TECHNICAL REVIEW OF THE EL DORADO MINE PROJECT ENVIRONMENTAL IMPACT ASSESSMENT (EIA), EL SALVADOR

October 2005

By :
Robert E. Moran, Ph.D.
Michael Moran Assoc., L.L.C.
Water Quality / Hydrogeology / Geochemistry
Golden, Colorado, U.S.A
Internet: remoran@aol.com

With Prologue by :
The Asociación de Desarrollo Económico y Social, Santa Marta (ADES)
Sensuntepeque, Cabañas
El Salvador
Internet : adessm.org@navegante.com.sv

Table of Contents

Cover Photo: **Heather Fraser**, showing the Río San Francisco downstream from the proposed site of the El Dorado Gold Project.

Prologue:

The following document completed by Dr. Robert Moran highlights the **near complete lack of baseline water quality and quantity data** in the El Dorado Gold and Silver Mining project EIA, the **lack of transparency in the public consultation process** that is required under Salvadorian Law, the **failure to consider the costs** to the community of "free water use" by the mining company, and concludes that the EIA **would not be acceptable** in countries such as Canada or the United States.

The results of this review were:

- Presented in a public forum October 8th, 2005 in Cabañas, El Salvador;
- Presented to the Ministry of the Environment and Natural Resources (MARN) El Salvador October 19th accompanied by a declaration signed by over 350 members of the community proclaiming that they feel that their lives will be threatened by the mining project; and
- Widely distributed to institutions at the local, national and international levels.

El Salvador is not known as a mining country. However, there are currently over 35 metal mining projects in either the exploration or pre-exploration stages of development. The El Dorado Project is currently seeking its exploitation permit from the Salvadorian Government, the reviewed EIA being a part of the process to solicit the permit. Many are interested as to how the government responds to the disapproval of the Project by members of the community, as the actions taken could be considered precedent setting.

Photo 1: Location of the El Dorado mining project and the approximate boundaries of the Río Lempa Watershed. (source of Map without watershed boundary markings: Pacific Rim Mining Corp. website http://www.pacrim-mining.com/s/Eldorado.asp)

The majority of the metal mining projects planned in El Salvador, the El Dorado Project included, are located within the watershed of the country's most important river, the Rio Lempa (see photo 1). **If high environmental standards are not demanded** by the government of the mining development companies such as Pacific Rim, it could **spell disaster for the hundreds of thousands of Salvadorians that rely on the river for their livelihoods and basic needs**.

Additionally, all of the mining projects are planned for the northern regions of the country which are also the **poorest regions of the country** where the number of households living in poverty is estimated to range from 35 – 55%. In such job-starved regions, it becomes relatively easy for mining companies to sell their projects as "job-opportunities" without mentioning the high risks of long-term environmental and health problems resulting from the projects.

Feedback from the Forum of October 8th, 2005 was that, for many, it was the first time they had heard that there could be environmental and health risks associated with a mining project (Photo 2). This brings into question the validity of the "consent" that the mining company says they have from the majority of the community on their website and in their EIA. If it isn't **informed** consent, then what is it?

Photo 2: Forum in Sensuntepeque, Cabañas El Salvador, October 8th 2005. The results of the Review of the EIA were presented here in front of over 500 people from the communities close to the proponed mine site. Photo: H. Fraser

Asociación de Desarrollo Económico Social, Santa Marta (ADES)
October 2005

Executive Summary.

The El Dorado Project EIA lacks basic testing and data necessary to adequately define baseline water quantity and quality conditions. It is especially weak in areas relating to the definition of ground water resources, yet it states that no significant impacts to water resources are expected.

The public EIA review process is clearly lacking in openness and transparency. Only one printed copy of the EIA is available for public review (at the offices of the Ministry of Environment and Natural Resources, MARN) within all of El Salvador. The public must review and submit written comments on this 1400 page document within a period of 10 working days. No photocopies or photos of any part of the document may be made at MARN. As such, the present process is driven largely by the mining industry and the regulatory agencies, without the substantive input from civil society.

Basic data within this EIA are poorly organized and summarized making the public review process even more difficult. Ideally, a well organized and complete EIA would facilitate public involvement.

At present, the EIA process ensures that all of the sampling and test information is provided by the mining companies or their paid representatives. In order to promote public confidence in the process, independent sources of information need to be developed and encouraged.

Many of the environmental impacts routinely encountered at similar gold mining sites are being neglected, which generates uncertainty for the public and the regulators. This uncertainty is dealt with in the U.S.A. and Canada through the use of financial assurance requirements. Financial assurance issues are not discussed in this EIA.

The realistic costs for water as a commodity are neglected, which biases cost-benefit analyses. As a result, the public often argues that the poor are being required to subsidize the rich.

This EIA would not be acceptable to regulatory agencies in most developed countries.

TECHNICAL REVIEW OF THE EL DORADO MINE PROJECT ENVIRONMENTAL IMPACT ASSESSMENT (EIA), EL SALVADOR

1. Introduction.

Purpose and Scope. The following report is intended to provide a brief, technical review of the Estudio de Impacto Ambiental for the "Proyecto Mina El Dorado", (Vector 2005). This report does not discuss all aspects of the EIA, but focuses on water and water quality-related issues, those issues which normally cause the most serious and expensive, unforeseen, economic impacts and public liabilities at mining sites. It is intended to express viewpoints that are independent of those presented by the mining company.

The opinions presented here are neither pro- nor anti-mining. I have often worked for clients with both orientations. **This report is not intended to tell the citizens and regulators what to do.** Rather, it is intended to provide technical assistance to the general public and the Salvadoran government so that better informed decisions can be made and to constructively influence the public review *process*. **The ultimate choices, however, must be made by the citizens and their elected representatives. They are the ones who will be personally impacted.**

My participation in these activities was requested by the Salvadoran non-governmental organization (NGO) Asociación de Desarrollo Económico Social, Santa Marta (ADES), supported by funds from DIAKONIA, Swedish Ecumenical Action, Oxfam America and the Anglican Church**.** ADES provided technical and logistical support for my efforts, but the opinions expressed here are my own, and they may differ from those held by ADES, or other portions of Salvadoran civil society.

These opinions were developed after reviewing two versions of the EIA, Estudio de Impacto Ambiental "Proyecto Mina El Dorado", (Vector 2004 and 2005). The August 2004 DRAFT document was provided in electronic format several months ago by Pacific Rim to ADES--and then to me. Unfortunately, this electronic version lacked much of the actual monitoring data and many of the details on several figures were unreadable**.** I reviewed much of the FINAL EIA at the Documentation Centre of the Ministry of Environment and Natural Resources (MARN) in San Salvador. In addition, my opinions were informed by travel to El Salvador (October 3 through 11, 2005), which included visits to the mine site and the general region, participation at the mining forum in Sensuntepeque (October 8, 2005) and meetings with representatives of the company, the Ministry of Environment and Natural Resources (MARN), and local and national NGOs. The President of Pacific Rim El Salvador led myself and members of ADES on a tour of much of the proposed mining site, and later provided permission to allow me to meet with their U.S. consultants, Vector Colorado, the preparers of the EIA. At Vector's offices I

again reviewed portions of the FINAL EIA and related documents (see References Cited) and asked water-related questions of their staff and Patricia Acker, another consultant responsible for selected aspects of the EIA.

Pacific Rim has been quite open in allowing me to review the available reports and data and in answering technical questions. However, it has been much more difficult for the general public to access much of this information. For example, only one printed copy of the final EIA is available for public review within all of El Salvador. Furthermore, the entire Salvadoran public is allowed to review and comment on this single document only during a period of 10 working days at the MARN offices in San Salvador (from October 6, 2005 until October 19, 2005). The public is not allowed to photocopy, or photograph any portions of the EIA at the MARN office. In addition, most of the technical documents used to support statements made in the EIA are not available for review by the general public.

In the U.S. and Canada, it is routine for the public to be allowed between 30 and 60 days to review comparable environmental documents, and the regulatory agencies will often allow extensions to these limitations if citizens make a formal request. The public is invariably allowed to photocopy unlimited portions of the documents at their own expense, but numerous printed copies of the reports are always available at various locations and electronic versions are usually available---all at public expense.

2. Background.

Pacific Rim El Salvador (PRES) is a wholly-owned subsidiary of Pacific Rim Mining Corp., a revenue generating gold *exploration* company (September 26, 2005) headquartered in Vancouver, Canada. PRES is presently proposing to operate an underground gold mine, the El Dorado Project, near Sensuntepeque, El Salvador. Pacific Rim Mining Corp. has partial ownership in other mining operations, but does not actually *operate* any other gold mines.

The El Dorado Project is located approximately 65 km to the east of San Salvador at an elevation of approximately 420 m. It is *presently* designed to have a total life of about 10 years, with an operating life of approximately 6.2 years, based on the presently-defined ore. The operation will include a processing plant using cyanide vat- leach techniques, combined with cyanide decomposition facilities. The EIA indicates that the plant operations will require 10.4 liters / sec of water, which is equal to approximately 327,970,000 liters per year.

Based on the Pacific Rim website, http://www.pacrimmining.com/s/Eldorado.asp, the project will have an operating cost averaging $163 per gold equivalent ounce. PRES states that the presently defined gold and silver reserves are 490,758 ounces and 3,138,016 ounces, respectively.

3. Environmental Impact Assessment

3.1 General Comments.

The 3 volumes (approximately 1400 pages) of the Final EIA basically say, don't worry, there will be no significant environmental or socioeconomic problems resulting from this project! Of course, that is predominantly what is stated in most comparable gold mining EIAs around the world, especially in less developed countries. Such documents are prepared by consultants, paid by the company, and are intended to facilitate the award of mining permits. If such documents did not make largely-optimistic statements, the consultants would no longer be employed by their industrial clients.

The less-happy-reality is that a large percentage of similar, modern gold mining operations throughout the world **do generate negative environmental impacts** to some degree, especially to water resources. Most degrade water quality to some degree, and / or contribute to an increase in the competition for water. These impacts often do not become visible until after a mine closes.

It is important to note firstly, that mining companies are not predominantly *development companies*. Their main expertise is in extracting gold and silver from rock; not primarily at preventing environmental degradation, and certainly not at developing communities. Secondly, one needs to recall that simply because a company *states or predicts* that no negative impacts will occur (for example, that water supplies will not be impacted), even when stated repeatedly for 1400 pages, this does not mean that significant impacts will not, in fact, develop.

The El Dorado EIA, unfortunately, presents baseline data that are incomplete and which do not allow a reader to adequately evaluate the pre-mining water quantity conditions. To a lesser extent the baseline water quality data are also inadequate, especially with respect to ground water quality. In addition these data are not organized and summarized in a fashion that makes it easy for the regulators or the general public to evaluate either the pre-mining conditions or the future impacts.

In order to explain the lack of adequate testing and data in the Final EIA, PRES stated that the document is only a "working document" and that it need not be "complete" regarding detailed water and geochemical data. At the same time, Pacific Rim and their consultants are still comfortable making definite predictions in this same EIA stating repeatedly that no significant impacts will occur.

Why is an EIA prepared for large, publicly-sensitive projects? So that the public and regulators can be informed about the potentially-significant impacts---environmental, social, economic, etc. In addition, an EIA theoretically serves as the beginning of a *process of dialogue* between the company, regulators and civil society concerning the degree to which impacts are acceptable or unacceptable, and it discusses the approaches that will be employed to minimize or prevent impacts.

While EIAs often focus on technical and legal details, it is frequently these **public processes of dialogue that matter most to civil society**. The citizens want to be adequately consulted in this process. **Unfortunately, civil society in much of the world often does not trust the conclusions presented in EIAs**, especially those involving the extractive industries, such as mining. One of the pivotal reasons for this mistrust is that the mining companies are allowed to choose, direct and pay the consultants who prepare the EIAs. Essentially all of the technical data, opinions, and predictions in such documents come from the company-paid consultants. As a result, most metal mining EIAs are notorious for presenting overly optimistic discussions of future impacts. Mining is not alone when it comes to public mistrust of published information. Citizens in developed countries have recently voiced similar mistrust with the "independence" of reporting in the financial markets, public accounting, and food and drugs industries.

The contents of the El Dorado EIA and the related public review process indicate clearly that neither the general public nor the Salvadoran regulators have been adequately informed regarding the possible environmental or socioeconomic impacts to the local populations.

A few specific examples will explain the reader's dilemma.

3.2 Specific Technical Comments.

3.2.1 Surface Water Quantity

- **What quantities of surface water exist at the El Dorado site prior to commencement of mining?**

Normally the Hydrology section of the main volume of an EIA would summarize (usually in tables) the existing quantitative surface water data so that a reader could determine the volumes of stream flow in the project area. These tables would summarize actual measured flows or estimates of flow. Measured data are generally much more reliable than simulated data. Such tabular summaries would also indicate whether the historical stream flow data were adequate in terms of areas measured, seasonal variability, etc. Such summaries would normally begin with a location map showing the surface water monitoring locations---sites where both stream flow measurements (sometimes estimates) and water quality sampling had been performed. If data were shown on the map, the map itself would contain an explanation, clearly indicating when (dates) the data were collected.

The Hydrology section of the EIA is found in volume 1, chapter 5. This chapter contains numerous colored photos and figures, but lacks the actual stream flow *measurements* necessary to reliably determine how much surface water is available within the project area in pre-mining conditions. Also, the EIA contains no organized tabular summaries of stream flows by station and date which would

facilitate access to the data. Both the EIA and the Vector Technical Memoranda (2004) state that *estimates* – not the *measurements*-- of stream and spring flow were made in 2004. They also indicate that earlier hydrologic studies were conducted in 1995 by Hydro-Triad (1995), but these earlier studies are also not presented or summarized in the EIA or its Annexes.

The surface water location map, Figure 5.2-10, shows locations where field water quality measurements and *estimates* of stream flow have been made, but it is unclear from the EIA alone whether these are recent data. The Vector Technical Memoranda suggest that these are 2004 data. The field measurements of pH, temperature and specific conductance are water quality measurements and are not useful for directly determining water quantity.

Figure 5.2-11a presents hydrographs for five local stream locations, but all are simply theoretical flow graphs (computer simulations) based on hydrologic assumptions and the 1995 data, not recent (2004), measured stream flow data. **Most importantly, the 1995 data were collected too far in the past to be representative of current conditions.**

It is clear that the main local rivers have numerous man-made diversions, which complicates measuring local surface water flows. Nevertheless, such flows must be quantified for both wet and dry seasons in order to provide a reliable baseline for water quantity. Otherwise, there will be no reliable method for the public to verify that future impacts have or have not occurred.

Annex 5.2 shows flow data from three surface water stations, collected in the final months of 2004 and the first three months of 2005. These are apparently weirs that have been recently installed. However, these figures contain no site location numbers and are not tied to any location map. These data are mentioned briefly in the text of the EIA and also are not tied to any location map. Further, when discussing possible changes in the quantity of flow of Rio San Francisco as a result of the mining project, the reader is referred to the qualitative Matrix 6.5-3 in section 6 of the EIA**.**

After review of the figures and text, one concludes that **no actual stream flow or spring yield measurements were made during the recent field activities conducted to support preparation of the El Dorado EIA**. **Thus, one would be unable to reliably determine the quantity of surface water at this site.**

3.2.2 Ground Water Quantity

- **What quantities of ground water can be extracted from the water-bearing rocks and sediments at the El Dorado project site, prior to mining?**

Normally an EIA would have a section on hydrogeology that would include maps showing the locations of existing wells as well as wells or exploration bore holes drilled as part of the project where water level and yield information had been collected. An acceptable EIA would also summarize the well (and spring) information (for the ground water sites on the map), in simple tables. These tables would include information such as aquifer names, total well depth, well completion and development details, well yield information, etc. Such EIAs also include tables summarizing an Inventory of existing wells (domestic, agricultural, municipal, etc.) in the project region, describing approximate yields, depths, water uses, etc.

In addition, it would include one or more maps showing the depths to ground water (potentiometric surface), throughout the project area. Furthermore, it would include summaries of the hydrogeologic testing (i.e., slug, bail, pump tests) that had been done on the wells to evaluate the quantities of water that could be pumped from them.

An acceptable EIA might then present computer simulations that would show *estimates* of the volumes of available ground water (ranges of estimates)---using both the *recent* surface water and ground water data described above.

In the El Dorado EIA, the section entitled Hydrogeology (section 5.2.4.3) **contains inadequate actual hydrogeologic data**. It presents measurements of the water-yielding properties of the local rock based on **packer tests,** which only provide rough estimates of these properties within a small radius around the test borehole. **No actual aquifer / pumping tests were performed to evaluate the detailed hydrogeologic characteristics and long-term impacts**. Similarly, the EIA presents a **theoretical** characterization of the interactions between local surface waters and ground waters without presenting any measured interaction data from the site. The EIA presents no test data to support the statement that local spring flows are “resistant to mining-related impacts.”

The EIA has not adequately defined the depths to ground water within the project area. Figure 5.2-15 presents interpretations of ground water levels (potentiometric surface) within a very limited portion of the site, but this is based on totally inadequate data. Seasonal variability of ground water levels is not defined by measured data.

The EIA presents no discussion or data on possible impacts to either surface water or ground water that might result from long-term pumping from the underground workings. Such pre-mining evaluations are routinely developed within EIAs by interpreting long-term, multiple-well, pumping / aquifer tests from wells completed within the zones to be mined. The Hydrogeologic Impacts Technical Memorandum (Vector, 2004) does present a conceptual (computer) model that makes very rough predictions of volumes of groundwater to be pumped from the mine. However, the simulation is not based on any long-term aquifer testing, as stated above. **As a result, there is little reason to believe these estimates are quantitatively reliable for predicting the extent of impacts to local water resources.**

Most importantly, the EIA fails to answer in any credible, quantitative manner, the basic question: How much ground water is available at the site and what will be the long-term impacts to ground water resources?

3.2.3 Baseline Water Quality

- **What is the *baseline* (existing, pre-mining) water quality of the surface and ground waters within the project area and areas likely to be impacted?**

Baseline Surface Water Quality.
Several programs of baseline surface water quality monitoring have been conducted over the last **ten years**, beginning in 1995 and continuing to the present. A summary of surface water quality data is presented in Annex 5.1, but not in the main body of the EIA itself (volumes 1 and 2). Based on conversations with the consultants to Pacific Rim (October 13, 2005), the data in Annex 5.1 having sampling location designations such as (for example) WQ-1 and WQ-2 are the same locations (or approximately the same) as stations designated as Pto 1 and Pto 2 on Figure 5.2-17 and in Table 5.2-9. Unfortunately, the relationships are not obvious to the EIA reader.

Annex 5.1 presents a significant compilation of surface water quality data, which should be useful for determining the *general baseline conditions.* However, baseline data for many important chemical constituents are lacking or are inadequate at numerous locations in Annex 5.1, as will be discussed below**.** Also, **much of the water quality data in Annex 5.1 does not represent recent conditions.** Pre-mining activities involve road construction, well drilling, excavation of pits, etc., and these activities often alter the baseline water quality for both sediments and chemical constituents. In addition, over the ten years from 1995 to the present, different parties have collected samples, different sampling and handling methods may have been used, different laboratories and analytical procedures were likely employed. For all of the above reasons, **most baseline water quality data sets are compiled over a period of one to two years prior to the initiation of the operational phase.** For example, while Table 5, Annex 5.1 shows that Station WQ-1 (or some approximate equivalent) had 20 aluminum determinations, Table 2 shows that only 5 of these were collected after February of 1999 (September 2003 through March 2004). The Final EIA was released in September 2005, but fails to contain water quality data at most sites representing the most recent year and a half. **The recent 2004-2005 monitoring data should have been incorporated into the final EIA baseline data, and been available for public review.**

The data in Annex 5.1 would have been much more useful and reliable if the following had been explained or clarified:

--Include in the EIA a simple description of the sample collection and handling methods employed, including which parties performed the activities. The present document simply states that samples were collected according to standard methods. Incorrect sampling and sample handling procedures are generally the main causes of unreliable water quality data.

--In Annex 5.1, designate chemical constituents as Total or Dissolved, so that the reader can determine whether they result from analysis of unfiltered or filtered samples.
--Summarize the baseline data so that one can determine the actual pre-mining, baseline concentration, by monitoring location, for any chemical constituent that has a relevant standard or criterion. A format that has been used in other studies includes:

Station Designation / number
Constituent (i.e. Dissolved Aluminum)
n (number of determinations)
Range (minimum—maximum)
Mean (average, calculated by including all determinations, including < values)
Median
Confidence Intervals

Annex 5.1, Table 5 presents a statistical summary for selected chemical constituents, which includes most of the categories above, but is often presented in an unclear manner. For example, the reader cannot determine whether the ND values, (< detection values) were used in calculating the mean, or what the numerical ND limit was (i.e. < 0.005 mg/L). In addition, Annex 5.1, Table 5 shows a column entitled Tolerancia Superior, but fails to explain its meaning. The Pacific Rim consultants explained that this was equivalent to an upper confidence limit, but the reader would not know this.

It is important to the public that specific baseline water quality be designated, by sampling location. Otherwise it will be largely impossible to “prove” that future contamination has occurred (or not) at a specific location. This requires that statistically-reliable baseline data on the mean or median concentrations of all constituents having relevant regulatory standards or criteria be determined and summarized. This should have been completed for the present EIA. Annex 5.1, tables 5 and 6, present no designated baseline concentrations (means) for numerous constituents, for example arsenic, antimony, cadmium, chrome, cobalt, mercury, selenium, cyanide, nitrate, sulfate, etc.

Note: It is not statistically-meaningful to make conclusions about data where there are less than about five or six data points in the “population”. That is, if one wishes to describe, for example, the mean or median baseline mercury concentration in a certain spring or well, the data set needs to include *at least* 5 or 6 reliable determinations of mercury. Statistics derived from smaller populations can be highly unreliable.

The data in Annex 5.1 are inadequate or lacking at numerous locations for Total and WAD cyanide, uranium, molybdenum, and chloride. Determinations should also be made to evaluate organic carbon, cyanate and thiocyanate.

Presentation of ion balance calculations in the raw data would allow one to better evaluate the overall quality of the analytical results.

Baseline Ground Water Quality.

The EIA presents no recent, laboratory analytical data describing baseline ground water quality. Table 5.2-14 shows only field measurements collected in 1996 from three exploration holes; no laboratory data are presented. Annex 5.1 Table 2 shows a small number of analyses for metals from boreholes, which do not even have formal monitoring location designations. These samples were collected in 1996 and 2000 and are clearly not part of any routine ground water monitoring program. **As a result, it is reasonable to state that the EIA contains little usable data with which to define the local ground water quality.**

Clearly, the EIA provides inadequate, quantitative information to allow the public to determine baseline water quality concentrations at the El Dorado site. It also raises concerns about possible contamination to the Rio San Francisco from the discharge of mine water.

Ground water quality samples are often collected monthly or at least quarterly prior to compilation of a mining EIA for projects completed in developed countries.

Acceptable EIAs routinely include baseline data and statistical summaries for: water quality and quantity, aquatic biology, soils chemistry, etc. Baseline water (surface and ground water) and soil and sediment monitoring sites need to be located in areas near and down-gradient from the proposed mining and processing facilities, including proposed smelters, waste rock and tailings locations. Most importantly, these monitoring locations should be located so that they can be continuously monitored throughout the life of the mine and post-closure.

At present, all of the water quality data described above is generated by Pacific Rim or their representatives. In order to gain public confidence in this data collection process, procedures need to be implemented to allow trained representatives of the general public to participate in monitoring activities and to collect and analyze split samples.

3.2.4 Geochemical Data—Rocks and Wastes.

Section 5.2.6.8 states that the available geochemical testing indicates that the mine wastes have a low possibility to generate acid rock drainage (ARD), and that the waste rock has little potential to release high concentrations of toxic metals.

The supporting geochemical data (Annex 4.4) for these conclusions are either lacking, inadequate, unreadable or largely disorganized. It is correct that the available Acid-Base Accounting (ABA) data do indicate that most samples had a significantly greater tendency to release neutralizing chemical components than to release acid. However, the ABA data present no data on the volumes of the various rock categories and are not organized in a way to allow one to determine which samples are from which individual rock types, or which samples represent waste rock or ore. In addition, there is no way for the reader to determine the adequacy of the geochemical sampling as no related sample maps or cross-sections are provided.

Such ABA tests fail to evaluate chemical changes that develop over the long-term. The Leach Extraction tests discussed in sections 2.2.4 and 2.3.4 of the Vector Technical Memorandum by Gene Muller, August 2004, (Annex 4.4) also are largely useless for reliably predicting long-term water quality. More disturbingly, the data in Table 3 have detection limits that are too high for routine environmental purposes and lack data on mercury.

Most similar EIAs subject numerous rock samples to kinetic tests to provide estimates of the water quality that may be produced, long-term, by the chemical interaction of the rocks and water. Such tests may be conducted for 1 to 2 years in order to produce reliable results. **This EIA includes no Kinetic testing data.**

These geochemical data indicate that the public should be concerned with general long-term water quality degradation that will likely result from the release of contaminants, **even without the formation of acid conditions**. Such contamination is likely to result from the mobilization of numerous anions like nitrate, sulfate, ammonia, together with increased sediment loads, mobilization of fuels, greases, and numerous metals and metalloids that are mobile at both acid and alkaline pHs, such as arsenic, aluminum, antimony, iron, manganese, mercury, lead, nickel, chrome, selenium, molybdenum, uranium, etc.

3.2.5 Water Costs.

This EIA contains no discussion of the costs the company will pay for water as a commodity. In most of Latin America, the Civil Legal Code is applicable. Thus, mining companies can usually operate without paying an actual market price for the water they use, while local campesinos usually are required to pay market prices for irrigation water (Moran, 2002b).

Frequently, industries in Latin America will be required to pay a *nominal* and artificially-low price for the use of surface waters---prices much lower than are paid by agricultural users. However, often the mining companies will simply avoid even these modest water costs by constructing wells near rivers or lakes, which then extract the surface waters **indirectly,** because the nearby ground waters are usually interconnected with the surface waters.

The El Dorado EIA provides no specific hydrogeologic details to evaluate either the interactions of the surface and ground waters or to evaluate the actual costs the company will pay for water. As a result, any attempts to describe **cost-benefit analyses** would seem to be unrealistically biased.

3.2.6 Cyanide Detoxification.

The EIA states that the waste solutions from the process plant, the tailings solutions, will be treated using the INCO cyanide decontamination process. This process is frequently employed to treat ores containing iron sulfides, or where iron cyanide complexes are present in the effluents in significant concentrations. It involves the addition of SO_2, air, and a copper catalyst to break down cyanide. While this process does greatly reduce free cyanide concentrations, it results in the formation of several other byproducts that may be toxic to aquatic organisms, such as: cyanate, thiocyanate, sulfate, ammonia, nitrate, some free cyanide, and elevated copper concentrations. Such treated effluents may also contain elevated concentrations of other metals.

Most Canadian gold sites that use the INCO process are able to generate effluents that meet the official discharge standards in relation to cyanide concentrations. However, many of these effluents are still toxic to organisms in bioassay tests (Dr. George Dixon, toxicologist, U. of Waterloo, personal communication, 1999). Thus, these complex solutions produce toxicity effects we do not understand, probably as a result of synergistic effects, or they contain toxic constituents that are not being detected or regulated (Moran 2001, 2002a).

Table 3 of Annex 7.3 is a comparison of the tailings process solutions before and after INCO treatment. The table shows data for one measurement of weak acid dissociable cyanide, (WAD) cyanide, pre-treatment and post-treatment. The tailings solution before INCO treatment contained 1.3 mg/L WAD cyanide, and 0.64 mg/L after treatment. However, it fails to provide any data on the various other toxic forms of cyanide that might still be present, such as cyanate, thiocyanate, and some of the cyanide-metal complexes not detected by the WAD cyanide analytical process.

Interestingly, the concentrations of many of the metals and other chemical constituents [i.e. aluminum, antimony, arsenic, copper, cobalt, lead, mercury, manganese, molybdenum, iron, selenium, strontium, thallium, sulfate, chloride, alkalinity, etc.] in the tailings liquid actually **increased following INCO treatment**.

Note that Table 3 shows results from only one pre-treatment and one post-treatment solution sample, both collected under TEST conditions. The concentrations in the actual treated effluents coming from the operating plant might have significantly different concentrations than those reported in the TEST solutions.

Potential toxicity of mining effluents are often evaluated by conducting Whole Effluent Toxicity (WET) tests, where organisms, such as freshwater shrimp (*Ceriodaphnia)* are exposed to varying concentrations of the *actual waste mixture*. Actual WET tests should be conducted using treated El Dorado tailings solutions, rather than relying on promises or theoretical predictions.

Annex 7.3: Environmental Characterization and INCO Detoxification Test Work (July 22, 2004) is **only available in English (see Appendix 2)**.

The EIA contains numerous other half-truths regarding the environmental sampling and potential toxicity of cyanide at mine sites. For example the EIA states that the tailings will contain concentrations of cyanide that are less than the WAD cyanide standard or permissible limit of 0.50 mg/L. **Unfortunately, no such international standard exists.** This concentration has been discussed within the various drafts of the Cyanide Code as being acceptable, but it has never been adopted by any international regulatory agency. **More importantly, most freshwater aquatic organisms would be killed by prolonged exposure to a WAD cyanide concentration of 0.50 mg/L.**

On pages 7-127 and 7-128, the EIA discusses the actions to be taken if a cyanide spill were to occur. If read closely, one will note that no actual remediation measures are discussed for a spill of cyanide into a river or lake---because all of the options have significant environmental impacts (Moran 2002a). Nevertheless, the tone of the EIA implies that the public should have no concerns regarding a cyanide spill into water! This is simply untrue.

3.2.7 International Guidelines.

The EIA frequently attempts to tell the reader not to worry by saying that the El Dorado Project will comply with World Bank Group guidelines. Unfortunately, these guidelines are, in many respects, much weaker than those that would be required to operate a mine in Canada or the U.S.A. The International Finance Corporation's (IFC) Environmental Health and Safety Guidelines for Precious Minerals Mining (Draft) provide insight into the weakness of this claim of World Bank compliance. [available at: http://www.ifc.org/ifcext/enviro.nsf/AttachmentsByTitle/gui_draftmining/$FILE/PMM_Guidelines_DRAFT_019_Final+for+Comments_.pdf]

For example, Table 1 within these Guidelines presents effluent concentration limits for mines. Although these guidelines are still in draft form, many of these IFC/WBG guidelines are, in fact, *much weaker* than comparable guidelines and standards promulgated by other regulatory authorities*. **Table 1 of Appendix 1 of the present report* is a summary of these IFC guidelines as compared to some comparable U.S. and Canadian Water Quality standards and guidelines.** Note that there are no WB guidelines for several contaminants such as aluminum, antimony, uranium, ammonia, nitrate, chloride, and thallium---while the U.S. and Canadian documents do contain recommended limits for these constituents. Aside

from being potentially toxic to aquatic organisms, several of these missing constituents, such as chloride, nitrate, ammonia---together with sulfate---are exceptionally useful as standard indicators of mine contamination. These constituents are very mobile, thus act as useful "fingerprints" of mine contamination---yet they are not listed within the WB/IFC guidelines. Other toxic constituents, such as arsenic, cadmium and lead, are listed within the IFC Precious Minerals Mining guidelines, but the acceptable effluent concentrations are much higher than would be allowable in either the U.S. or Canada. For example, the WB/IFC guideline for arsenic in a mine effluent is 0.1 mg/L, while the Canadian guideline for either drinking water or aquatic life is only 0.005 mg/L. That is, the arsenic concentration allowable in a mine effluent according to the WB guidelines might be 20 times that acceptable in Canadian fish-bearing streams.

3.2.8 Dam Risks.

Annex 4.3- Tailings Deposit Design. This section states that The Tito tailings dam has been rated in a "high risk" category according to the criteria of the Canadian Association of Dams. The dam has been classified "high risk" because of the possible financial risks of a failure. Such a failure **would result in socioeconomic and environmental impacts to downstream water quality and downstream potable water supplies.**

3.2.9 Seismic Risks.

Volume 1 of the EIA qualitatively discusses the significant historical tendency for earthquakes in the project region. However, unlike most similar EIAs, this document fails to present a specific summary of past seismic events (locations, magnitudes, frequencies) that have been measured and recorded within a designated radius of the proposed mine. Thus, it is not possible to reasonably evaluate the potential risk that various El Dorado mine structures might catastrophically-fail as a result of future seismic events.

Appendix C, Preliminary Evaluation of the Site Seismic Risks, does discuss historical seismic events within the project region (summarized in Appendix 3), and the **significant uncertainty in the seismic risk calculations.** This discussion should have been included in Volume 1. **Unfortunately, Appendix C was presented only in English** (see Appendix 2).

3.2.10 Cumulative Impacts.

The Pacific Rim website describes several additional ore bodies near those described in the EIA, which may be developed in the foreseeable future. [See http://www.pacrim-mining.com/:Eldorado]

Thus, as with most similar gold mine EIAs, the document fails to realistically discuss **the total impacts** the local population is likely to experience. If other ore bodies are developed, additional natural resources will be impacted. In fact, many

of the technical details presented in the EIA will obviously change. For example, according to the Pac Rim website, the Nueva Esperanza vein may be developed using **open pit mining approaches**, which could totally alter many of the assumptions presented in the EIA.

Companies normally argue that they cannot evaluate a scenario that does not actually exist. Obviously that sort of comment is foolish as that is precisely what EIAs were originally intended to do.

This EIA should have been required to evaluate the *cumulative impacts* to all populations and resources within the region, **and required to evaluate and discuss "what if" scenarios which would consider the possible impacts to regional water resources if several of the additional metal deposits were also permitted and operated.**

3.2.11 Financial Assurance.

If unexpected environmental impacts occur after mine closure, who will pay for them and with what funds? The EIA makes no mention of any aspects of financial assurance requirements for Pacific Rim. There are hundreds of sites in the U.S.A. and Canada where environmental problems have become obvious, often after the mines have closed, and the costs to remediate these problems have often been from a few millions of dollars up to hundreds of millions of dollars (U.S.).

Following mine closure, who will pay for the continued operation and maintenance of the public facilities that PRES says will be constructed or augmented at the site? [Such as water supplies and treatment systems, schools, roads, health clinics, etc.] **Once the mine closes, the funding to operate and maintain such activities ceases.**

In both Canada and the U.S.A., it is now routine procedure for the State and Federal regulatory agencies to require the mining companies to provide some form of adequate financial assurance, often a financial bond. The bond is normally provided by a reputable insurance company and held for the government by a trustee.

Discussions regarding financial assurance should be made available to the public. The citizens would have increased confidence in the EIA process, if the details of financial assurance issues had been included in the original EIA.

4. Conclusions

The El Dorado Project EIA lacks basic testing and data necessary to adequately define baseline water quantity and quality conditions. It is especially weak in areas relating to the definition of ground water resources, yet it states that no significant impacts to water resources are expected.

The public EIA review process is clearly lacking in openness and transparency. Only one printed copy of the EIA is available for public review (at the offices of the Ministry of Environment and Natural Resources, MARN) within all of El Salvador. The public must review and submit written comments on this 1400 page document within a period of 10 working days. No photocopies or photographs of any part of the document may be made at MARN. As such, the present process is driven largely by the mining industry and the regulatory agencies, without the substantive input from civil society.

Basic data within this EIA are poorly organized and summarized making the public review process even more difficult. Ideally, a well organized and complete EIA would facilitate public involvement.

At present, the EIA process ensures that all of the sampling and test information is provided by the mining companies or their paid representatives. In order to promote public confidence in the process, independent sources of information need to be developed and encouraged.

Many of the environmental impacts routinely encountered at similar gold mining sites are being neglected, which generates uncertainty for the public and the regulators. This uncertainty is dealt with in the U.S.A. and Canada through the use of financial assurance requirements. Financial assurance issues are not discussed in this EIA.

The realistic costs for water as a commodity are neglected, which biases cost-benefit analyses. As a result, the public often argues that the poor are being required to subsidize the rich.

This EIA would not be acceptable to regulatory agencies in most developed countries.

References Cited.

Hydro-Triad, Ltd., 1995, Mina El Dorado Prefeasibility Report.

Moran, R.E., 2001, More Cyanide Uncertainties: Lessons from the Baia Mare, Romania, Spill---Water Quality and Politics. Mineral Policy Center Issue Paper No. 3, Wash. D.C., 15 pgs. (available at: http://www.mineralpolicy.org/publications/issuepapers.php3?nav=4 http://www.earthworksaction.org/ewa/pubs/mcu_final.pdf and http://www.zpok.hu/cyanide/baiamare/impacts.htm).

Moran, Robert E., 2002a, De-coding Cyanide. A Submission to the European Union and the United Nations Environment Programme: Sponsored by Hellenic Mining Watch, Ecotopia, CEE Bankwatch, FOE Europe, FOE Hungary, FOE Czech Republic, Food First Information and Action Network, Minewatch UK, and Mineral Policy Center, 25 pg. [Available at: http://www.hnutiduha.cz/publikace/studie/kyanidova_studie.pdf , www.mineralpolicy.org/publications/, http://www.eireview.org/eir/eirhome.nsf/(DocLibrary)/15583282B873481185256BFB00609501/$FILE/Decoding%20Cyanide%20(Feiler).pdf

Moran, Robert E., 2002b, The Quellaveco Mine: Free Water for Mining in Peru's Driest Desert? [Quellaveco: ¿agua libre de costo para la minería en el desierto más seco del Perú?] Report prepared for Asociacion Civil "Labor", Lima, with funds from Oxfam America / Friends of the Earth Int'l. / Global Green Grants. [available at: http://www.labor.org.pe/revision%20EIA%20Quellaveco.pdf and http://www.foei.org/ifi/quellavecostudy.pdf].

Moran, Robert E., 2005 (February), New Country, Same Story: Review of the Glamis Gold Marlin Project EIA, Guatemala [Nuevo País, la Misma Historia: Revisión del EIA del Proyecto Glamis Gold Marlin,Guatemala] : Prepared for Colectivo Madre Selva, Guatemala City, Guatemala. Available at: http://www.madreselva.com.gt/documento_de_robert_moran.pdf http://www.miningwatch.ca/index.php?/Glamis_Gold/Moran_Glamis_en http://www.miningwatch.ca/index.php?/Glamis_Gold/Moran_Glamis_sp

Pacific Rim Mining Corp. 2005. www.pacrim-mining.com

Vector [2004 (electronic DRAFT) and FINAL 2005], Estudio de Impacto Ambiental "Proyecto Mina El Dorado", (Prepared by Vector Colorado, L.L.C. and Consultoria y Tecnología Ambiental, S.A., Guatemala City**)**; dated August 2004 and September 2005, respectively.

Vector, 2004 (May 7), Technical Memorandum: Description of the Environment—Hydrogeology; prepared by Larry Breckenridge for Frederick Earnest.

Vector, 2004 (May 7), Technical Memorandum: Description of Hydrogeologic Impacts; prepared by Larry Breckenridge for Frederick Earnest.

Appendices

Appendix 1 – International Water Quality Guidelines

Appendix 2—Summary of the recent seismic activity in the area of the Project

Appendix 3— Summary of the Annexes in the El Dorado Project EIA that are in English

Appendix 1-
Table 1.0. INTERNATIONAL WATER QUALITY GUIDELINES

Parameters	Units	WHO Guidelines[1]	IFC Precious Minerals[2]	World Bank Guidelines[3]	US EPA	US EPA Aq. Life[5]		Canada Agricultural[6]		Canada[7]	Canada[8]
		Drink. Water	Mine Effluents	Open pit mining	Drinking Water[4]	Acute	Chronic	Irrig.	Livest.	Drinking Water	Freshwater Aq. Life
pH	Units	6.5 -8.5	6.0-9.0	6.0 - 9.0	6.5—8.5	6.5	9			6.5-8.5	6.5--9.0
TDS	mg/l	1000			500			500 - 3500	3000	500	
Tot Susp Solids	mg/l		50	50							
Turbidity	NTU	5									
COD	mg/l		250	250							
Bioch Ox Dem	mg/l		50	50							
Oil + Grease	mg/l	10	10								
Total N	mg/l		10	10							
Total Phos	mg/l		2	2							
Sodium	mg/l	200								200	
Chloride	mg/l				250			100 - 700		250	
Cl, tot res	mg/l					0.019	0.011				
Sulfate	mg/l				250				1000		
Sulfide	mg/l		1	1			0.002				
Nitrate	mg/l	50			10 (as N)				100	10 (N)	13
Nitrite	mg/l									1	
Ammonia (as N)	mg/l					0.002 to 0.325	0.032 to 0.049				0.019
Fluoride	mg/l		20	20	4.0 (2.0)			1.0	1.0-2.0	1.5	0.12
Aluminum	mg/l				0.05—0.2	0.75	0.087	5.0	5.0	0.1	0.005--0.1
Antimony	mg/l				0.006					0.006	
Arsenic	mg/l	0.01	0.1	0.1	0.05 (0.01)	0.34	0.15	0.10	0.025	0.005	0.005

Table 1.0. INTERNATIONAL WATER QUALITY GUIDELINES
…Continued

Parameters	Units	WHO Guidelines[1]	IFC Precious Minerals[2]	World Bank Guidelines[3]	US EPA	US EPA Aq. Life[5]		Canada Agricultural[6]		Canada[7]	Canada[8]
		Drink. Water	Mine Effluents	Open pit mining	Drinking Water[4]	Acute	Chronic	Irrig.	Livest.	Drinking Water	Freshwater Aq. Life
Boron	mg/l									5	
Cadmium	mg/l	0.003	0.1	0.1	0.005	0.002	0.00025	0.0051	0.08	0.005	0.000017
Chromium, hex	mg/l	0.05	0.1	0.1		0.016	0.011	0.008	0.050		0.001
Chromium (tot)	mg/l				0.1					0.05	
Copper	mg/l	2	0.5	0.5	1.3 (1.0)	0.013	0.009	0.2--1.0	0.5--5.0	1	0.002--0.004
Iron (tot)	mg/l		3.5	3.5	0.3		1	5		< 0.3	0.3
Lead	mg/l	0.01	0.1	0.1	0.015	0.065 0.025	0.0025	0.20	0.10	0.01	0.001--0.007
Manganese	mg/l				0.05				0.2	<0.05	
Mercury	mg/l	0.001	0.01	0.01	0.002	0.0014	0.00077		0.003	0.001	0.000026
Molybdenum	µg/L							10-50	500		73
Nickel	mg/l	0.02	0.5	0.5		0.47	0.052	0.2	1.0		0.025--0.15
Selenium	mg/l		0.1	0.1	0.05		0.005	0.02-.05	0.05	0.01	0.001
Silver	mg/l		0.5	0.5	0.1	0.0032	0.0019				0.0001
Thallium	mg/l				0.002						0.0008
Uranium	µg/L				30			0.01	0.2	20	
Zinc	mg/l	3	2	2	5	0.12 0.12	0.12	1.0-5.0	50.0	5	0.03
Alpha, Gross	picoCi/L				15						
Radium	picoCi/L				5						

Table 1.0. INTERNATIONAL WATER QUALITY GUIDELINES
…Continued

Parameters	Units	WHO Guidelines[1]	IFC Precious Minerals[2]	World Bank Guidelines[3]	US EPA	US EPA Aq. Life[5]		Canada Agricultural[6]		Canada[7]	Canada[8]
		Drink. Water	Mine Effluents	Open pit mining	Drinking Water[4]	Acute	Chronic	Irrig.	Livest.	Drinking Water	Freshwater Aq. Life
Cyanide(total)	mg/l		2 (0.20)	1		0.022	0.0052			0.2	0.005
Cyanide(free)	mg/l	0.07		0.1	0.2						
Cyanide WAD	mg/l		0.5 (0.05)	0.5							
Chlor, tot resid	mg/l		0.2	0.2							
Phenols	mg/l		0.5	0.5							0.004
Fecal Coliform	MPN/100ml		400	400						< 5	100
Tot Colif.										< 5	1000
Temp (increase)			<3°C	<3 C							
Salinity (change)			<20%	< 20 %							

Foot Notes:

[1] World Health Organization, 1996—Drinking Water guidelines.
[2] IFC Environmental Health and Safety Guidelines for Precious Metals Mining (Draft) July 2004
3 World Bank General Env.-Proc. Wastewater discharges to surface waters: Pollution Prevention and Abatement Handbook, July 1998:

[http://wbln0018.worldbank.org/essd/PMExt.nsf/d798dd11401b4e068525668000766b9d/cb6c29e967664f658525666e00705a4e?OpenDocument]

4 U.S. Environmental Protection Agency (US EPA) Drinking Water Standards: http://www.epa.gov/safewater/mcl.html#inorganic
Arsenic standard in ( ) becomes effective January 2006.

5 US EPA Water Quality Criteria for Aquatic Life—acute(Ac)and chronic(Chr):
http://www.epa.gov/OST/standards/index.html#criteria
Due to space limitations, A=acute, and C=chronic.

5 US EPA, 2002, National Recommended Water Quality Criteria: 2002. EPA-822-R-02-047
http://www.epa.gov/waterscience/pc/revcom.pdf

6 Canadian Guidelines for the Protection of Agricultural Water Uses(1999)—Irrigation (Irrig.)
and Livestock (Livest.): http://www2.ec.gc.ca/ceqg-rcqe/agrtbl_e.doc Due to space limitations, I=irrigation, and L= livestock.

7 Canadian Environmental Quality Guidelines, Dec. 2004, Summary Table: http://www.ccme.ca/assets/pdf/e1_062.pdf

8 Canadian Council of Ministers of the Environment, 2003, Canadian Water Quality Guidelines for the Protection of Aquatic Life.
MERCURY: Inorganic mercury and methylmercury. http://www.ccme.ca/assets/pdf/ceqg_hg_wqg_fctsht_aug2003_e.pdf

Appendix 2- Summary of the Recent Seismic History in the Region of the El Dorado Project

Date	Magnitude of Earthquake	Distance of El Dorado Project site from Epicentre (km)	Exact location	Depth of Earthquake (km)
March 10, 2001	4.7	0 – directly below project site	13.865ºN 88.691ºW	21
January 13, 2001	7.6	88		"intra-plate subduction"
December 18, 1997	6.1	4	13.84ºN 88.808ºW	182
November 8, 1997	6.5	11	13.84ºN 88.808ºW	176

Source: El Dorado Project Environmental Impact Assessment
Anexo 4.3- Diseño del Depósito de Colas
Reporte de Diseño de Pre-factibilidad de Tito, Proyecto Vecto No. 30.3003.00.02
Apéndice C, Pagina C3

Appendix 3—Summary of the Annexes in the El Dorado Project EIA that are in English

1) All of the Appendices of Anexo 4.3- Diseño del Depósito de Colas

2) Labels of the Charts included in Annex 5.2

3) Annex 7.3 – Environmetal Characterization and INCO Detoxification Testwork – Remade Minita Vein Core Composite Conformatory Test Leached Residue. ML1 Job No. 2985, July 22, 2004

4) All of the References included in Annex 7.4: Cyanide Destruction Processes - References