816, 1817, 1818, 1819, 1820, 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1942, 1943, 1944, 1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 32/D;5611/B, 36, 42, 43, 44, 45, 49, 51
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	No. 110741/25.08.2006andNo. 76086/05.09.2006, No. 110740/25.08.2006andNo. 76087/05.09.2006, No. 110739/25.08.2006andNo. 76088/05.09.2006, No. 110737/25.08.2006andNo. 76090/05.09.2006, No. 110736/25.08.2006andNo. 76091/05.09.2006, No. 110735/25.08.2006andNo. 76092/05.09.2006, No. 110732/25.08.2006andNo. 76095/05.09.2006, No. 110731/25.08.2006andNo. 76096/05.09.2006, No. 110730/25.08.2006andNo. 76097/05.09.2006, No. 110729/25.08.2006andNo. 76098/05.09.2006, No. 110728/25.08.2006andNo. 76099/05.09.2006, No. 110727/25.08.2006andNo. 76100/05.09.2006, No. 110726/25.08.2006andNo. 76101/05.09.2006, No. 110725/25.08.2006andNo. 76102/05.09.2006, No. 110852/25.08.2006andNo. 165062/06.09.2006, No. 110853/25.08.2006andNo. 165063/06.09.2006, No. 110854/25.08.2006andNo. 165064/06.09.2006, No. 110855/25.08.2006andNo. 165065/06.09.2006, No. 110856/25.08.2006andNo. 165066/06.09.2006, No. 110857/25.08.2006andNo. 165067/06.09.2006, No. 110858/25.08.2006andNo. 165068/06.09.2006, No. 110859/25.08.2006andNo. 165069/06.09.2006, No. 110860/25.08.2006andNo. 165070/06.09.2006, No. 110861/25.08.2006andNo. 165071/06.09.2006, No. 110862/25.08.2006andNo. 165072/06.09.2006, No. 110863/25.08.2006andNo. 165073/06.09.2006, No. 110864/25.08.2006andNo. 165074/06.09.2006, No. 111829/25.08.2006, No. 111828/25.08.2006, No. 111827/25.08.2006., No. 111824/25.08.2006., No. 111823/25.08.2006, No. 111822/25.08.2006., No. 111821/25.08.2006., No. 111820/25.08.2006., No. 111819/25.08.2006, No. 111818/25.08.2006, No. 111817/25.08.2006, No. 111816/25.08.2006, No. 111815/25.08.2006, No. 111814/25.08.2006, No. 111813/25.08.2006, No. 111812/25.08.2006, No. 111811/25.08.2006, No. 111810/25.08.2006, No. 111809/25.08.2006, No. 111808/25.08.2006, No. 111807/25.08.2006, No. 111806/25.08.2006, No. 111805/25.08.2006, No. 112093/25.08.2006, No. 112092/25.08.2006, No. 112091/25.08.2006, No. 112090/25.08.2006, No. 112089/25.08.2006, No. 112088/25.08.2006, No. 112087/25.08.2006, No. 112086/25.08.2006, No. 112085/25.08.2006, No. 112084/25.08.2006, No. 112083/25.08.2006, No. 112083/25.08.2006, No. 112082/25.08.2006, No. 112081/25.08.2006, No. 112080/25.08.2006, No. 112079/25.08.2006, No. 112078/25.08.2006, No. 112077/25.08.2006, No. 112076/25.08.2006, No. 111551/25.08.2006, No. 111552/25.08.2006, No. 111553/25.08.2006, No. 111554/25.08.2006, No. 111555/25.08.2006, No. 111556/25.08.2006, No. 111557/25.08.2006, No. 111558/25.08.2006, No. 111559/25.08.2006, No. 111560/25.08.2006, No. 111560/25.08.2006, No. 115103/13.10.2006, No. 116056/11.12.2006, No. 169324/06.11.2006, No. 169323/06.11.2006, No. 169322/06.11.2006, No. 169321/06.11.2006, No. 114373/169078/10.10.2006, No. 114903/05.10.2006
RMGC internal unique code	MMGA_1229
Proposal	The questioner requests the MMGA not to emit the environment permit for the Rosia Montana mining projectThe questioner does not agree to the implementation of the Rosia Montana project formulating the following remarks and comments: Within EIA, there are no presented all the possible risks caused by this project; SEE THE CONTENT OF THE TYPE 1 CONTESTATION
Solution	It is the nature of risk that it can be mitigated and diminished; it cannot be made to disappear. In order to put this into context, the common action of walking on the street or developing everyday activities have an accident potential. This accident potential is twice higher than within the framework of industrial activities that use hazardous substances.

In the larger sense, the entire EIA report is focused on the assessment of impacts and their associated mitigation. Specifically, Chapter 4 of the EIA presents that impact assessment of the project. The following discussion presents a summary of the impact discussed in the EIA.

As far as natural and technological risks assessments are concerned, Chapter 7, "Risk Cases", from the Report on Environmental Impact Assessment, emphasizes the fact that safety and prevention measures, the implementation of the environmental management and risk systems are mitigating the consequences to acceptable levels as compared to the most restrictive norms, standards, the best practices or national and international recommendations in the field. The risk level has been established as moderate and so, socially acceptable. The extension of the risk assessment and the intensity of the prevention and mitigation measures of the consequences should be proportionate to the risk involved. Selection of a specific mitigation technique is depends on the analyzed accident scenario.

More detailed assessments are conducted for accident scenarios that, based on the qualitative assessment are found to be potentially major, of probability more than 10^{-6} (reduced recovery periods of 1/1,000,000) meaning that they could have major consequences therefore, elevated associated risk, a higher risk level than 9 to 12 (on a scale of 1-25). To put this in context, simply living in southern Florida rates a 1 - 25 on the risk scale.

A global assessment of the risks associated with the Roşia Montană Project is obtained by the quick environmental and health risk assessment methodology initially developed by the Italian Ministry of the Environment and the World Health Organization. Natural hazard and risk identification and analysis presents key data and information in assessing potential technological accidents. Thus:

- in designing the Tailings Management Facility, the design parameters were chosen to fully cover the characteristic seismic risk of the area. These seismic design parameters adopted for the TMF and other facilities on the proposed site result in a safety factor much greater than the minimum accepted under the Romanian and European design standards for such facilities;
- in the sector physically impacted by the Project, the risk of floods will remain very low due to the small catchments (controlled by the Roşia and Corna Streams) the area affected by the operation, and the creation of containment, diversion and drainage hydro-technical structures for storm waters on the site, and in the Abrud catchment in general;
- risks caused by meteorological events have been reviewed and used in assessing the hazards of the affected technological processes.

From the analysis of morphometrical parameters and their correlation with other sets of information on the natural slopes on and near the site shows that the (qualitatively estimated) landslide occurrence risk is low to moderate and its consequences will not cause major impacts on the structural components of the Project.

There is no significant risk associated with resource depletion. Mining activities are planned judiciously, so as to extract only the profitable gold and silver resources and only the necessary construction rock for the Project. The management of the mining concession site will minimize reserve "sterilization" (limitation of future access to the reserves).

In assessing technological hazards and risks, the quantity of hazardous substances on the site was calculated as a total and by category, as provided by the *Notification Procedure* approved by Ministry of Agriculture, Forestry, Water and Environment (MAFWE) Order 1084/2003. Based on an evaluation of hazardous substances in stock on the Project site in relation to the relevant quantities provided by the Government Decision 95/2003 which transposes the Seveso Directive, the Project ranges between the upper and the lower limits, and therefore S.C. Roşia Montană Gold Corporation S.A. is required to prepare a Report on Environmental Impact Assessment Study to be sent to the local environmental authority and the local civilian protection authority a *Safety Report* on its operations to prevent major accident risks.

In assessing the consequences of major accidents involving dangerous substances, physical-mathematical models accepted internationally and especially at EU level, and the current version of the SLAB (Canada) software have been used, the latter for the atmospheric dispersion of denser than air gases, that may handle a multitude of situations and scenarios. Similarly, the EFFECTSGis 5.5 (Netherlands) software, developed for the analysis of the effects of industrial accidents and of consequences. Several scenarios

were considered in response to the internal legislative requirements, especially related to the implementation of the Internal Emergency Plans (GD 647/2005). The conclusions of the risk assessment for major accidents were:

- The total destruction of plant facilities may only be caused by terrorist attack with classic or nuclear weapons. Simultaneous damage to the HCl tank (including containment) and to the NaCN solution tank, the tanks containing enriched solution, to one or more leaching tanks, having as a result HCN dispersion into the air. At the same time, under certain situations and weather conditions unfavorable for dispersion, people within 40 m of the emission source, surprised by the toxic cloud for more than 1 minute without respiratory protection equipment, will most certainly die. It may also be considered that, on a radius of about 310 m, persons exposed for more than 10 minutes may suffer serious intoxications that may also lead to death. Toxic effects may occur in persons up to about 2 km downwind of the process plant;

- Operating errors and/or failures in the measurement and control devices, resulting in a lower pH in the leaching tank, thickener and/or DETOX slurry and accidental emissions of hydrocyanic acid. The area affected by concentrations of 290 ppm over a 10 min exposure time is within a circle of 36 m radius and the 50 ppm IDLH threshold for 30 min exposure will be reached over an area of 157.5 m radius. The center of these circles is the middle of the CIL tanks platform;

- Accidental HCN emission from the decanter. The accident may be caused by a drop of pH in the CIL tanks combined with an overdose of flocculent solution and faulty pH monitoring systems. The area affected by concentrations of 300 ppm over a 10 min exposure time is within a circle of 65 m radius and the 50 ppm IDLH threshold for 30 min exposure will be reached over an area of 104 m radius. The center of these circles is mid-distance between the two DETOX facilities;

- Accidental HCN emission from the DETOX facility. The accident may be caused by a drop of pH in the reactors generated by an overdose of metabisulfite solution and/or copper sulphate combined with faulty pH monitoring systems. The area affected by high 1900 ppm concentrations for a 1 min exposure time is located within a 10 m radius circle. The area affected by concentrations of 300 ppm over a 10 min exposure time is within a circle of 27 m radius and the 50 ppm IDLH threshold for 30 min exposure will be reached over an area of 33 m radius. The center of these circles is mid-distance between the two DETOX facilities;

- Explosion of the LPG storage tank. The LPG storage tank has a 50 ton capacity and is located outdoors, near the heating plant. The simulation was conducted for the worst case scenario, considering an explosion of the full tank. Threshold I with heat 12.5 kW/m² is within a 10.5 m radius circle and Threshold II, of heat radiation 5 kW/m² is within a circle of 15 m radius;

- Damage and/or fire at the fuel tanks. Simulations were conducted for the worst case scenarios, considering ignition and combustion of all the diesel (fire in the tank, or in the containment vat, when full of diesel);

- Corna Dam break and breach development. Two credible accident scenarios were considered in simulating tailings flow out of the Tailings Management Facility, and six credible scenarios for the flow of decant water and tailings pore water, with significant effects on the terrestrial and aquatic ecosystems, in different weather conditions;

- Tailings flow may occur along Corna Valley, on a 800 m (starter dam break) or over 1,600 m reach should the Corna dam break in its final stage;

- In regard to water quality impacts, cyanide concentrations in the water in the shape of a pollution plume may reach Arad, near the Romanian-Hungarian border on the Mures River, in concentrations ranging between 0.03 and 0.5 mg/L. Due to inherent mathematical limitations in the models, these values and the accident effects are considered overestimated. Therefore, the results describe the "worst case scenario" based on extreme dam break assumptions for the Corna Dam.

A new and much more precise and realistic simulation has been subsequently established based on the INCA Mine model, that considers the dispersion, volatilization and breakdown of cyanides during the downstream movement of the pollutant flow (Whiteland et al., 2006).

The model used is the INCA model developed over the past 10 years to simulate both terrestrial and aquatic systems within the EUROLIMPACS EU research program (www.eurolimpacs.ucl.ac.uk). The model has been used to assess the impacts from future mining, and collection and treatment operations for pollution from past mining at Roşia Montană.

The modeling created for Roşia Montană simulates eight metals (cadmium, lead, zinc, mercury, arsenic, copper, chromium, manganese) as well as Cyanide, Nitrate, Ammonia and dissolved oxygen. The model

has been applied to the upper catchments at Roşia Montană as well as the complete Abrud-Arieş-Mureş river system down to the Hungarian Border and on into the Tisa River. The model takes into account the dilution, mixing and physical-chemical processes affecting metals, ammonia and cyanide in the river system and gives estimates of concentrations at key locations along the river, including at the Hungarian Boarder and in the Tisa after the Mureş joins it.

Because of dilution and dispersion in the river system, and of the initial EU BAT-compliant technology adopted for the project (for example, the use of a cyanide destruct process for tailings effluent that reduces cyanide concentration in effluent stored in the TMF to below 6 mg/l), even a large scale unprogrammed release of tailings materials (for example, following failure of the dam) into the river system would not result in transboundary pollution. The model has shown that under worse case dam failure scenario all legal limits for cyanide and heavy metals concentrations would be met in the river water before it crosses into Hungary.

The INCA model has also been used to evaluate the beneficial impacts of the existing mine water collection and treatment and it has shown that substantial improvements in water quality are achieved along the river system under normal operational conditions.

For more information, an information sheet presenting the INCA modeling work is presented under the title of the Mureş River Modeling Program and the full modeling report is presented in Annex 5.1:

- Development of HCN on the tailings pond surface. Simulated emissions of HCN from the Tailings Management Facility pond surface and of their dispersion into the ambient air show that the level of $400\mu\text{g}/\text{m}^3$ hourly average and $179\mu\text{g}/\text{m}^3$ 8hr average will not be exceeded. These HCN concentrations are only slightly over the odor threshold (0.17ppm) and much below potentially dangerous concentrations;

- Cetate Dam break and breach development. Flood modeling was in case of a break in Cetate dam was based on the design parameters obtained from the hydrometeorological study "Assessment of rainfall intensity, frequency and runoff for the Roşia Montană Project - Radu Drobot". The breach characteristics were predicted using the BREACH model, and the maximum height of the flood wave in various flow sections was modeled using the FLDWAV software. The assumptions included a total $800,000\text{ m}^3$ discharge for one hour, when the peak of the flood hydrograph is about 4.9 m above base flow immediately below the dam and in the narrow Abrud valley 5.9-7.5 km downstream of the dam, while in the last section considered (10.5 km) water depth is about 2.3 m above base flow and the maximum flow rate $877\text{ m}^3/\text{s}$. Further, the broader Aries valley allows the flood wave to propagate on a significantly wider bed, which results in a highly attenuated hydrograph. These results describe the "worst case scenario" based on extreme dam break assumptions;

- Accidents during cyanide transportation. Due to the large quantities of cyanide transported (about 30t /day) the risks associated to this activity were assessed in detail using the ZHA- Zurich Hazard Analysis method. As a consequence, the optimum transport route was selected from the manufacturer to the Process Plant, e.g

Cyanide transport (in solid state) will exclusively involve special SLS (Solid to Liquid System) containers, 16 tons each. The ISO compliant container will be protected by a framework with legs, which allows separation from the transport trailer for temporary storage. The wall is 5.17 mm thick, which, together with the protective framework, provides additional protection to the load in case of accident. This system is considered BAT and is currently one of the safest cyanide transportation options.

It is being mentioned the fact that the study develops the occurrence possibility of these scenarios (pages 166-171, Conclusions).

As regards the cyanides management, there is a baseline study named "Roşia Montană Golden Project, Cyanides Management Plan" prepared in compliance with the "International Management Code for the Manufacture, Transport and Use of Cyanide in the Production of Gold (International Cyanide management Institute) May 2002". S.C. Roşia Montană Gold Corporation is signatory to this code.

Bibliographical references for Chapter 7 "Risk Cases" are listed at page173-176.

Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	1897
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	No. 110906/25.08.2006
RMGC internal unique code	MMGA_1235
Proposal	<p>During operation, accidents with catastrophic effects may occur: floods, landslides, equipment breakdowns, etc.</p>
Solution	<p>Extreme natural events have been considered throughout the design of the Roşia Montană project. These include, but are not limited to extreme rainfalls (including rainfall and snow melt), extreme draught, and extreme earthquakes. In addition, consideration has been given to climate change factors during the development of the extreme natural events.</p> <p>To illustrate this, special measures have been taken to prevent and mitigate the potential negative effects caused by heavy rainfalls. What is of interest, in view of the project, is the quantity of water flowing over the ground surface as a result of the floods. The measures have been detailed in Chapter 7, <i>Risks</i>, Subchapter 2.4.3, p. 38-42 '<i>Measures to Prevent, Reduce and Remediate the Effects of Floods and High Waters</i>'.</p> <p>Overall, the measures include:</p> <ul style="list-style-type: none"> – the development of structures over almost the entire surface of the Roşia and Corna catchment areas. As a result, runoff on the surface covered by the site will be almost entirely retained (including pits, waste rock dumps, tailing's ponds and other types of impoundments). The Corna dam was designed to retain the total amount of water resulting from two successive PMPs (450 mm/24 h+450 mm/24 h), so as to avoid overtopping. Estimates indicate that the Probable Maximum Precipitation, defined as "<i>theoretically the greatest depth of precipitation for a given duration that is physically possible over a given size storm area at a particular geographical location at a certain time of year, without taking into consideration long-term climate changes</i>" (WMO, 1986) with a chance occurrence of 1 in more than 100 million years [1]; – as a safeguard relating to runoff volume, the project includes construction of diversion channels within both the Roşia and Corna valley drainage basins to route rainfall runoff around the mine waste materials. As an additional measure – and based on the absence of any diversion channels – the design provides ample freeboard in the case that excessive rainfall combines with wind conditions to generate waves. <p>To ensure increased stability, we have also buttressed the dam itself, with a ration of H:V well beyond any existing requirements, as outlined below.</p> <p>The Corna Dam (the main dam) will be a rockfill structure built using the centerline method of construction. The dam will have a downstream slope of 3H: 1V. Typically, the slopes for such hydraulic structures range between 1.5H: 1V and 1.75H: 1V.</p> <p>As for the broader range of extreme events, the following discussion present a summary of the conditions considered in the Roşia Montană Project design.</p> <p>Chapter 4 of the Report on the Environmental Impact Assessment Study, subchapter 4.1 "Water", p. 20, as well as the Mine Rehabilitation and Closure Plan, p. 123 reflect all future potential changes of the basic climatic parameters and of the extreme events. The Water Management and Erosion Control Plan as well as Mine Rehabilitation and Closure Plan include continuous assessment procedures of learned data and climatic change forecasts, in such a manner that any implications regarding the management and design activities to be immediately identified and managed.</p> <p>Climatic conditions that have been taken into account during the design activity developed for Corna</p>

Tailings Management Facility, with specific reference to extreme precipitations (the main factor that causes failures worldwide), are sufficient, even in the case of summation of forecasted values for extreme events (increase estimated at 15% for the period of project's development, the Mine Rehabilitation and Closure Plan, p. 123, subchapter 4.1. "Water", p.20 from the Report on Environmental Impact Assessment Study).

Finally, the probability of major landslides to appear in that specific area is also very low, as a result of the stable petrographic composition that hosts especially compacted rocks, without large volumes of rocks that have an unstable composition. At most, There may appear superficial landslides and rocks fragmentations, generating a minimal influence on the objectives (subchapter 2.6 Section 7 Risks).

References:

[1] Figure 4.1.8, Chapter 4.1 Water, the EIA Report.

MMDD's item no. for the question which includes the observation identified by the RMGC internal code

14, 15, 16, 17, 21, 24, 25, 26, 27, 28, 29, 30, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 62, 63, 64, 65, 67, 68, 69, 70, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 151, 152, 158, 163, 164, 165, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 190, 196, 197, 198, 199, 200, 201, 204, 206, 210, 211, 212, 213, 215, 217, 218, 219, 220, 222, 223, 224, 225, 226, 227, 228, 229, 235, 236, 237, 238, 239, 240, 241, 244, 247, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 264, 272, 274, 275, 276, 277, 278, 279, 280, 281, 282, 286, 288, 289, 293, 297, 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RMGC internal unique code

MMGA_1259

Proposal

In EIA there are no presented all the possible risks derived from this project; SEE THE CONTENT OF THE TYPE 1 CONTESTATION

It is the nature of risk that it can be mitigated and diminished; it cannot be made to disappear. In order to put this into context, the common action of walking on the street or developing everyday activities have an accident potential. This accident potential is twice higher than within the framework of industrial activities that use hazardous substances.

Solution

A major chapter of the EIA report was dedicated to the identification of risks for the project. In addition, this chapter provides a discussion of the mitigation measures for each risk and how they were incorporated into the project designs. It is recognized that risk identification is difficult due to the number and diversity of events that can be envisioned. The EIA report cannot assume to cover all of the potential risks associated with the project. However, it has attempted to identify and address the most relevant risks. The extent of risk assessment and the intensity of the prevention and mitigation measures should

be proportional to the risk involved and therefore only the risks that have been considered important have been assessed in detail. Each is described below.

In the larger sense, the entire EIA report is focused on the assessment of impacts and their associated mitigation. Specifically, Chapter 4 of the EIA presents that impact assessment of the project. The following discussion presents a summary of the impact discussed in the EIA.

As far as natural and technological risks assessments are concerned, Chapter 7, "Risk Cases", from the Report on Environmental Impact Assessment, emphasizes the fact that safety and prevention measures, the implementation of the environmental management and risk systems are mitigating the consequences to acceptable levels as compared to the most restrictive norms, standards, the best practices or national and international recommendations in the field. The risk level has been established as moderate and so, socially acceptable. The extension of the risk assessment and the intensity of the prevention and mitigation measures of the consequences should be proportionate to the risk involved. Selection of a specific mitigation technique is depends on the analyzed accident scenario.

More detailed assessments are conducted for accident scenarios that, based on the qualitative assessment are found to be potentially major, of probability more than 10^{-6} (reduced recovery periods of 1/1,000,000) meaning that they could have major consequences therefore, elevated associated risk, a higher risk level than 9 to 12 (on a scale of 1-25). To put this in context, simply living in southern Florida rates a 25 on the risk scale.

A global assessment of the risks associated with the Roşia Montană Project is obtained by the quick environmental and health risk assessment methodology initially developed by the Italian Ministry of the Environment and the World Health Organization. Natural hazard and risk identification and analysis presents key data and information in assessing potential technological accidents. Thus:

- In designing the Tailings Management Facility, the design parameters were chosen to fully cover the characteristic seismic risk of the area. These seismic design parameters adopted for the TMF and other facilities on the proposed site result in a safety factor much greater than the minimum accepted under the Romanian and European design standards for such facilities;
- in the sector physically impacted by the Project, the risk of floods will remain very low due to the small catchments (controlled by the Roşia and Corna Streams) the area affected by the operation, and the creation of containment, diversion and drainage hydro-technical structures for storm waters on the site, and in the Abrud catchment in general;
- risks caused by meteorological events have been reviewed and used in assessing the hazards of the affected technological processes.

From the analysis of morphometrical parameters and their correlation with other sets of information on the natural slopes on and near the site shows that the (qualitatively estimated) landslide occurrence risk is low to moderate and its consequences will not cause major impacts on the structural components of the Project.

There is no significant risk associated with resource depletion. Mining activities are planned judiciously, so as to extract only the profitable gold and silver resources and only the necessary construction rock for the Project. The management of the mining concession site will minimize reserve "sterilization" (limitation of future access to the reserves).

In assessing technological hazards and risks, the quantity of hazardous substances on the site was calculated as a total and by category, as provided by the *Notification Procedure* approved by Ministry of Agriculture, Forestry, Water and Environment (MAFWE) Order 1084/2003. Based on an evaluation of hazardous substances in stock on the Project site in relation to the relevant quantities provided by the Government Decision 95/2003 which transposes the Seveso Directive, the Project ranges between the upper and the lower limits, and therefore S.C. Roşia Montană Gold Corporation S.A. is required to prepare a Report on Environmental Impact Assessment Study to be sent to the local environmental authority and the local civilian protection authority a *Safety Report* on its operations to prevent major accident risks.

In assessing the consequences of major accidents involving dangerous substances, physical-mathematical models accepted internationally and especially at EU level, and the current version of the SLAB (Canada) software have been used, the latter for the atmospheric dispersion of denser than air gases, that may

handle a multitude of situations and scenarios. Similarly, the EFFECTSGis 5.5 (Netherlands) software, developed for the analysis of the effects of industrial accidents and of consequences. Several scenarios were considered in response to the internal legislative requirements, especially related to the implementation of the Internal Emergency Plans (GD 647/2005). The conclusions of the risk assessment for major accidents were:

- The total destruction of plant facilities may only be caused by terrorist attack with classic or nuclear weapons. Simultaneous damage to the HCl tank (including containment) and to the NaCN solution tank, the tanks containing enriched solution, to one or more leaching tanks, having as a result HCN dispersion into the air. At the same time, under certain situations and weather conditions unfavorable for dispersion, people within 40 m of the emission source, surprised by the toxic cloud for more than 1 minute without respiratory protection equipment, will most certainly die. It may also be considered that, on a radius of about 310 m, persons exposed for more than 10 minutes may suffer serious intoxications that may also lead to death. Toxic effects may occur in persons up to about 2 km downwind of the process plant;

- Operating errors and/or failures in the measurement and control devices, resulting in a lower pH in the leaching tank, thickener and/or DETOX slurry and accidental emissions of hydrocyanic acid. The area affected by concentrations of 290 ppm over a 10 min exposure time is within a circle of 36 m radius and the 50 ppm IDLH threshold for 30 min exposure will be reached over an area of 157.5 m radius. The center of these circles is the middle of the CIL tanks platform;

- Accidental HCN emission from the decanter. The accident may be caused by a drop of pH in the CIL tanks combined with an overdose of flocculent solution and faulty pH monitoring systems. The area affected by concentrations of 300 ppm over a 10 min exposure time is within a circle of 65 m radius and the 50 ppm IDLH threshold for 30 min exposure will be reached over an area of 104 m radius. The center of these circles is mid-distance between the two DETOX facilities;

- Accidental HCN emission from the DETOX facility. The accident may be caused by a drop of pH in the reactors generated by an overdose of metabisulfite solution and/or copper sulphate combined with faulty pH monitoring systems. The area affected by high 1900 ppm concentrations for a 1 min exposure time is located within a 10 m radius circle. The area affected by concentrations of 300 ppm over a 10 min exposure time is within a circle of 27 m radius and the 50 ppm IDLH threshold for 30 min exposure will be reached over an area of 33 m radius. The center of these circles is mid-distance between the two DETOX facilities;

- Explosion of the LPG storage tank. The LPG storage tank has a 50 ton capacity and is located outdoors, near the heating plant. The simulation was conducted for the worst case scenario, considering an explosion of the full tank. Threshold I with heat 12.5 kW/m² is within a 10.5 m radius circle and Threshold II, of heat radiation 5 kW/m² is within a circle of 15 m radius;

- Damage and/or fire at the fuel tanks. Simulations were conducted for the worst case scenarios, considering ignition and combustion of all the diesel (fire in the tank, or in the containment vat, when full of diesel);

- Corna Dam break and breach development. Two credible accident scenarios were considered in simulating tailings flow out of the Tailings Management Facility, and six credible scenarios for the flow of decant water and tailings pore water, with significant effects on the terrestrial and aquatic ecosystems, in different weather conditions;

- Tailings flow may occur along Corna Valley, on a 800 m (starter dam break) or over 1600 m reach should the Corna dam break in its final stage;

- In regard to water quality impacts, cyanide concentrations in the water in the shape of a pollution plume may reach Arad, near the Romanian-Hungarian border on the Mureş River, in concentrations ranging between 0.03 and 0.5 mg/L. Due to inherent mathematical limitations in the models, these values and the accident effects are considered overestimated. Therefore, the results describe the “worst case scenario” based on extreme dam break assumptions for the Corna Dam.

A new and much more precise and realistic simulation has been subsequently established based on the INCA Mine model, that considers the dispersion, volatilization and breakdown of cyanides during the downstream movement of the pollutant flow (Whiteland et al., 2006).

The model used is the INCA model developed over the past 10 years to simulate both terrestrial and aquatic systems within the EUROLIMPACS EU research program (www.eurolimpacs.ucl.ac.uk). The model has been used to assess the impacts from future mining, and collection and treatment operations for pollution from past mining at Roşia Montană.

The modeling created for Roşia Montană simulates eight metals (cadmium, lead, zinc, mercury, arsenic, copper, chromium, manganese) as well as Cyanide, Nitrate, Ammonia and dissolved oxygen. The model has been applied to the upper catchments at Roşia Montană as well as the complete Abrud-Arieş-Mureş river system down to the Hungarian Border and on into the Tisa River. The model takes into account the dilution, mixing and physical-chemical processes affecting metals, ammonia and cyanide in the river system and gives estimates of concentrations at key locations along the river, including at the Hungarian Boarder and in the Tisa after the Mureş joins it.

Because of dilution and dispersion in the river system, and of the initial EU BAT-compliant technology adopted for the project (for example, the use of a cyanide destruct process for tailings effluent that reduces cyanide concentration in effluent stored in the TMF to below 6 mg/l), even a large scale unprogrammed release of tailings materials (for example, following failure of the dam) into the river system would not result in transboundary pollution. The model has shown that under worse case dam failure scenario all legal limits for cyanide and heavy metals concentrations would be met in the river water before it crosses into Hungary.

The INCA model has also been used to evaluate the beneficial impacts of the existing mine water collection and treatment and it has shown that substantial improvements in water quality are achieved along the river system under normal operational conditions.

For more information, an information sheet presenting the INCA modeling work is presented under the title of the Mureş River Modeling Program and the full modeling report is presented in Annex 5.1:

- Development of HCN on the tailings pond surface. Simulated emissions of HCN from the Tailings Management Facility pond surface and of their dispersion into the ambient air show that the level of $400\mu\text{ g/m}^3$ hourly average and $179\mu\text{ g/m}^3$ 8hr average will not be exceeded. These HCN concentrations are only slightly over the odor threshold (0.17ppm) and much below potentially dangerous concentrations;

- Cetate Dam break and breach development. Flood modeling was in case of a break in Cetate dam was based on the design parameters obtained from the hydrometeorological study "Assessment of rainfall intensity, frequency and runoff for the Roşia Montană Project - Radu Drobot". The breach characteristics were predicted using the BREACH model, and the maximum height of the flood wave in various flow sections was modeled using the FLDWAV software. The assumptions included a total 800000 m^3 discharge for one hour, when the peak of the flood hydrograph is about 4.9 m above base flow immediately below the dam and in the narrow Abrud valley 5.9-7,5 km downstream of the dam, while in the last section considered (10,5 km) water depth is about 2.3 m above base flow and the maximum flow rate $877\text{ m}^3/\text{s}$. Further, the broader Aries valley allows the flood wave to propagate on a significantly wider bed, which results in a highly attenuated hydrograph. These results describe the "worst case scenario" based on extreme dam break assumptions:

- Accidents during cyanide transportation. Due to the large quantities of cyanide transported (about 30t /day) the risks associated to this activity were assessed in detail using the ZHA- Zurich Hazard Analysis method. As a consequence, the optimum transport route was selected from the manufacturer to the Process Plant, e.g.;

- Cyanide transport (in solid state) will exclusively involve special SLS (Solid to Liquid System) containers, 16 tons each. The ISO compliant container will be protected by a framework with legs, which allows separation from the transport trailer for temporary storage. The wall is 5.17 mm thick, which, together with the protective framework, provides additional protection to the load in case of accident. This system is considered BAT and is currently one of the safest cyanide transportation options.

It is being mentioned the fact that the study develops the occurrence possibility of these scenarios (pages 166-171, Conclusions).

As regards the cyanides management, there is a baseline study named "Roşia Montană Golden Project, Cyanides Management Plan" prepared in compliance with the "International Management Code for the Manufacture, Transport and Use of Cyanide in the Production of Gold (International Cyanide management Institute) May 2002". S.C. Roşia Montană Gold Corporation is signatory to this code.

Bibliographical references for Chapter 7 "Risk Cases" are listed at page173-176.

Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	2985
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	No. 111784/25.08.2006
RMGC internal unique code	MMGA_1286
Proposal	<p>The questioner does not agree to the implementation of the Rosia Montana mining project formulating the following remarks and comments:</p> <p>Within EIA, there are not presented all the possible risks caused by this project; SEE THE CONTENT OF THE TYPE 1 CONTESTATION</p> <p>Also, the questioner sends within the letter two points of view of some independent specialists</p> <p>It is the nature of risk that it can be mitigated and diminished; it cannot be made to disappear. In order to put this into context, the common action of walking on the street or developing everyday activities have an accident potential. This accident potential is twice higher than within the framework of industrial activities that use hazardous substances.</p> <p>A major chapter of the EIA report was dedicated to the identification of risks for the project. In addition, this chapter provides a discussion of the mitigation measures for each risk and how they were incorporated into the project designs. It is recognized that risk identification is difficult due to the number and diversity of events that can be envisioned. The EIA report cannot assume to cover all of the potential risks associated with the project. However, it has attempted to identify and address the most relevant risks. The extent of risk assessment and the intensity of the prevention and mitigation measures should be proportional to the risk involved and therefore only the risks that have been considered important have been assessed in detail. Each is described below.</p> <p>In the larger sense, the entire EIA report is focused on the assessment of impacts and their associated mitigation. Specifically, Chapter 4 of the EIA presents that impact assessment of the project. The following discussion presents a summary of the impact discussed in the EIA.</p> <p>As far as natural and technological risks assessments are concerned, Chapter 7, "Risk Cases", from the Report on Environmental Impact Assessment, emphasizes the fact that safety and prevention measures, the implementation of the environmental management and risk systems are mitigating the consequences to acceptable levels as compared to the most restrictive norms, standards, the best practices or national and international recommendations in the field. The risk level has been established as moderate and so, socially acceptable. The extension of the risk assessment and the intensity of the prevention and mitigation measures of the consequences should be proportionate to the risk involved. Selection of a specific mitigation technique is depends on the analyzed accident scenario.</p> <p>More detailed assessments are conducted for accident scenarios that, based on the qualitative assessment are found to be potentially major, of probability more than 10^{-6} (reduced recovery periods of 1/1,000,000) meaning that they could have major consequences therefore, elevated associated risk, a higher risk level than 9 to 12 (on a scale of 1-25). To put this in context, simply living in southern Florida rates a 25 on the risk scale.</p> <p>A global assessment of the risks associated with the Roşia Montană Project is obtained by the quick environmental and health risk assessment methodology initially developed by the Italian Ministry of the Environment and the World Health Organization. Natural hazard and risk identification and analysis presents key data and information in assessing potential technological accidents. Thus:</p> <ul style="list-style-type: none"> - In designing the Tailings Management Facility, the design parameters were chosen to fully cover the characteristic seismic risk of the area. These seismic design parameters adopted for the TMF and other facilities on the proposed site result in a safety factor much greater than the minimum accepted under the Romanian and European design standards for such facilities; - in the sector physically impacted by the Project, the risk of floods will remain very low due to
Solution	

the small catchments (controlled by the Roşia and Corna Streams) the area affected by the operation, and the creation of containment, diversion and drainage hydro-technical structures for storm waters on the site, and in the Abrud catchment in general;

- risks caused by meteorological events have been reviewed and used in assessing the hazards of the affected technological processes.

From the analysis of morphometrical parameters and their correlation with other sets of information on the natural slopes on and near the site shows that the (qualitatively estimated) landslide occurrence risk is low to moderate and its consequences will not cause major impacts on the structural components of the Project.

There is no significant risk associated with resource depletion. Mining activities are planned judiciously, so as to extract only the profitable gold and silver resources and only the necessary construction rock for the Project. The management of the mining concession site will minimize reserve "sterilization" (limitation of future access to the reserves).

In assessing technological hazards and risks, the quantity of hazardous substances on the site was calculated as a total and by category, as provided by the *Notification Procedure* approved by Ministry of Agriculture, Forestry, Water and Environment (MAFWE) Order 1084/2003. Based on an evaluation of hazardous substances in stock on the Project site in relation to the relevant quantities provided by the Government Decision 95/2003 which transposes the Seveso Directive, the Project ranges between the upper and the lower limits, and therefore S.C. Roşia Montană Gold Corporation S.A. is required to prepare a Report on Environmental Impact Assessment Study to be sent to the local environmental authority and the local civilian protection authority a *Safety Report* on its operations to prevent major accident risks.

In assessing the consequences of major accidents involving dangerous substances, physical-mathematical models accepted internationally and especially at EU level, and the current version of the SLAB (Canada) software have been used, the latter for the atmospheric dispersion of denser than air gases, that may handle a multitude of situations and scenarios. Similarly, the EFFECTSGis 5.5 (Netherlands) software, developed for the analysis of the effects of industrial accidents and of consequences. Several scenarios were considered in response to the internal legislative requirements, especially related to the implementation of the Internal Emergency Plans (GD 647/2005). The conclusions of the risk assessment for major accidents were:

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- Accidental HCN emission from the decanter. The accident may be caused by a drop of pH in the CIL tanks combined with an overdose of flocculent solution and faulty pH monitoring systems. The area affected by concentrations of 300 ppm over a 10 min exposure time is within a circle of 65 m radius and the 50 ppm IDLH threshold for 30 min exposure will be reached over an area of 104 m radius. The center of these circles is mid-distance between the two DETOX facilities;

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Cyanide transport (in solid state) will exclusively involve special SLS (Solid to Liquid System) containers, 16 tons each. The ISO compliant container will be protected by a framework with legs, which allows separation from the transport trailer for temporary storage. The wall is 5.17 mm thick, which, together with the protective framework, provides additional protection to the load in case of accident. This system is considered BAT and is currently one of the safest cyanide transportation options.

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Bibliographical references for Chapter 7 “Risk Cases” are listed at page173-176.

MMDD's item no. for the question which includes the observation identified by the RMGC internal code

14, 15, 16, 17, 21, 24, 25, 26, 27, 28, 29, 30, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 62, 63, 64, 65, 67, 68, 69, 70, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 151, 152, 158, 159, 163, 164, 165, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 210, 211, 212, 213, 215, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 249, 250, 251, 252, 253, 254, 255, 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MMDD's identification no. for the question which includes the observation identified by the RMGC internal code

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RMGC internal unique code

MMGA_1295

Proposal

There is not a Safety Report submitted for the public consultation and evaluation by the competent authorities; SEE THE CONTENT OF THE TYPE 1 CONTESTATION
Also, the questioner sends within the letter two points of view of some independent specialists

Solution

The Security Report has been made available for public access by being posted at the following Internet address http://www.mmediu.ro/dep_mediu/rosia_montana_securitate.htm as well as through the printed version which could have been found at several information locations established for public hearings.

Domain	RISK MANAGEMENT
MMDD's item no. for the question which includes the observation identified by the RMGC internal code	3027
MMDD's identification no. for the question which includes the observation identified by the RMGC internal code	No. 111774/25.08.2006
RMGC internal unique code	MMGA_1324
Proposal	<p>The questioners request the MMGA to refuse EIA and not to emit the environment permit for the Roşia Montana mining project. The questioners submit the following remarks: The risks of cyanide seepage are not correctly evaluated</p>
Solution	<p>There is no foundation for the Questioner's assertion regarding cyanide analysis in the Roşia Montană Project EIA. The risk of cyanide seepage from the Tailings Management Facility has been addressed in the EIA Report and the associated engineering studies conducted to support the design. The studies have evaluated seepage from the TMF basin into the Corna Valley basin, the volatilization of cyanide from the TMF pond, and the possible release of cyanide from the plant facilities. Each of these major release mechanisms is presented below and discussed.</p> <p>In order to collect the processing tailings, the design of the dam which is going to be located on Corna Valley was established based on certain design criteria compliant with Romanian and international standards. All these criteria are presented in the Report on Environmental Impact Assessment Study, chapter 7, paragraph 3.2.5.1, and they have the role to convey a maximum safety level during the construction, the operational phase and during the post-closure stage.</p> <p>Even in these conditions, hypothetical scenarios with reference to the dam failure have been anticipated, a failure caused by certain technical issues, supposing that the construction methodology won't be observed. These scenarios represent the worst case situations which could have ever been identified, taking into account the technical characteristics of the Tailings Management Facility. These scenarios are detailed in chapter 7 of the Report on Environmental Impact Assessment Study, subchapter 6.4.3, p. 117-121.</p> <p>In order to assess cyanide transport within the hydro graphic system when a major accident occurred, a mixture model has been developed, without considering the chemical dispersion, volatilization and breakdown of cyanides and the results are being presented in chapter 7 of the Report on Environmental Impact Assessment Study, subchapter 6.4.3, table 7.27.</p> <p>Results on the distribution of cyanides concentrations that have been presented within the Report on Environmental Impact Assessment were obtained by using a model of a traditional combination, which ignores both the dispersion that occurs as long as the pollutant flow moves downstream and the occurrence of mitigation events. The results of this model are being presented in chapter 7 of the Report on Environmental Impact Assessment Study, subchapter 6.4.3, table 7.27.</p> <p>A new and much more precise and realistic simulation has been subsequently established based on the INCA Mine model, that considers the dispersion, volatilization and breakdown of cyanides during the downstream movement of the pollutant flow (Whiteland et al., 2006).</p> <p>The model used is the INCA model developed over the past 10 years to simulate both terrestrial and aquatic systems within the EUROLIMPACS EU research program (www.eurolimpacs.ucl.ac.uk). The model has been used to assess the impacts from future mining, and collection and treatment operations for pollution from past mining at Roşia Montană.</p> <p>The modeling created for Roşia Montană simulates eight metals (cadmium, lead, zinc, mercury, arsenic, copper, chromium, manganese) as well as Cyanide, Nitrate, Ammonia and dissolved oxygen. The model has been applied to the upper catchments at Roşia Montană as well as the complete Abrud-Arieş-Mureş river system down to the Hungarian Border and on into the Tisa River. The model takes into account the dilution, mixing and physical-chemical processes affecting metals, ammonia and cyanide in the river</p>

system and gives estimates of concentrations at key locations along the river, including at the Hungarian Boarder and in the Tisa after the Mureş joins it.

Because of dilution and dispersion in the river system, and of the initial EU BAT-compliant technology adopted for the project (for example, the use of a cyanide destruct process for tailings effluent that reduces cyanide concentration in effluent stored in the TMF to below 6 mg/l), even a large scale unprogrammed release of tailings materials (for example, following failure of the dam) into the river system would not result in transboundary pollution. The model has shown that under worse case dam failure scenario all legal limits for cyanide and heavy metals concentrations would be met in the river water before it crosses into Hungary.

The INCA model has also been used to evaluate the beneficial impacts of the existing mine water collection and treatment and it has shown that substantial improvements in water quality are achieved along the river system under normal operational conditions.

For more information, an information sheet presenting the INCA modeling work is presented under the title of the Mureş River Modeling Program and the full modeling report is presented in Annex 5.1.

Bibliography:

- MWH, Roşia Montană TMF Dambreak Study, January 2006;
 - MWH, TMF Dam break scenarios for use in Roşia Montană EIA, February 2006;
 - "A Water Quality Modelling Study of Roşia Montană and the Abrud, Arieş and Mureş RiverSystems: Assessing Restoration Strategies and the Impacts of Potential Pollution Events" by Professor Paul Whitehead, Danny Butterfield and Andrew Wade, University of Reading, School of Human and Environmental Sciences, December 2006.
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