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Review of the Technical Aspects of the Sepon Project Environmental and Social Impact Assessment Addendum Volume 2: Main Report Text

NSR Environmental Consultants Pty Ltd, in association with Earth Systems Lao.
October 2002

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CENTER for SCIENCE in PUBLIC PARTICIPATION
February 6, 2003

EXECUTIVE SUMMARY

Lang Zang Minerals Ltd., proposes to mine 13.5 million tons of ore grading 5.1% copper, and 36.9 million tons of waste over a 12 year period of time, with a high probability that the life of the project will be extended by the discovery of further economic mineralization.[1]

The projected operating cost to produce the cooper is $0.40 per pound, which they project will be "… inside the lowest quartile of cash costs for world copper producers."[2] 5.1% copper ore is relatively high grade ore, so the cost projections are probably not out of line.

Operating cost estimates generally do not include the monies needed to pay back the cost of capital to build the mine. Interest and principle costs on capital would add approximately $0.10 per pound to the operating cost – assuming a capital investment of US$167.3 million (see ESIA Addendum, p. 3-2), with an interest rate of approximately 6%, and production of 1.1 million metric tons of copper over the life of the project (ESIA Addendum, p. 7-1).[3]

Copper is presently selling for approximately $0.73 per pound (January 2003). This suggests there should be some room to fund environmental or social improvements if required.

Significant concerns, which are further explained in the body of this report, are:

(1) Pressure Oxidation of the copper concentrate might lead to mercury contamination via airborne emissions. This potential for this contamination needs to be discussed/analyzed.

(2) The appropriate standard to use for measuring the potential impacts of mercury release to surface and groundwater is the human health standard, not the chronic aquatic standard, which is being applied in the ESIA.

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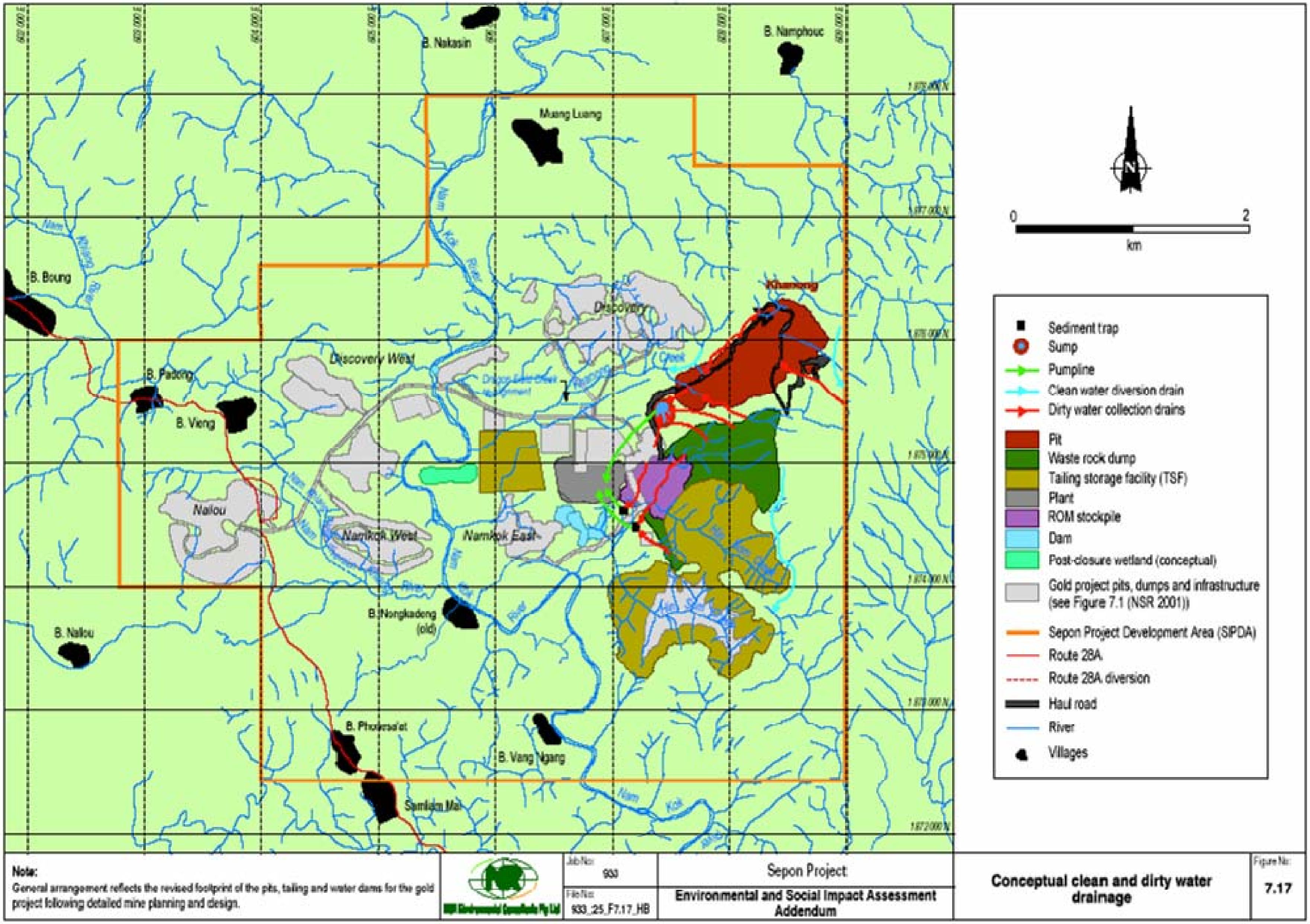
[1] Sepon Project Environmental and Social Impact Assessment, Addendum Volume 2: Main Report Text (ESIA Addendum), NSR Environmental Consultants Pty Ltd, in association with Earth Systems Lao, October 2002, pp. 3-1 through 3-4, and p. 7-4.

[2] ESIA Addendum, p. 3-1.

[3] Principle/Interest cost estimated by the author.



ESIA Addendum Figure 7.17 Showing Project Layout of both the Sepon Gold (in gray) and Copper (in color) Projects

(3) Acid generation from the waste rock probably poses the greatest long term risk to the environment because of the large volume of this waste, the physical characteristics of the waste which can allow rapid exposure to air and water, and the cover/encapsulation designs which are not as sophisticated (and expensive) as those employed for the tailings. Great care must be taken to establish good pre and post closure monitoring to detect the presence of acid generation, and an adequate financial surety should be retained to provide for collection and treatment of contamination should the effectiveness of the planned closure scheme fail to meet closure objectives.

(4) There are several details of the Saturated Soil Cover (oxygen barrier) for the potentially acid generating areas of the Khanong Pit that need to be further examined. These include: (a) calculation of the oxygen diffusion rate through the cover; (b) the probability of the clay layer drying out during a prolonged drought; and, (c) the potential for roots to penetrate the protective clay layer.

(5) There will also be a Saturated Soil Cover (oxygen barrier) for each of the 3 tailings facilities. As with the pit, there should be: (a) calculations for the oxygen diffusion rate through the cover; (b) the probability of the clay layer drying out during a prolonged drought; and, (c) the potential for roots to penetrate the protective clay layer.

(6) The covers proposed for the pit will need to be 95% effective for wetland proposed for final contaminant removal to function as modeled. It is probably overly optimistic for this to be the case. A financial surety for a conventional water treatment system should be held until it has been demonstrated that the wetland treatment proposed for water treatment will indeed work.

(7) It would be prudent, given the potential for contamination of a release from the tailings impoundments during operation, to design the storage capacity of the tailings impoundments to hold the operating volume of water plus the Probable Maximum Flood event, instead of the storm event with an average recurrence interval of 1 in 500 years as is now proposed.

(8) It is not clear from the discussion in the ESIA what sort of impact the 17% - 19% withdrawal of water from the river during copper startup operations will have if this occurs during low flow conditions. More discussion of the potential impacts from water withdrawal during copper startup operations during the dry season is warranted in the ESIA. The goal for protecting environmental values in the river should be to prevent any “significant” impacts, not just “severe” impacts.

(9) Although air quality is predicted to meet the applicable guidelines, assumptions that dirt roads will be kept wet are generally a critical part of this calculation. Keeping roads adequately watered is difficult, especially in non-mine areas where traffic is more difficult to regulate. Paving the road in the vicinity of any habitations should be a priority, either for the project or the government. In combination with watering, this should keep the dust level within standards.

(10) Although it may still be too early to determine exactly what measures will best effect noise reduction, a commitment can be made to (a) monitor the noise levels in these communities; and, (b) reduce the noise levels to the intrusiveness level, or lower, if required.

(11) It is not clear why only the POx tailing facility will have both a top and bottom liner, while the southern and northern tailings facilities utilized for the floatation tailings will have only a top liner. Seepage from the southern and northern floatation tailings storage facility could contaminate groundwater, especially since this tailings facility covers a much larger area than the POx TSF. A bottom liner for the southern and northern floatation tailings storage facility should be investigated.

(12) Since this is the first metal mine in Laos, the Monitoring Plan should include a discussion of the financial resources and skilled personnel that will be required by Laotian government agencies to adequately interpret environmental and social monitoring data from the mine.

DETAILED COMMENTS
on the
Technical Aspects
of the
Environmental and Social Impact Assessment Addendum
Volume 2: Main Report Text

GENERAL OBSERVATIONS on the ESIA

7.4.2 Ore Processing / Pressure Oxidation

a) Potential Problems with Mercury Bioaccumulation

Mercury is present in both the copper and gold ores. Mercury is known to bioaccumulate, and to impact humans. Since fish is an important source of food for people living in the vicinity of the mine, and the river is also utilized as a source of drinking water, great care should be exercised in keeping this contaminant out of the food chain.

In addition to the human health concern for the discharge of mercury into water, an autoclave operating at high temperature and pressure will be utilized to oxidize copper sulfides (as well as other metal sulfides) so that acid leaching will be able to dissolve the copper.[4] In addition to producing a large amount of sulfur dioxide, which may be used to produce sulfuric acid for the copper leaching, other metals – mercury in particular – may be volatilized and released into the atmosphere. This has been a problem at autoclaves used for gold ore processing in Nevada.

In the data presented in Table 7.5 - *Filtered metal concentrations in liquor of untreated and treated copper plant flotation tailing*, and from Table 7.6 – *Filtered metal concentrations in POx tailing liquor*, it is evident that mercury is present in the ore because it is being detected in significant amounts in the process solutions utilized in these processes. If mercury is released into the exhaust from the autoclave, it can contaminate organisms downwind from the autoclave. Mercury is a bioaccumulative contaminant, and can work its way up the food chain and affect humans.

There is no analysis of the potential release of mercury into the atmosphere during the operation of the pressure oxidation circuit, and there is no indication that mercury will be collected from the exhaust of the POx plant.

Recommendation: If there is any atmospheric release of gases from the autoclave, tests should be run to determine the amount of mercury vapor that will be released. If this release is significant, a circuit to remove the mercury should be installed.

b) Potential for other Airborne Contaminants

The ore also contains significant amounts of arsenic and lead,[5] each of which can be an airborne problem, although usually as particulates, not vapor as with mercury. Again, it is possible that arsenic and lead, both contaminants that can harm humans, might be released as particulates in the exhaust of the autoclave.

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[4] The Pressure Oxidation circuit is designed to oxidize rougher floatation concentrated sulfide minerals at temperatures of 220ºC, and pressures of 3000 kPa. (ESIA Addendum Section 7.4.2, p. 7-10)

[5] See ESIA Addendum, Table 6.1 *Elemental distribution in Khanong soil samples*, p. 6-6.

Recommendation: Tests should be run to insure that arsenic and led will not be released in significant amounts.

c) Appropriate Standard for Mercury Level

While there is significant discussion of the presence of mercury in the ore and waste material, the standard used for reference in these discussions is the standard for aquatic organisms. Although the standards for aquatic organisms are generally more restrictive than that for human health, largely because aquatic organisms see more exposure to these contaminants and have less body mass to dilute them when absorbed, this is not true for the standard for mercury. The US EPA human health standard for mercury is 15 times lower than the aquatic standard.[6]

Recommendation: Since human consumption of drinking water, and the potential for bioaccumulation in humans is of primary concern, the human health standard for mercury, rather than the less restrictive aquatic standard, should be utilized for the discussion of potential impacts and discharge limits for mercury.

7.4.3 Waste Rock Management

Acid generation from waste rock is typically a more common problem than acid generation from tailings, since tailings are better contained and more easily covered than waste rock (as is the case at Sepon), and also for acid generating pit walls, which are less permeable and contain less exposed rock than waste dumps. Waste dumps are highly permeable because they contain unsorted materials, and readily allow both water and oxygen to penetrate into the waste.

a) Infiltration Barrier for the Waste Rock

Unlike the closure plans for the tailings storage facilities and the Khanong Pit (see the discussion below on Sections 7.4.4 and 7.5 for the proposed Soil Cover for the pit and tailings storage facilities), the plan in the ESIA appears to be to place a layer of compacted clay, but not an oxygen barrier cover, on the potentially acid generating waste rock.

> "Based on current information including geochemical characteristics, resource modelling and the mine plan, LXML proposes to control acid generation by minimising water infiltration and selective placement and burial of waste rock."[7]

and;

> "As each lift is formed, the outside surface of the PAG waste will be covered in a layer of compacted inert clay (sourced directly from the pit or from the waste rock stockpile) and then further buried in non-acid–generating waste." [8]

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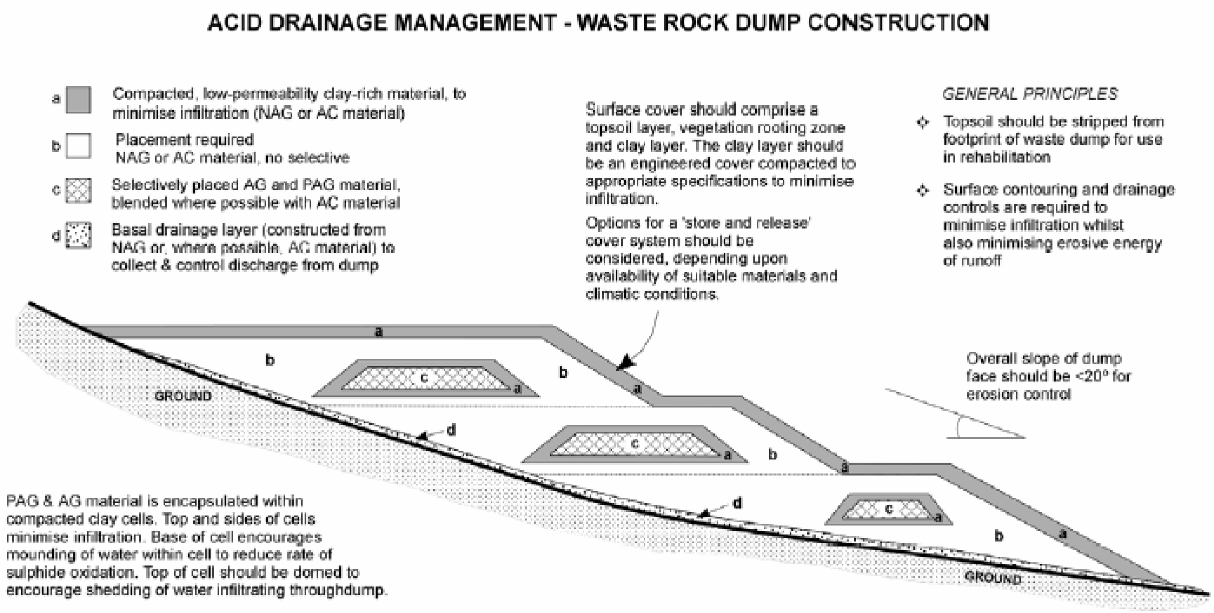
[6] The US EPA human health standard for mercury is 0.00005 mg/l, while the chronic aquatic standard is 0.00077 mg/l

[7] ESIA Addendum, Section 7.4.3, p. 7-21.

[8] ESIA Addendum, Section 7.4.3, p. 7-22.



Waste Rock Dump Construction (ESIA Addendum Appendix 19 Figure 6.2)

The engineering specifications for the waste dumps covers and drains are still tentative as presented in the ESIA Addendum and supporting Appendices. It would be best to specify a full engineering design so that materials can be put aside for construction, and so financial provisions can be made. This will not preclude changing the design in the future, should better waste storage technology become available, but does insure that the waste will be stored with a design that is acceptable based on the best understanding of waste storage technology available today.

Appendix 19 of the ESIA contains an excellent analysis of the potential of the waste rock to produce long term contamination, and proposes some excellent recommendations for the containment of this waste:

> "The options for consideration are:[9]
>
> **Option 1**: Permanent sub-aqueous storage of (all or selected) sulphidic materials (i.e. approach 1, in Section 6.1).
>
> **Option 2**: Minimisation of infiltration through the use of low-permeability clay barriers (i.e. approach 2, in Section 6.1) and selective placement.
>
> **Option 3**: Option 2 combined with the blending of sulphidic materials with acid consuming materials (i.e. approaches 2 and 3, in Section 6.1).
>
> **Option 4:** Combinations of all of the above options."

The Option selected in the ESIA appears to be Option 2, Minimisation of Infiltration. While this is potentially the least costly of the options, the consultant in its report in Appendix 19 has cautioned:

> "For Option 2, it is expected that there will be a high risk of acid drainage from waste rock dumps containing sulphidic materials."[10]

[9] ESIA Addendum, Appendix 19, Sepon Project Khanong Copper Deposit Geochemical Characterization Waste, Tailings and Pit Wallrock, Earth Systems, October 2002, Section 6.2 Waste Rock Management Options, p. 65.

Because the risk of acid drainage is great, additional care should be taken not only in designing measures for the waste rock that will inhibit the generation of acid, and the isolation and collection of any contamination that may result, but also appropriate financial measures should be taken to insure that if acid generation and metal contamination is worse than predicted, there are financial resources available to collect and treat that contamination.

Recommendation: In order to minimize the flow/transmission of water and oxygen, minimum specifications for thickness, compaction, and permeability of the compacted clay layer should be specified in writing before construction begins, along with applying appropriate quality control measures during construction of the waste rock dumps.

b) Collection and Possible Treatment of Seepage After Mine Closure

It is anticipated that there will be some acid drainage from the Khanong waste rock dump after closure of the mine.

> "Acid drainage from the Khanong waste rock dump will be addressed by minimising water infiltration and selective placement of waste rock …"[11]

On closure, plans for discharge from the Khanong waste dump are to route seepage and runoff from the northern side of the Khanong waste rock dump to Khanong pit (after closure, excess water will be discharged from the Khanong pit to the Nam Kok River, via the polishing wetland system on Khanong Creek), while that from the southern side of the Khanong waste rock dump will flow over the remediated run-of-mine ore pad and into natural drainage.[12]

These post-closure discharges from the waste rock dump, especially the discharge from the southern side into a 'natural drainage' could be problematic.

In the ESIA it is stated:

> "… assessment of the impacts of stages 1 and 2 on water quality downstream of the project, particularly in the Nam Kok River, indicates that water quality guidelines/criteria for trace metals will be met in *almost all circumstances*."[13] (*emphasis added*)

Water quality criteria are normally required to be met at all times. It is not clear what is meant by the statement that water quality guidelines will be met in almost all circumstances.

Will discharges from the Khanong Waste Rock Dump be allowed to exceed water quality guidelines/criteria for trace metals, as is implied in this section?

Recommendation: If acid and/or metals are generated in significant amounts, which seems likely from the discussion in the ESIA for contamination coming from the southern side of the waste dump, then this discharge should be collected and treated, and not discharged directly into the environment.

and:

Recommendation: Financial provision for installing an oxygen barrier cover like that on the tailings storage facilities and unflooded pit should be retained until it is clear that acid/metals generation from the waste rock will not be a significant problem.

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[10] ESIA Appendix 19, p. 68.

[11] ESIA Addendum, Section 8.2.2, p. 8-20.

[12] ESIA Addendum, Section 8.2.2, p. 8-21.

[13] ESIA Addendum, Section 8.2.2, p. 8-24.

7.4.4 Pit Acid Drainage / Saturated Soil Cover, *and*
7.5 Decommissioning and Rehabilitation

After the completion of mining it is proposed to use a combination of (1) a water cover in the bottom of the pit, and (2) an oxygen barrier cover on the parts of the Khanong Pit walls that are potentially acid generating.

The cover proposed for the tailings storage facilities is a Saturated Soil Cover designed to limit the diffusion of oxygen into the waste material. The waste material will be overlain by 1.0 meter of waste rock (capillary break), 1.0 meter of compacted clay, another 0.8 meter of waste rock (capillary layer), and 0.2 meter of topsoil.[14]

The compacted clay is the critical layer in the cover because it limits the amount of oxygen that reaches the acid generating material. Maintaining saturation of this layer is important in limiting the diffusion (i.e. flow) of oxygen through the barrier. Calculations on another Oxygen-Barrier Cover for potentially acid generating material suggest that 85% saturation of the oxygen-barrier layer must be maintained in order to reduce oxygen flux to a negligible value.[15]

It is also important to protect the physical integrity of the clay layer. Although the proposed design thicknesses are in the appropriate range for this type of cover, care must be taken to insure that the roots of vegetation will not penetrate the clay layer, destroying its integrity, and also drying it out. The characteristics of vegetation that could cause this type of problem, which include trees, shrubs, and even small plants with deep-penetrating roots, are highly site specific.

Recommendation: (1) The oxygen diffusion rate has not been calculated for the clay layer, and this can and should be done; (2) the availability of moisture to keep the clay layer saturated year-round at the desired moisture level should be discussed; and, (3) the potential for the roots of vegetation to penetrate the clay layer should be disclosed in the ESIA.

7.4.4 Pit Acid Drainage / Water Retention Dam

After closure of the mine, a polishing wetland system is planned downstream of the Khanong pit through which drainage from the pit will be diverted prior to reaching the Nam Kok River to treat the contamination that comes from the pit. If the polishing system (wetland) does not remove all of the contaminants, or works for only a portion of the year, conventional water treatment might be required to meet water quality standards.

It is difficult to predict the amount of contaminated seepage that will come from the reclaimed pit. One of the disadvantages of utilizing passive systems like wetlands for water treatment is that they typically will not effectively treat high volumes of contaminated water. If the seepage is greater than can be effectively treated by the wetland, the alternative might have to be an active water treatment system.

In addition, the consultant's report states:

> "Under optimum circumstances, wetlands will be capable of dealing with 1 kg of $CaCO_3$ acidity for every 200 m^2 of wetland. Based on a 60,000 m^2 wetland, it will be possible to deal with roughly 300 kg of $CaCO_3$ acidity per day, or about 110 tonnes per year. At this acidity loading, the clay cover remedial measures proposed by Knight Piesold for the

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[14] ESIA Addendum, Section 7.5, p. 7-55.

[15] Waste Rock Cover Design, Kennecott Greens Creek Mining Company, Unsaturated Soils Engineering Ltd., 334 Costigan Crescent, Saskatoon, Canada, S7J 3P3, December 23, 1998, p. 6.

> Khanong open pit will need to be >95% effective, even if local alkaline waters are directed through the pit."(emphasis added)[16]

In other words, "optimum circumstances' are required for the wetland treatment system to provide the desired level of water treatment.

The covers proposed for the pit will need to be 95% effective, and the contaminant load must be equal to or less than that estimated in the modelling. In other words, achieving final water treatment objectives depends on everything working optimally, which is not likely to happen.

Recommendation: A financial surety for a conventional water treatment system should be held until it has been demonstrated that the wetland treatment proposed for water treatment will indeed work.

7.4.5 Tailing Management / Seepage

The tailings in the Pressure Oxidation Tailings Storage Facility (POx TSF) will be acid generating, and will depend on a liner to prevent the discharge of significant amounts of contaminants. However, it is unlikely that seepage can be completely eliminated.

As with the seepage from the waste rock dumps, the Khanong pit, and the main Tailings Storage Facility, predicting the amount of seepage is very difficult, and there must be the contingency for collection and treatment of the seepage should it become significant in terms of environmental contamination of ground or surface waters.

Recommendation: As with seepage from the waste rock dumps, the Khanong pit, and the main Tailings Storage Facility, a financial surety for a conventional water treatment system should be held until it has been demonstrated that the less expensive methods proposed for water treatment will indeed work.

7.4.5 Tailing Management / Emergency Spillways

The embankments of the northern and POx TSFs are designed with spillways that would prevent overtopping of the dams, which could erode and destroy them, by allowing discharge of effluent from the impoundments in the event flooding overwhelms the capacity of the impoundments. This could happen in the case the 'design' storm event with an average recurrence interval of 1 in 500 years, or if several smaller events were to occur in close succession, overwhelming the capacity of the impoundments.

Designing tailings dams with spillways is a prudent design choice in light of the alternative – a potential catastrophic failure of a tailings dam.

However, the potential impacts of an unintended discharge from an impoundment should be discussed in the ESIA, especially since the effluent in the POx TSF is so toxic. Should a discharge from the spillway during a major storm have the potential to cause significant environmental harm the Nam Kok River, then the holding capacity of the impoundment(s) should be increased.

It is common, for example, to design an impoundment to hold a Probable Maximum Flood (PMF) event, plus accumulated precipitation and runoff at the time of year when accumulated stormwater is maximum (probably in July and August), plus the desired freeboard (usually one meter or more) for the dam.

Recommendation: The potential environmental impacts of a discharge related to large storm event should be discussed in the ESIA. If this discharge could have significant negative impacts, the storage capacity of each impoundment should be increased to hold the Probable Maximum Flood event.

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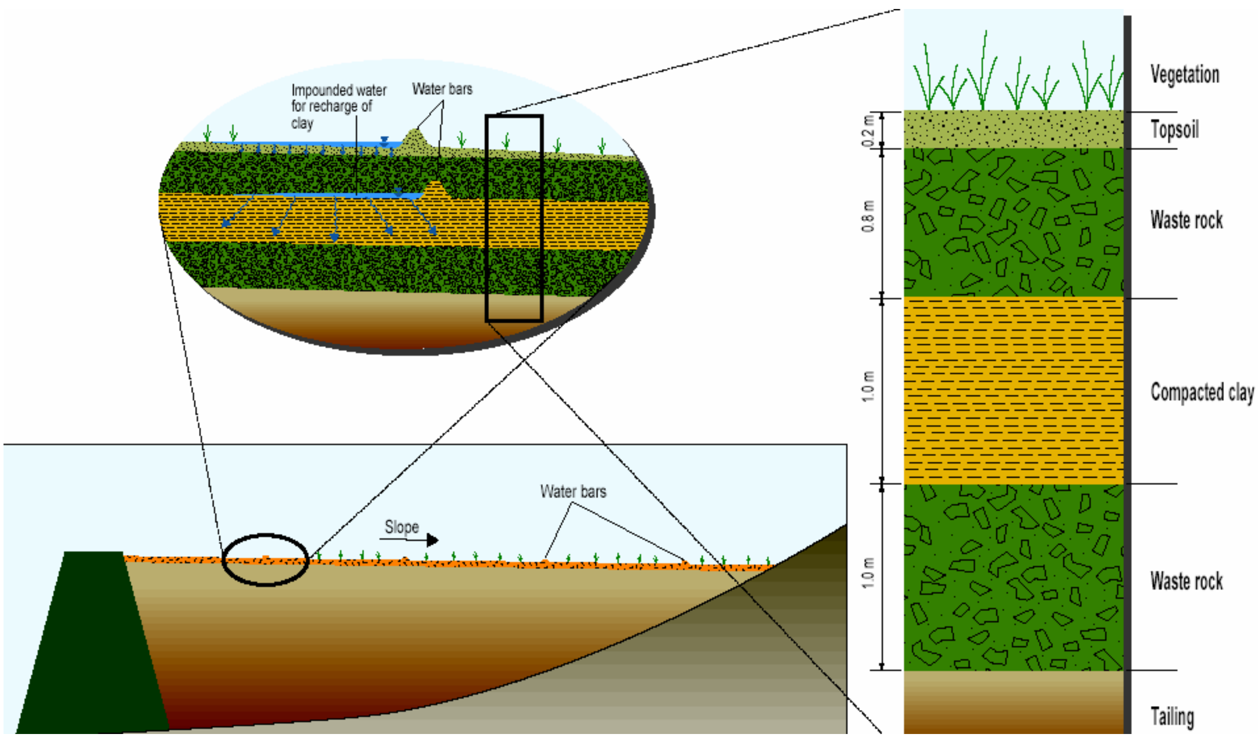
[16] Wetland For Improving Water Quality From The Khanong Open Pit, Earth Systems, Pty. Ltd., 12/9/02, Appendix 19, subpart Appendix 4, p. 7 – Description of Options for Wetland Remediation, ESIA Addendum.

7.5 Decommissioning and Rehabilitation / Tailings Storage Facilities

The oxygen barrier covers for the tailings impoundments will have 1 meter of soil/waste rock on top of the 1 meter thick clay layer that is function as the oxygen barrier.

It is important that the clay layer (1) maintain saturation with water; and, (2) not be penetrated by plant roots which would destroy the physical integrity of the barrier.



Proposed Cover for Tailing Impoundments(ESIA Addendum Figure 7.19)

Plants with roots greater that can penetrate greater than 1 meter in depth are not uncommon. However, care must be taken to identify which local plants/trees are potentially likely to penetrate the clay layer with their roots.

Recommendation: A survey by a botanist familiar with the local plant and tree assemblages should specify which plants and trees might constitute a risk to the integrity of the clay layer. A plan to keep these plants and trees from becoming established on the tailings impoundment covers must be incorporated into the long term management plan for all engineered covers, including the rehabilitated tailings impoundments and the mine pit. As with the pit cover, the oxygen diffusion rate for the tailings facilities covers should also be calculated.

Alternatively, the thickness of the waste rock layer between the soil layer and the clay layer can be increased to provide an additional buffer to protect the clay layer.

8.2.1 Hydrology and Physical Impacts / Water Extraction / Impact Assessment

In this section of the ESIA it is mentioned that the 'rule of thumb' for anticipating serious damage to an aquatic ecosystem is where extraction rates exceed more than one third of the median flow of the river.[17]

There is already the potential for "serious" impacts to the aquatic ecosystem during the "maximum" year, Year 2 - construction. It is not clear what sort of impact the 17% - 19% withdrawal of water from the river during low flow conditions will have.

The goal should be to avoid "significant" impacts, not just "serious" impacts. Copper startup operations withdrawing 17% -19% of the flow could likely impact aquatic life.

Setting a limit for maximum withdrawal might be appropriate.

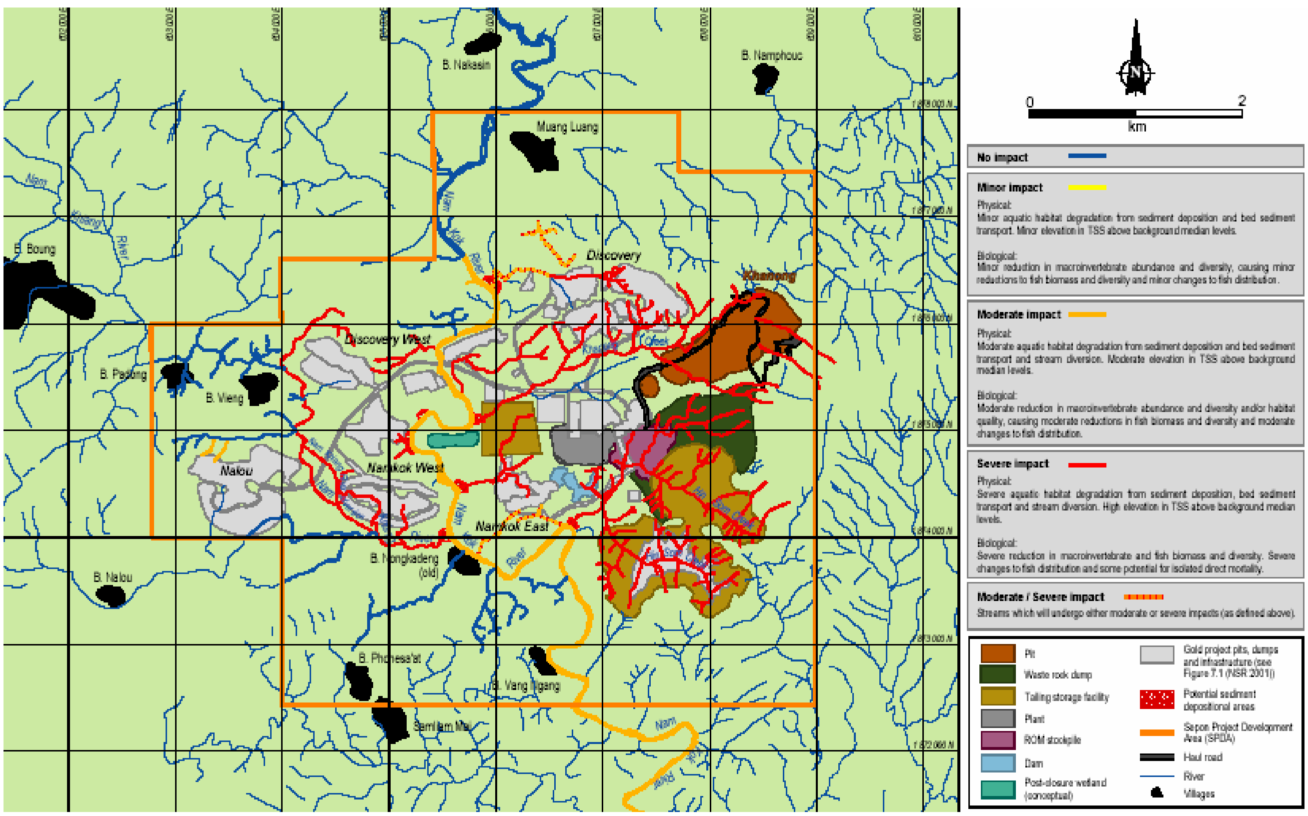


Figure 4.1 from Appendix 22, Freshwater Impacts – Stage 2, showing the portions of the streams that will be potentially "severely (in red)"and "moderately (in gold) impacted during construction.

Recommendation: More discussion of the potential impacts from water withdrawal during copper startup operations during the dry season is warranted in the ESIA. The goal for protecting environmental values in the river should be to prevent any "significant" impacts, not just "severe" impacts.

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[17] ESIA Addendum, Section 8.2.1, p. 8-16. (Cullen 2001)

8.2.2 Water Quality / Avoidance, Management and Mitigation / Trace Metals

> "After closure, seepage and runoff from the northern side of the Khanong waste rock dump will continue to be directed to Khanong pit, while that from the southern side of the Khanong waste rock dump will flow over the remediated ROM pad and into natural drainage."[18]

It is possible, even probable, that the seepage from the waste rock could degrade water quality if it is not treated before discharge into 'natural drainages,' as it will be during mine operation.

Recommendation: Financial provision, in the form of a reclamation surety, should be provided in order to collect and treat the seepage from the northern side of the waste rock dump should this seepage contain contaminants that adversely affect water quality.

8.4 Air Quality

Although air quality is predicted to meet the applicable guidelines, assumptions that dirt roads will be kept wet are generally a critical part of this calculation. Keeping roads adequately watered is difficult, especially in non-mine areas where traffic is more difficult to regulate.

Picture from ESIA Addendum (Figure 8.3) showing water truck pass for dust suppression.

[18] ESIA Addendum, Section 8.2.2, p. 8-21.

Since the revenues from this mine are projected to yield a healthy profit, and since an improved road would benefit both the mine and the longer term welfare of the surrounding communities, providing an improved road system in the vicinity of the mine would be beneficial.

Recommendation: Paving the road in the vicinity of any habitations should be a priority, either for the mining project or the government. In combination with watering, this should keep the dust level within standards.

8.5 Noise

It is noted in the ESIA that while the Lao noise standard will be met some sites, including the villages of Ban Vieng, Ban Padong and Ban Vang Ngang will exceed the "intrusiveness" standard set for the project.[19]

It is noted in Appendix 23 that the Lao standard of 70 dB (A) is a relatively high noise standard that, and while it may be acceptable for urban areas, it is probably too high for application as a standard for the rural villages in this area.[20]

While several means for lessening the predicted noise to a level less than the intrusiveness standard are identified in the ESIA, it is unclear which, or whether, these means will be implemented.

Recommendation: Although it may still be too early to determine exactly what measures will best effect noise reduction, a commitment can be made to (1) monitor the noise levels in these communities; and, (2) reduce the noise levels to the intrusiveness level, or lower, if required.

9.2.6 Tailing / Tailing Deposition

It was stated earlier in the ESIA:

> "Post-closure seepage from the northern and southern TSFs and POx TSF is potentially an issue in terms of water quality impacts on the Nam Kok River."[21]

In this section it is further cautioned that:

> "Both the flotation and POx tailing are expected to have significant acid generating capacity."[22]

It is not clear why only the POx tailing facility will have both a top and bottom liner, while the southern and northern tailings facilities utilized for the floatation tailings will have only a top liner.

Seepage from the southern and northern floatation tailings storage facility could contaminate groundwater, especially since this tailings facility covers a much larger area than the POx TSF.

Recommendation: A bottom liner for the southern and northern floatation tailings storage facility should be investigated.

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[19] ESIA Addendum, Section 8.5, p. 8-31.

[20] ESIA Addendum, Appendix 23, Noise Assessment Sepon Project (Phase 2), LPDR, Holmes Air Sciences, October 2002, Section 4.1, p. 6

[21] ESIA Addendum, Section 8.2.2, p. 8-27.

[22] ESIA Addendum, Section 9.2.6, p. 9-4.

10.2 Management and Monitoring

The 'conceptual plan' for project monitoring is outlined in this chapter. However, the Detailed Monitoring Plan developed in 2002 for the Sepon Gold Project is not presented as an appendix to the ESIA, so it is not possible to comment at this time whether the sample locations, monitoring frequencies, or how government oversight of monitoring will be performed are adequately specified in the plan.[23] It is also noted that the combined Monitoring Plan for both the gold and copper stages of the Sepon Project will not be complete until April 2004.[24]

Since this is the first metal mine in Laos, it is important to understand the role Laotian government agencies will play in monitoring and with environmental and social compliance at this site. Without this guidance, it will be difficult to identify what sort of financial resources and skilled personnel will be required by the agencies to meet their monitoring needs.

The role of government oversight could be critical in avoiding or mitigating environmental and social impacts in that if the project developer is just monitoring and reporting to itself, response time to problems and the resources devoted to assessing and addressing those problems could be less than optimal.

Recommendation: Since this is the first metal mine in Laos, the Monitoring Plan should include a discussion of the financial resources and skilled personnel that will be required by Laotian government agencies to adequately interpret environmental and social monitoring data from the mine.

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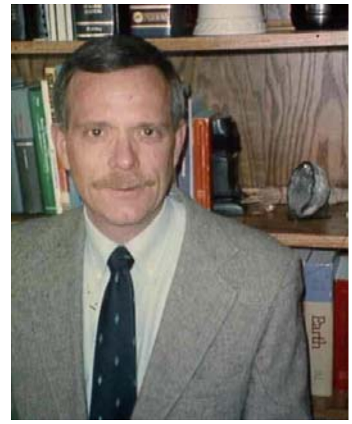
[23] LXML 2002g. Sepon Project, Savannakhet Province, Lao PDR, Detailed Monitoring Program, EMP 6.

[24] ESIA Addendum, Section 10.2, p. 10-20.

DAVID M. CHAMBERS – BIO



Dr. Chambers is the president and executive director of the CENTER for SCIENCE in PUBLIC PARTICIPATION, a non-profit corporation formed to provide technical assistance on mining and water quality to public interest groups and tribal governments.

David Chambers has 15 years of management and technical experience in the mineral exploration industry, and for the past 10 years has served as an advisor on the environmental effects of mining projects both nationally and internationally. He is a registered professional geophysicist (California # GP 972) with a Masters Degree in Geophysics from Berkeley, and Professional Engineering Degree in Physics from the Colorado School of Mines.

Dr. Chambers received his Ph.D. in Environmental Planning from the University of California at Berkeley. His doctoral dissertation analyzed the U.S. Forest Service's efforts to plan for and manage minerals on the National Forests.

He has provided assistance to citizen groups on proposed, operating, and abandoned mines in Alaska, Arizona, California, Colorado, Idaho, Missouri, Montana, Nevada, Oregon, South Carolina, South Dakota, Utah, Washington, and Wisconsin, British Columbia, Labrador, Kyrgyzstan, and Northern Ireland. This assistance has often been in the form of technical reviews to assist groups in submitting comments on the environmental deficiencies of proposed mines as a part of Permit or Environmental Impact Statement reviews, as well as suggesting mine-development alternatives that are more environmentally sound than the developer's proposals. Much of this assistance has focused on analyzing the potential adverse affects on surface and groundwater quality of acid mine drainage from tailings pond discharges and runoff from waste rock piles.

Dr. Chambers has also been involved with negotiating with mine owners, developers, and federal and state regulators, to gain major environmental improvements to proposed projects through agreements both on proposed mines and on the reclamation of abandoned mines. He has also played a key role in negotiating complex agreements on several mining issues, including alternative development plans for mine proposals, and technical studies related to placer mining in Alaska.

Dr. Chambers has worked with the State of Alaska Departments of Natural Resources and Environmental Conservation on mining, reclamation, cyanide and solid waste regulations. He is presently a member of the University of Alaska-Fairbanks School of Mineral Engineering Advisory Board. He was also a member of the Western Governors' Association Abandoned Mine Waste Working Group, and of the EPA's RCRA Policy Dialogue Committee, a group of industry, environmental and government representatives who worked to develop regulations for mining wastes under the authority of RCRA Subtitle D.