22 May 2014

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Progreso VII EIA: Summary Comments Regarding Water Resources.

-The Progreso VII EIA is the worst quality EIA / EIS I have reviewed in more than 42 years of professional hydrogeology / geochemistry experience, involving hundreds of mines, worldwide.

-It would **not be acceptable** in developed countries, i.e. Canada, USA, EU, Australia, etc.

-The proposed mining scenario does not appear to be logical or economically-viable, given my experience at numerous similar mines, worldwide. EXMINGUA claims they will operate both underground and open-pit facilities and construct a processing plant within such a short period of time. Most similar mines try to avoid constructing underground workings as they are much more costly than open-pit operations. Whenever possible and practical, they would operate using less costly heap-leach procedures. This is especially questionable given that the proposed life-of-mine (LOM) is only 5 years, which is much shorter than most similar gold-silver operations. It is likely that ore from other nearby concessions would actually supply this process plant in the future, leading to a much longer LOM and many additional CUMULATIVE IMPACTS to the regional water resources. No such cumulative impacts are discussed in the EIA.

-Where similar mines operate underground and construct similar flotation plants, they usually do so because the ore contains high concentrations of sulfide minerals, rendering heap-leach options less ineffective. However, the EIA claims that the ore and waste rock contain negligible percentages of sulfide (see p. 707-712), despite the presence of samples with paste pHs as low as 5.0 and 5.5. These Acid-Base Accounting (ABA) test data appear to be totally unrepresentative of the site rocks given that the EIA states the gold-bearing veins contain significant occurrences of arsenopyrite and chalcopyrite (see for example, p. 145, 147), both of which would normally show up as elevated sulfide concentrations in ABA tests. One can only conclude that the rock samples tested were not representative of these ores and waste rocks, or that the lab data are unreliable.

-Water Data, both surface water (SW) and ground water (GW), are essentially **useless** for:

- evaluating volumes of water (both SW & GW) presently available within and around the project area;

- evaluating existing, pre-mining water quality for both GW and SW;

-No actual wells or boreholes were constructed during the EIA to evaluate the quantity or quality of GW. It is obvious that some exploration boreholes were drilled, but no data on the locations or results of these boreholes with respect to water data were included in the EIA. The company drilled an exploration borehole in the center of the road in **El Tisate,** claiming it would be a water supply well. The borehole continues to sit in the center of the road as of 15 May 2014, but no data have been provide in the EIA and no well has been completed.

-No actual surface water flow MEASUREMENTS were made as part of the EIA activities.

-No water-levels or water flow direction maps are presented. No true aquifer tests were performed, only some totally inadequate slug tests were performed (Anexo B), which are useless for determining aquifer characteristics about the rock at any significant distance from the borehole walls.

-The EIA authors fail to make clear that the GW and SW flow pathways are interconnected via faults, fractures and weathered zones, and where GW and SW are exchanged directly at the edges of the streams. Thus, pumping GW during mine operations will cause depletions in stream-flows, will likely cause declines in the water levels of local wells, and will likely cause most local springs to dry up.

-The water quality (WQ) sampling was totally inadequate and amateurish.
All sites were sampled only ONCE, so it is impossible to evaluate any seasonal variability in water quality, water levels and well yields.

- **One well** was sampled, and this was an existing municipal well in San Jose del Golfo, which is likely MUCH deeper than the zones to be mined, so it is not representative of site water-bearing zones. Normally tens of wells or more would be sampled for such a project, and they would be sampled and measured at least quarterly for at least one year prior to submitting an EIA.
- **Seven surface water** sites were sampled **ONCE**! Any similar EIA would normally have collected samples monthly at all of these sites and many more, including numerous springs. No field measurements (T, EC, pH) are reported for any of the surface or ground water sites, and it appears that all samples failed to receive any preservative. **As a result, all of these reported laboratory results are largely useless.**

I see no reason to accept that any of the water quality data presented in the EIA are reliable. The authors fail to describe any of the methods for sample collection or sample handling prior to analysis. Because water quality begins to change as soon as samples are collected, specific **preservatives** must be added to the

bottles prior to delivering them to the laboratory, or the results will be unreliable. This is so important that any competent EIA or similar document will always have a detailed discussion of the specific preservatives that were added (and to which bottles), whether samples were filtered in the field, etc. This EIA contains no such discussion. Thus, one must assume the samples were not preserved in the field. While some water analyses show the presence of elevated arsenic, because the samples were likely not preserved correctly, the concentrations (of arsenic and other trace elements) are probably unrealistically low.

Cyanide determinations were made in these few analyses, but the specific type of cyanide determination is not reported (e.g weak acid dissociable (WAD), total cyanide, etc.), nor is sample preservation mentioned. As such, these data are meaningless.

The data contain no mention of **field measurements** of temperature, electrical conductance (EC), pH and comparisons of these field measurements to similar lab measurements. Likewise, there are no checks of analytical quality such as anion-cation balances; comparisons of TDS (total dissolved solids) to EC, etc. *In addition, the discussions and interpretations of site water quality are so poor and naïve, that one must assume the authors lack any significant experience or understanding of applied mine water quality or geochemistry.*

-Because the EIA lacks any **statistically-reliable** water baseline data, there will be no “yardstick” against which to measure any present or future changes to water quality or quantity. Thus, it will not be possible for the operating company to be held legally responsible for most water-related impacts that may occur.

-No data are presented showing the **detailed** chemical composition of the rocks to be mined, including whole rock analyses for the ores, waste rock, tailings, etc. Such data are always determined in similar mining projects, and must be released as part of Feasibility Studies to potential investors. Only one partial analysis of **one** rock sample is provided (see p. 805), and it reports the following: silver = 15.3 ppm; copper = 46,300 ppm; lead = 4760 ppm; zinc = 2590 ppm. Whole rock analyses for similar rocks would normally include other metals and metalloids such as arsenic, antimony, chromium, nickel, cadmium, mercury, molybdenum, selenium, strontium, uranium, cobalt, rare earths, etc. Similar gold ores frequently contain significant concentrations of natural radioactive components, which are often concentrated in the tailings wastes. No determinations of any natural radioactive components were included in any of the few laboratory analyses presented.

-No ACTUAL Water Balance is presented, despite stating that the discussions in Anexo 9 (p. 806—810) are a water balance. In fact they simply describe infiltration tests at some test pits. An **actual water balance** would provide **measured quantitative data** on all the water inputs and outputs for the entire mine operation, including (as a minimum): surface water flow data (measured,

not calculated); available ground water (based on actual measurements and aquifer / pump tests); site-specific (measured) rainfall and evapotranspiration, collected over at least one year; process plant water use (based on actual measured data as part of pilot testing for Feasibility Studies, etc.); human consumption; dust suppression on mine and site roads; water volumes lost to tailings; tailings discharges (e.g. p. 103) and leakage from tailings and waste rock piles, etc. [To what area does EXMINGUA propose to release contaminated tailings discharges?] *All such measured data is normally presented as an actual Water Balance.*

-Many of the water sections of the EIA are presented in a dishonest fashion, attempting to disguise the fact that no useful data have been collected. For example:

- The EIA implies that Anexo 5 (p. 713-749) contains details of a Hydrogeologic Study. In fact, no such study is contained in this Anexo.
- The EIA implies that a detailed hydrogeologic study was conducted, but in fact no wells were drilled, and no attempt was made to relate the presence of water in exploration boreholes (or the existing tunnel) with any hydrogeologic information.
- The EIA implies that both the waste rock (disingenuously called “esteriles”) and the tailings are geochemically **inert** (see p. 181). No data are provided to substantiate this claim and in my experience this is always incorrect. All tailings and waste rock I have examined and analyzed release contaminants after reacting with various waters (and bacteria) over time.
- The EIA presents no long-term kinetic tests to demonstrate that any of the site rocks are inert. Such testing is routine in EIAs for similar gold-silver sites.
- They state that local surface waters flow only during the rainy season. Clearly this is untrue as most of the drainages had significant flows during our field visit on May 15, 2014, despite the fact that there had been very little rain previously, and the rainy season had obviously not begun.

-<u>Likely Impacts</u>: based on review of hundreds of mines, many similar to Progreso, and relevant literature:

- Increased competition for water with locals in one of the driest areas of Guatemala;
- Reduction in ground water levels; some wells will go dry; most local springs will go dry; well yields will be reduced; stream-flows are likely to be reduced.
- Likely degradation of ground and surface water quality. Given the presence of significant arsenopyrite and chalcopyrite in the gold veins, it is likely that some portions of the facilities and wastes will generate **acidic drainages**, which will mobilize the potentially-toxic trace elements contained in these materials, such as: arsenic, copper, lead, zinc, and other metals / metalloids; ammonia & nitrate (from explosives), sulfate,

diesel, organic compounds from the decomposition of the plant processing chemicals, increased sediment loads, etc.

The EIA states they will use massive quantities of **explosives** [1608 Kg per month of ANFO (ammonium nitrate-fuel oil) and 792 Kg per month of other explosives (p. 128); and 66,000 liters per month of **diesel** (p.126). Such fuels and explosives release degradation compounds **toxic to aquatic life and humans.**

Many of the chemical substances intended for use in the processing plant (see p. 126-127, etc.) are in fact **toxic to humans and aquatic organisms**, as is obvious when one reads the details in the Toxicity Data Sheets (see Anexo 7; p. 756—800). On p. 107, they mention the use of concentrated nitric acid to dissolve the Doré bars, but nitric acid is not included in any lists of the dangerous substances to be used.

Will they also use cyanide, which is often used in flotation operations to separate gold and silver from other sulfide ores? Use of cyanide is not mentioned.

The expected impacts mentioned above are those routinely occurring at most metal mines around the world. A recent (May 15, 2014) article in *The Guardian* [http://www.theguardian.com/environment/andes-to-the-amazon/2014/may/14/canadian-mining-serious-environmental-harm-iachr] prepared for the Inter-American Commission on Human Rights (IACHR) describes such impacts at 22 specific sites in 9 countries throughout Latin America.

-Future Monitoring. On pages 404-406, the EIA discusses future monitoring of water resources, but proposes to employ analytical detection limits that are far too high to reveal the presence of most important contaminants. For example, the detection limit for arsenic is 0.1 mg/L, but the U.S. drinking water standard is 0.01 mg/L and the Canadian standard is lower, 0.005 mg/L. Using such improper detection limits, future analyses would fail to reveal the presence of arsenic (and other trace constituents), even when they were present.

-**Expected Volumes of Water Use** at Progreso. The EIA states that most of the water will come from a well or wells and that surface water will not be used "directly" (see p. 118) for mine operations. They fail to state that extraction of such large volumes of ground water will ultimately generate a hydrogeologic interaction with the surface waters, likely reducing surface flows.

The EIA **estimates** that the mine operations will require 4.8 cubic meters per day of water for human consumption (Anexo 16; p. 122), and 154.8 cubic meters per day to operate the processing plant (p. 118). Using these totally preliminary numbers one calculates the following water usages:
per day = 159,600 liters
per month = 4,788,000 liters
per year = 57,456,000 liters
over 5 years (expected life of mine) = 287,280,000 liters
over 25 years (period of permit) = 1,436,400,000 liters

It is unclear whether these estimates include water for dust suppression on roads, etc.

Clearly these volumes of proposed water usage will generate increased competition with the other water users in this driest area of Guatemala, likely generating significant negative impacts.

-The Progreso project is located in one of the most seismically-active regions in the western hemisphere, yet the EIA authors have failed to present a detailed history of the actual earthquakes that have been recorded in this region. The U.S. Geological Survey provides electronic data on all such earthquakes in at least the last 40 to 50 years, yet none are presented in the EIA. Several historic earthquakes in this region have had Richter magnitudes of greater than 7.0, have destroyed nearby villages, and would present obvious risks of failure to the mine facilities.

-Once active mining operations cease, the **wastes will remain onsite forever**. Depending on the actual post-mining conditions of these wastes, they may require operation of an expensive, active water treatment facility, and because the area is seismically-active all waste facilities are likely to require perpetual maintenance.

-My conclusions confirm those of Robert H. Robinson and Steve Laudeman in their Progreso VII Derivada report of December 29, 2012.