**CENTER for SCIENCE in PUBLIC PARTICIPATION**
224 North Church Avenue, Bozeman, MT 59715
Phone (406) 585-9854 / Fax (406) 585-2260 / web: www.csp2.org / e-mail: csp2@csp2.org
***"Technical Support for Grassroots Public Interest Groups"***

CSP²

September 18, 2002

**To:** Jozsef Feiler
CEE Bankwatch Network

**From:** David M. Chambers
CENTER for SCIENCE in PUBLIC PARTICIPATION

**Re: Comments on the Rosia Montana Feasibility Study**

## 1. Low Grade Ore Deposit

This is a low grade ore deposit, and the only thing that makes it worth developing is the large amount of gold in the resource. But, given the low grade of the deposit, the mine will also be sensitive to market fluctuations, meaning that it could close temporarily, or prematurely-permanently, due to a drop in the price of gold.

Although the deposit contains a large reserve of gold (225.7 million tons at a grade of 1.4 gram/ton gold and 7.5 gram/ton silver containing 10.5 million ounces of gold and 54.6 million ounces of silver), the cutoff grade used to calculate these reserves is 1.2 grams/ton, which is near the practical lower limit for economically processing gold.[1]

## 2. Sulfur Content / Acid Mine Drainage Potential

An overall mean sulfur grade of 1.9% S has been calculated for the ore coming from all the deposits. The Cetate deposit shows the highest mean sulfur grade of 2.4% S, followed by Cirnicel deposit with 2.2% S.[2] In general, material with sulfur grades greater than 1% can be expected to produce metals as a result of acid mine drainage, although there are many variables that can affect this process.

The Feasibility Study does not present data on the sulfide/sulfur content of the waste rock. It is probably more important to know the sulfide/sulfur content of the waste rock than of the ore. The waste rock will be piled next to the pits, and left exposed where water and oxygen can easily penetrate the waste storage areas and oxidize the exposed sulfide minerals. The waste in the tailings pond will be of relatively uniform composition, and will be better 'managed' than the waste rock.

We can assume that the sulfide content of the waste will be similar to that of the ore, and that there will be a significant potential for acid mine drainage in the waste rock.

Acid Rock Drainage, or acid mine drainage, occurs when sulfide minerals are exposed to air and water. This causes the sulfide minerals, which are unstable in a surface environment, to break down into a weak hydrosulfuric acid, while simultaneously making the metals in the sulfides available for mobilization in

---

[1] Feasibility Study, Table 1.1.1, page 5.

[2] Feasibility Study, page 26.

the water. Iron sulfides like pyrite and pyrrhotite are the most common acid-causing sulfide minerals, while lead, cadmium, copper, zinc and mercury sulfides are the damaging in terms of releasing metals harmful to the environment. While the pH (hydrogen ion concentration) must generally remain low for these metals to remain in solution and be harmful to aquatic and, in higher concentrations, to humans - another suite of metals also contained in sulfide minerals can remain in solution even if the pH is of the effluent, or the receiving water, is later raised. This suite of metals includes arsenic, selenium, and thallium, which, like the other metals mentioned, can be harmful to aquatic life, animals that drink the contaminated water, and even humans. The best way to prevent or limit acid rock drainage is to restrict the amount of oxygen that is available to oxidize the sulfides, because it is almost impossible to keep water from contacting this material once it has been mined. Once acid rock drainage has begun, it is almost impossible to stop completely. Acid rock/mine drainage from both hardrock and coal mining has severely affected thousands of miles of streams in the US, and is now recognized as the greatest potential environmental problem associated with mining.

Acid rock/mine drainage can cause severe impacts to aquatic life in surface waters, through impacts from heavy metals; and, if left unchecked, can impact human health – primarily through mercury, lead, and cadmium contamination. Many governmental jurisdictions today require that pollution from acid mine drainage be mitigated or eliminated before impacting surface and/or ground water off of the mine site. Where acid mine drainage and/or heavy metal contamination persists after active mining has ceased, as is evidently already the case at Rosia Montana, water treatment might be required – especially if new mining will significantly increase the amount of disturbed land, and add to existing pollution problems.

The waste material, in particular, is likely to have potential to cause long term water problems. Waste rock, especially in disseminated ore deposits, is really just below-grade ore, and often contains as much sulfide material as does the ore itself. The waste material contains both large boulders and small particles. Water and oxygen move easily through this material, and there is significant surface area exposed. Unless the waste dumps are capped, 30% to 60% of the incident precipitation can penetrate the waste dump. There are no liners below a waste rock dump. If pollution is generated from this material, it will either (1) enter surface or ground waters, or (2) need to be collected and evaporated or treated.

If water treatment is required, reclamation costs typically double. There is also considerable uncertainty in estimating the long term costs of water treatment, so government can also assume significant risk if the long term costs of water treatment are underestimated, and government is forced to pay for these increased costs if there is no mining company remaining to assume the liability, as is often the case.

Closure costs for Rosia Montana were estimated to be $19.53 million, and <u>do</u> <u>not</u> <u>include</u> any costs for water treatment.[3] In the United States closure costs for mines of a similar size have been in the $30 - $60 million range, and long term water treatment costs, if required, could be an additional $30 - $60 million.

## 3. Tailings Dam Construction

### a. Dam Design

The dam design chosen for this project is commonly referred to as a “modified upstream” design.[4]

Upstream dam construction is recognized as providing the least stability to seismic events of the three major types of dam.[5] In any mountainous region there is usually significant potential for earthquakes, and tailings dams – unlike water reservoirs – must be designed to hold back their ‘cargo’ in perpituity.

---

[3] Feasibility Study, page 88.

[4] Feasibility Study, Figure 1.9.5.

The safest dam design would be to make the entire dam a centerline-type construction. From an engineering standpoint construction of a full centerline dam should be simple to accomplish, but would add somewhat (although not prohibitively) to the construction cost of the dam.

The top half of the present dam, which is a modified upstream construction design, will be significantly more vulnerable to earthquakes than the lower half, which is a true centerline design. If the dam were to fail during an earthquake (probably the top half of the dam), sulfidic tailings could be released into the water course below the dam. Cleanup costs for such a spill would be significant, and there would also be unmitigatable environmental damage.

It is not apparent from the Feasibility Study just how much risk there is for an earthquake in this area, or to exactly what standard the dam was designed to withstand this risk. Specifically, the horizontal acceleration the dam is designed to withstand, and the magnitude and location of the seismic event that would cause this acceleration, should be disclosed, and the seismic modelling carefully checked by regulatory authorities.

### b. Construction Materials

Waste rock will be utilized to construct the tailings dam.[6] As mentioned, it is possible that much of the waste rock will be potentially acid generating. The waste rock utilized for tailings dam construction must be carefully tested to insure that it has no potential to generate acid or metals. It is not evident from the information presented in the Feasibility Study that this will be done.

### c. Waste Isolation

The tailings to be placed in the tailings facility will be potentially acid generating.

> "The tailings will contain about 4% sulfide minerals and will have a net acid producing potential. Under current European Union directives, the tailings are classified as "reactive – hazardous". The design of the TMF must be appropriate to respond to this classification and protect the receiving environment accordingly."[7]

In many jurisdictions where waste materials are classified as hazardous materials, a lined tailings facility is required. A double liner, usually of synthetic plastic material, is placed over a prepared bed of earth, and a conductive layer of gravel is placed between the two liners in order to facilitate detecting/collecting any leakage from the top liner.

There is no liner proposed for the Rosia Montana tailings facility. The designers appear to be depending on the bed rock, and on hydraulic pressure from the existing water table, to prevent migration of contaminants into groundwater systems.[8] From a practical standpoint, depending on bed rock and existing water table to prevent contamination has not worked in many places. This is why there is a requirement to contain hazardous wastes with synthetic liners.

If prevention of groundwater contamination is a concern at Rosia Montana, a synthetic liner (preferably a double liner with lead detection) should be required.

---

[5] The three major types are (1) Upstream – where the dam is actually built on the tailings, and depends in part on the stability of those tailings; (2) Downstream – where the dam is essentially a wedge holding the tailings, but built on solid ground; and, (3) Centerline– which is most stable design, and is constructed much like a large rock built reservoir dam, with abutment material upstream and downstream of the "centerline" of the dam.

[6] Feasibility Study, page 26.

[7] Feasibility Study, page 72.

[8] Feasibility Study, page 73.

## 4. Mining in the Pits

There are significant underground workings in the areas of the proposed open pits.[9] Drilling and operating heavy trucks over these old underground workings can cause them to cave in. This could pose a significant safety risk to mine workers. In addition to the probe-hole drilling proposed in the Feasibility Study – which cannot be done at a density that can detect all possible potential openings – ground penetrating radar, or similar, should be used to screen the work area before heavy equipment is placed over the old workings.

It is proposed that 15 meter-high benches be utilized for the pits.[10] It is also noted that there is "soft" rock present in some areas in these pits.[11] Using a 15 meter bench height might lead to premature failure of the benches in soft rock. Great care must be exercised in engineering and testing for "soft" rock in the pits so that premature bench failure, which could impact worker safety, is avoided.

## 5. Mine Pit Closure

The mine pits will intercept the water table at some point in the mining, and pumping will be required to keep the pits dry for mining.[12] Since mining will expose sulfide minerals that have not been oxidized,[13] there will probably be a significant potential for acid water in the pits once mining has stopped. This potential for acid in pit waters can be significantly enhanced by the presence of underground workings that can feed additional pollution into the pit waters.[14]

## 6. Waste Dump Construction

In the Feasibility Study it is stated:

> "Scarification and compaction will provide a semi-impervious layer under the waste dumps preventing any acid water produced entering the groundwater system."[15]

This is an unrealistic conclusion. While groundwater systems in mountainous terrain are typically very shallow, but acid that is produced by the waste rock will not be prevented from entering these groundwater systems by scarification and compaction.

## 7. Cyanide Use

Cyanide is the reagent used to recover precious metals from the ore. The project will utilize approximately 42,700 kilograms of cyanide per day, or 15.6 million kilograms per year.[16]

Great care must be taken in transporting, storing, and utilizing cyanide. Accidents in transporting cyanide have occurred with some regularity in recent years. A good Spill Response Plan should be developed, and a critical part of such a plan – a part which is often neglected – is a mechanism to notify the public when an accident occurs.

---

[9] Feasibility Study, page 39.

[10] Feasibility Study, page 38.

[11] Feasibility Study, page 5.

[12] Feasibility Study, page 40.

[13] Feasibility Study, page 39.

[14] This is a significant problem at the Berkeley Pit, Butte, Montana, and has led to a multimillion dollar requirement for water treatment in perpituity.

[15] Feasibility Study, page 40.

[16] Calculated from data given in the Feasibility Study of 0.78 CN kg/t (page 49) at a production rate of 20 Mt/a (page 2).

The use of cyanide in processing also generates significant amounts of cyanide by-products that take time to degrade, notably cyanate and thiocyanate, and metal complexes of cyanide. The exact toxicities, residence time, and impacts on aquatic organisms are still poorly understood. It is possible, for example that these compounds led to some of the impacts in the Baia Mare spill incident. It is also common for regulatory agencies to omit monitoring for these compounds in the discharges from mines, partially because there is so little known about them. The amounts of these compounds produced in the milling operation should be predicted, carefully monitored, and the amounts in the discharge regulated.

Cyanide levels in the tailings pond should be reduced to 50 milligrams per liter or less to avoid wildlife mortalities. Cyanide levels in the active tailings pond (i.e. during operation) are projected to be 100-130 milligrams/liter.[17] This level of cyanide is high enough to cause bird and other wildlife mortalities. The project planners have analyzed the methods and costs of treating the cyanide to a level where wildlife mortalities can be eliminated, but have not programmed these cost into the operation at the present.[18]

## 8. Low Power Costs

Power costs for the Rosia Montana project are calculated at $0.0225/Kwh.[19] Electrical power is a major cost to large mining projects because of the grinding and other large-volume processes involved in milling of the ore material. The costs for electrical power projected for the Rosia Montana are very low by western standards, which would typically be 2 to 3 times higher. It is possible that electrical power will be available at the rates quoted. But even if this is the case, cost escalation like that which has taken place in the US in 2001 could significantly increase the operating cost of the project, and might force a temporary or premature closure, as has happened to a low-grade metals producer in the US.[20]

## 9. Jobs

The Project is predicted to provide some 500 jobs during operation.[21] It is interesting to note that the proposed mine is 50 times larger than the present mine,[22] but the increase in employment is only from 336 to 558 jobs.[23] The amount of land disturbed due to the open pits, the waste rock dumps, and the tailings impoundment, will add an additional 722 hectares to the present disturbance of 625 hectares – more than doubling it, to some 17% of the total Comuna land, [24] and requiring that 877 households be relocated.[25]

If this project is typical of other mining projects managed by foreign owned companies, many of the high paying jobs will go to expatriates. In addition, 500 jobs are somewhat larger than would be expected for a mine of this type and size. When cost cutting becomes an issue, trimming the number of employees often becomes a primary consideration, so a reduction in the number of jobs in long-term might be expected, and the jobs cut will almost certainly be those of local workers.

#####

---

[17] Feasibility Study, page 72.

[18] Feasibility Study, page 59.

[19] Feasibility Study, page 5.

[20] Montana Resources Continental Mine, Butte, Montana, was forced to close in 2001 due the increased cost of electrical power. The mine has not reopened.

[21] Feasibility Study, page 8.

[22] Feasibility Study, page 90.

[23] Feasibility Study, page 94.

[24] Feasibility Study, page 96.

[25] Feasibility Study, page 101.