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To: Roxana Pencea Brădăţan
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Re: NI 43-101 Technical Report on the Rovina Valley Project in Romania

Background

David Chambers has 40 years of experience in mineral exploration and development – 15 years of technical and management experience in the mineral exploration industry, and for the past 25+ years he has served as an advisor on the environmental effects of mining projects both nationally and internationally. He has Professional Engineering Degree in physics from the Colorado School of Mines, a Master of Science Degree in geophysics from the University of California at Berkeley, and is a registered professional geophysicist in California (# GP 972). Dr. Chambers received his Ph.D. in environmental planning from Berkeley. His recent research focuses on tailings dam failures, and the intersection of science and technology with public policy and natural resource management.

This review was conducted at the request, and with the financial support, of Declic.

Summary Comments

Although the proposed design for the waste facilities calls for filtered tailings, and co-disposal of the non-acid generating tailings with the waste rock, both fundamentally good practices, significant concern for both long-term public safety and environmental impacts of this proposed project remains.

The basic upstream-type design of both the Co-Disposal Waste Facility, with its uncompacted inner core, and the Cleaner (i.e. acid-generating) Tailings Cell, while technically sound, are susceptible to several commonly encountered failure modes that could lead to a catastrophic failure, especially for the Cleaner Tailings Cell.

The release of acid-drainage contamination from the waste rock in the long-term is also a significant concern. From the description of the geochemistry of the waste rock, it is apparent that in the long-term the waste rock is likely to generate acid drainage. The fact that this might take tens of years or more is acknowledged, but the risks associated with this occurrence is not addressed in the Technical Report (Euro Sun 2021). The Co-Disposal Waste Facility is unlined, and infiltration of meteoric water is certain. Groundwater will be eventually be impacted, and water treatment for drainage from the Co-Disposal Waste Facility, as well as for seepage from the Cleaner Tailings Cell, will be required. No provision for paying for the collection and treatment of seepage in the long-term has been provided in the closure cost estimate.

There are no predictions for surface or ground water quality impacts to surface or groundwater presented as a part of the Technical Report. Water quality predictions are a standard part of environmental assessment for a project. This is a significant gap for any project assessment.

Lastly, the potential for mining the Colnic and Rovina deposits by underground methods was not addressed in the Technical Report. Most of the waste generated, included potentially acid-producing

waste, is directly related to the open pit mining method selected for this project. Underground mining has also been the historic approach to mining in this area. It is noteworthy that the third deposit in the Rovena valley, the Ciresata deposit, although not evaluated in the Technical Report, has been proposed for potential development as an underground mine. Underground mining of the Colnic and Rovina deposits would generate significantly less waste requiring surface disposal, and would probably allow the acid-generating tailings to be placed underground, where their potential to cause long-term contamination would be minimized.

Underground mining should be evaluated as a potential alternative for mining the Rovina and Colnic deposits because of the long-term advantages it provides for public and environmental safety.

Co-Disposal Facility (CDF) Design

The co-disposal of tailings and waste rock has seen much experimentation, but limited application, over the past several decades. Mixing non-acid generating tailings with potentially acid-generating waste rock theoretically limits the amount of oxygen available to the waste rock, reducing the rate of sulfide oxidation. The mixed tailings and waste rock does not have as much inherent geotechnical stability as the waste rock alone because the combined particle size is smaller, and there is more chance that water might be retained in the fine grained material.

The Co-Disposal Facility (CDF) design is described as:

- *The outer structural compacted shell of the CDF will be built of compacted layers of rougher tailings to provide drained and dilative behaviour under short-term and post earthquake conditions.*
- *The inner areas of the CDF will be constructed using co-mingled waste and are not expected to be formally-compacted other than for equipment accessibility and to reduce infiltration.*
(18.3.1.7 Construction Methodology)

This area is subject to moderate precipitation (approximately 1 meter per year). Global warming impacts have not been assessed, and additional precipitation and stronger storms in the future is a possibility.

The Co-Disposal Facility is unlined, top or bottom, with underdrains in the buried streambed channels under the facility. After closure the CDF will have a 0.5 m vegetative cover, but this thickness is significantly less than typically required for an “evaporation-transpiration” type cover that is designed to minimize infiltration from incident precipitation.

“Underdrains will be constructed in stream beds within the footprint of the CDF to collect groundwater seepage and precipitation infiltration, and thereby draw down the phreatic surface within the CDF.” (1.8 Waste Management Facility)

and;

“The seepage control system was designed to collect seepage from the CDF and convey it to the contact water management system. Underdrains will be constructed to collect both water that enters the base of the CDF as seepage from the stream beds and precipitation infiltration through the CDF.”
(18.3.1.6 Seepage Control and Underdrainage)

The underdrains are designed to carry both groundwater seepage into the buried stream channels, as well as infiltration from precipitation. The groundwater seepage will be contaminated by the infiltration discharge, but contamination in the infiltration discharge in-turn will be diluted by the groundwater seepage.

The water from these underdrains is likely to be contaminated by the waste rock. Initially that contamination would be due to the leaching of neutral drainage contaminants, possibly selenium, arsenic,

and/or zinc. There is a good possibility that the waste rock may generate acid drainage in the long-term as the buffering from the tailings is consumed.

It is also noted:

“To allow sufficient dissipation of such pore pressures within the structural toe zone of the CDF, it may be necessary to adopt a staging plan that allows construction of this structural toe zone in advance of the higher parts of the slope and to possibly flatten the temporary north-facing slope as it advances northwards. A detailed construction staging plan, in conjunction with stability analyses for the during-construction condition, will be undertaken during the next design stage of the CDF.”

(18.3.1.3 Stability Analyses)

Monitoring and controlling the phreatic surface in the CDF will be critical in avoiding a CDF failure over the long-term. The failure of a waste facility in steep terrain could lead to significant damage. It is not clear with the limited level of engineering presented that this design is appropriate for this location.

The "downstream shell of rougher tailings compacted in horizontal layers to a dilative condition" (18.3.1.2 Co-Mingled Waste Storage) is essentially an upstream-type design. Should the co-deposited waste become saturated, for example due to high infiltration rates associated with a large storm, or from partial drain failure, then the co-disposal facility could catastrophically fail.

Stability Analyses

The discussion of the stability analysis raises some issues.

"The static, long-term stability analysis was conducted with drained strength parameters for all materials." (18.3.1.3 Stability Analyses)

While this assumption is standard and appropriate from an engineering standpoint, maintaining a "drained" condition cannot be guaranteed over the long-term. A steep facility with uncompacted tailings will need to be carefully monitored, and safety precautions to protect public safety will need to remain in place indefinitely.

In discussing the factors of safety used in the design of the waste facilities, it is stated:

The minimum target factors of safety (FoS) for geotechnical stability of the CDF are as follows:

- *Static, Long-Term FoS: 1.5*
- *Static, During Construction FoS: 1.3*
- *Post-Earthquake FoS: 1.2*

(18.3.1.3 Stability Analyses)

Clarification is needed on whether mine will be considered "Construction" or "Long-Term". Maintaining a static factor of safety of 1.3 during the operation phase of the mine would be risky. This is what was done at Mount Polley before the dam failure.

A static factor of safety of 1.3 is only appropriate during construction of the initial phases of waste facility construction. Once waste is actively being placed in the facility, the factor of safety should be at least 1.5.

Cleaner (Sulfidic) Tailings Facility Design

The Cleaner, or sulfidic, tailings will be acid-generating, and have an acid-generating capacity that is high enough that even if mixed with the non-acid generating Rougher tailings, the combination is still acid-generating. As a result, the Cleaner tailings will be placed in a separate tailings cell.

Cleaner Tailings Cell will be lined top and bottom with a geomembrane and a secondary clay layer cover. Even though the Cleaner Tailings Cell is fully lined, there will be some accumulation water in the long-term, and there is no discussion of how this water will be drained, or how the drainage will be treated, since it will be highly contaminated. If the accumulated water is not drained, this would lead to the eventual failure of the facility, and would pose a significant public safety and environmental risk downgradient of the facility.

“The co-mingled rougher-scavenger tailings and waste rock will be used to construct a stable perimeter around the cleaner tailings cell in advance of each year’s placement to provide sufficient storage capacity for the cleaner tailings.”

(18.3.1.1 Cleaner Tailings Cell)

Since this is the same combined waste as in the Co-Disposal Facility, it appears this material will likely be acid-generating in the long-term. If this material is used to construct the dam/shell of the Cleaner Tailings Cell, as proposed, then precipitation that seeps through the dam/shell material will be contaminated. This water must be collected, and will likely require treatment in the long-term.

A description of the drain configuration for the waste facilities, a very important component of these structures, is also lacking. Maintaining adequate drainage for the waste facilities in perpetuity is critical to preventing their failure.

Although no cross sections are provided for the Cleaner Tailings Cell, it is obvious that the tailings will be restrained by upstream-type construction. There are no cross sections to show the design of the waste dumps, or the relative thicknesses of the "shells" providing structural support. Because of the limited

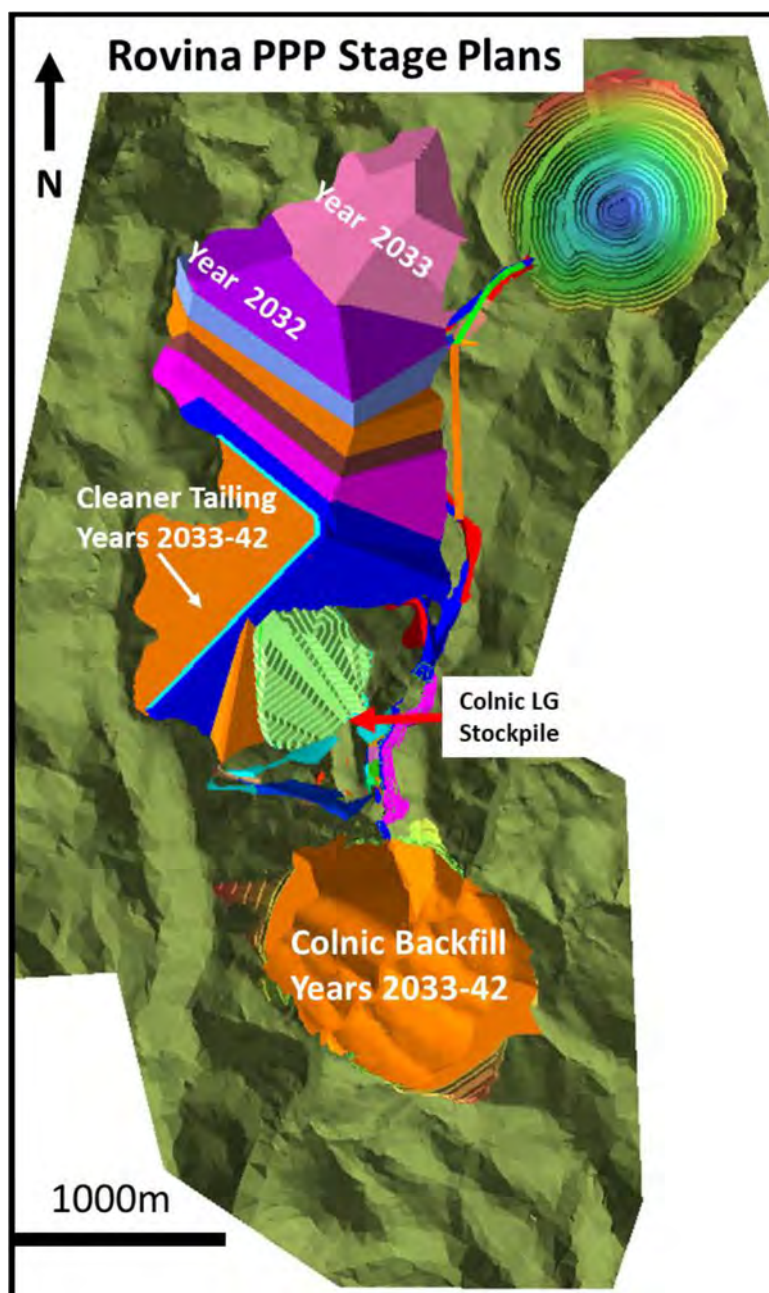


Figure 16.29: Rovina Pit and Co-Disposal Storage Facilities and Stockpiles

amount of space available for waste disposal, the slope of this facility will be, of necessity, steep. Structures with steep slopes are more prone to failure than structures with shallow slopes.

Upstream-type construction carries the highest risk for failure of all dam construction types. Even though the cleaner tailings have been filtered, so are no longer saturated, but are still subject to re-saturation. If the entire Cleaner Tailings Facility were compacted to “*Achieve dilatant conditions throughout the tailings deposit ...*”, as recommended by the Independent Expert Engineering Investigation and Review Panel (Expert Panel 2015), the stability of the Cleaner Tailings Facility would be significantly enhanced.

As it is presently designed, with potentially contaminated waste rock in the dam/shell, and uncompacted waste internally, the Cleaner Tailings Facility poses significant long-term risk.

Geochemistry

Although the Technical Report never unequivocally says that Acid Rock Drainage (ARD) will eventually occur in the co-deposited tailings/waste rock, it strongly suggests this will happen. For example:

“... earlier onset of ARD from the co-deposited waste rock.”

(Table 1.11: Summary of Test Work Results)

and;

“The greatest potential risk to groundwater quality is from ARD and ML at the waste facilities. Extensive ARD testing (see Section 18.3.3) demonstrates that the waste rock is PAG but that the rougher-scavenger tailings are non-PAG, will provide additional alkalinity, reduce the net sulphide mineral content, and their fine particle size will reduce the permeability of the mix. The co-mingled material will, therefore, not be PAG in the short to medium term.”

(20.8.2 Groundwater, emphasis added)

According to the description in section 18.3.3.2 Characterisation of Waste Rock and Low-Grade Ores, the waste rock being placed in the Co-Disposal Facility with rougher tailings is likely to be potentially acid generating. This is likely to lead to neutral drainage production of Se in the near term, as indicated by the kinetic testing.

“Samples were found to be predominantly potentially PAG, with Colnic rock having a higher percentage of PAG rock than the Rovina rock.”

(18.3.3.2 Characterisation of Waste Rock and Low-Grade Ores)

and;

“The oxidation and neutralisation rate data suggested that the generation of ARD is possible but that the delay to the onset of acidic conditions could be estimated to be measured in years or tens of years.” (18.3.3.2 Characterisation of Waste Rock and Low-Grade Ores)

and;

“Elements of possible environmental concern that were present in leachates included aluminium, manganese and selenium. The oxidation and neutralisation rate data suggested that the generation of ARD is possible but that the delay to the onset of acidic conditions could be estimated to be measured in years or tens of years due to the low rates of sulphide oxidation and the sufficiently high carbonate content of the rock.” (18.3.3.2 Characterisation of Waste Rock and Low-Grade Ores)

There are no apparent water quality predictions resulting from the geochemical work. From the references given, the only geochemical testing done as a part of the 2021 Technical Report was static testing for the tailings. Note that in all of these discussions in the Technical Report long-term ARD is never excluded, or even termed unlikely.

The geochemical testing mentioned in the Technical Report mentions that aluminum, manganese, and selenium were produced in the tests. These elements are indications that acid reactions are occurring, but the acidity is being neutralized for the present. The neutral drainage presence of selenium could be highly problematic over the long term.

The fact that the commingled waste will only be non-acid generating in the short to medium term is of concern, because this is essentially an admission that the commingled waste is likely to become acid-generating over the long-term. This means that provisions must be made to collect and treat any infiltration and seepage water in the long-term, which is in perpetuity. There are no financial or planning provisions to meet this need in the reclamation and closure discussions of the Technical Report.

Based on the limited geochemistry presented, neutral leaching of selenium from waste rock is likely, and acid drainage metals could be possible in the long-term, as noted.

There is also potential risk of acid mine drainage from sulfides in the Rovina pit walls, and from unsaturated backfill, and seasonal movement in the water table, in the Colnic pit. There are no predictions for the long-term water quality in the Rovina pit lake.

Water quality predictions are a standard part of environmental assessment for a project. This is a significant gap for any project assessment.

Groundwater

Groundwater from shallow wells is a typical source for drinking water in rural areas. Groundwater is also typically utilized for livestock and agricultural uses.

“Typical for the region, communities often have springs or fountains that once served the water needs of local residents, and still do in many parts of the RVP, including the Rovina Valley. Five of these fountains, along with three wells, were monitored periodically between 2006 and 2010. It is not known which aquifers these different wells, springs and fountains are producing from.”

(20.5.1.3 Groundwater)

and;

“(Test) results indicate that the water from the communal springs/fountains does not meet drinking water quality standards. The groundwater sampled from the monitoring wells has the typical characteristics for the area with no evidence of elevated concentrations of metals or other pollutants, and so is considered to be of good quality.” (20.5.1.3 Groundwater)

More data/information is needed to explain what drinking water constituents are not in compliance with water quality standards.

It has already been mentioned in this paper that, given the proposed waste facility design and pit closure plans, it is likely that shallow groundwater will be contaminated by mining in the long-term. As mitigation, in the Technical Report it is noted that Euro Sun plans to provide an alternative source of drinking water in the Rovina Valley;

“RVP plans to install a new potable water network in the Rovina Valley, removing dependence on groundwater.” (20.8.2 Groundwater)

However, it is not clear whether groundwater use in the Rovina Valley is limited to drinking water, or whether all users of groundwater in the Rovina Valley have accepted a new water network as an adequate replacement for existing and potential future uses of groundwater.

It is noted in Table 20.2: Environmental Studies Completed and Planned that, “Wastewater treatment and discharge scheme, to be determined.” This is further confirmation, in addition to the fact that no water

quality predictions for surface or groundwater are discussed in the Technical Report, that no water quality predictions have been developed.

With the Rovina pit located upgradient of the villages of Rovina and Merisor, it is likely that the pit walls of the Rovina pit, which will contain sulfides, could have a negative impact on groundwater quality in the long term. If that happens, there is probably nothing that could be done to restore the groundwater downgradient to the pits to its original quality.

Mine Closure Costs

A water treatment plant is planned during mine operation. Surface Water Management (SWM) or Waste Management Facility (WMF) operational costs end after year 9 (21.3.4 WMF and SWM OPEX).

Mine closure costs are estimated to be US\$20 million, with no details provided on how this estimate was made. The only information provided on post closure cost was contained in Section 21.2.4.3 Mine Closure CAPEX (capital costs).

21.2.4.3 Mine Closure CAPEX

The mine closure CAPEX includes contingency costs and is summarised in Table 21.9.

Table 21.9: Mine Closure CAPEX

Description	Total CAPEX
	US\$
Salvage of Mining Equipment	-20,000,000
Mine-Wide Rehabilitation and Closure	20,000,000
Total Mine Closure Costs	0

There is no similar section for Mine Closure OPEX (operating costs). However, it is noted in the Technical Report:

“In the long term, once geochemical and geotechnical stability has been achieved, the Rovina Valley, stream though altered, can return to flow without requiring active treatment.” (1.13.2 Risks, Impacts and Mitigation)

This suggests that it will be assumed that no post-closure expenditures will need to be provided for water collection and treatment. It was also noted that:

“The post-closure costs and passive care for the surface water management systems are included in the water management OPEX.” (21.2.4.3 Mine Closure CAPEX)

However, as noted above, the water management OPEX ends in year 9 of mining.

In Table 21.9: Mine Closure CAPEX, no details provided on reclamation and closure costs, just a lump sum estimate of the closure costs. Furthermore, it is presumed that these costs will be covered by the sale of salvaged mining equipment.

The details of closure cost need to be provided, and should include post-closure water treatment costs which appear to be necessary based on the information provided in this Technical Report. It is not appropriate, nor has it been demonstrated to be reliable, to assume that selling used mining equipment is a reliable way to cover reclamation costs.

Underground Mining

Underground mining has the advantage of producing significantly less waste rock than open pit mining. In an area like the Rovina Valley, where locations for mine waste disposal are at a minimum, this should be a significant consideration. In addition, the waste rock from the Rovina and Colnic pits has the potential to generate both acid-drainage and neutral-drainage contaminants, so minimizing the amount of this waste produced should be a concern for the project. The Ciresata deposit, although not evaluated for potential development in the Technical Report, is included in enough discussions in the Report to strongly suggest that mining this deposit is something that will be a development goal by Euro Sun. According to the Report, Ciresata would be mined using underground mining methods, so this is clearly a mining approach with which Euro Sun believes is viable.

Underground mining would also present the opportunity to backfill the highly acid-generating sulfide cleaner tailings into the underground mine. Backfilling would probably present the least potential for long-term contaminants that could leach from this material. Backfilling also requires that the backfilled waste be filtered in order to remove excess water. This is usually a costly addition to a mine proposal, but in this case this expense is already included in the mining costs for the tailings produced from the open pit mining plan, so it would not be an additional cost to an underground mining plan.

The Ciresata deposit, which would be mined by underground methods, has been described as having a resource of 154.4 million tons at a gold equivalent grade of 1.00 grams/ton (Table 1.4: 2019 Mineral Resource Estimate – Ciresata Deposit). The combined Rovina and Colnic deposits have a mineral resource of 237.7 million tons grading 0.65 grams/ton gold equivalent (Table 1.3: 2021 Mineral Resource Estimate – Rovina and Colnic Deposits). Assuming that 1.00 gram/ton gold equivalent is the economic cutoff grade for underground mining, we do not have enough information from the Technical Report to deduce the amount of “ore” that would be lost from the Rovina and Colnic deposits if they were to be mined by underground mining methods. This information could have been easily provided in the Technical Report.

The basic question of whether it would be worth foregoing full economic development of the Rovina and Colnic deposits by open pit mining in order to minimize the risk of long-term contamination from the sulfidic tailings and waste rock, was not addressed in the Technical Report, and cannot be surmised from the data in the Report. The amount of 1.00 gram/ton ore in the Rovina and Colnic deposits is certainly available from the deposit to Euro Sun, but is not available in the Technical Report.

This is an issue that should be thoroughly evaluated in any environmental analysis.

Thank you for the opportunity to comment on this Technical Report.

Sincerely;

A handwritten signature in black ink that reads "David M. Chambers". The signature is written in a cursive, slightly slanted style.

David M. Chambers, Ph.D., P.Geop.

References:

Euro Sun 2021. NI 43-101 Technical Report on the Rovina Valley Project in Romania, Prepared for Euro Sun Mining Inc. by New Senet (Pty) Ltd, Effective Date 14 April 2021

Expert Panel 2015. Report on Mount Polley Tailings Storage Facility Breach, Independent Expert Engineering Investigation and Review Panel, Province of British Columbia, January 30, 2015, <https://www.mountpolleyreviewpanel.ca/final-report>