ANNEXES A-D

CAO ASSESSMENT
of a complaint submitted to CAO
in relation to the Marlin Mining Project in Guatemala

ANNEX A: Supporting Tables 1-7

TABLE 1: MARLIN MINE POTENTIAL IMPACTS, MITIGATION AND MONITORING OF WATER QUALITY

Potential contaminant	Proposed mitigation	Monitoring Plan	Additional information
Cyanide in discharge from TSF • Potential risk to aquatic life and environment. • Perceived risk to human health.	• INCO reduction of cyanide in tailings slurry to less than 2ppm total cyanide into the TSF and less that 1ppm total and .5ppm WAD and .1 free cyanide at discharge point (WBG CN effluent standards). • Commitment to principles of the International Cyanide Management Code (ICMC). • No discharge from TSF into the environment for two years and only after TSF cyanide concentration determined to meet at least WBG standards depending on determination of receptors and their water use. • After one year of testing TSF water and definition of water quality standards, company will determine if water treatment plant is needed at TSF discharge point. • Outline of cyanide management in Waste and Materials Management Plan completed in June 2005.	• Regular testing of TSF water and discharge water. • Surface water monitoring at one station immediately downstream of TSF, one station further downstream, one station in the Cuilco after confluence with the Quivichil. (note: four other surface water stations are monitored in areas not not downstream of TSF). All stations are monitored quarterly. • Data reported quarterly to both the MARN and the MEM, and annually to the IFCOperation of the Project, from the construction phase to the closure phase, will be audited periodically, by an external and independent professional, to verify compliance with the principles and standards stipulated by the ICMC.	• Specific CN levels in TSF, at discharge from TSF and standards for different beneficial water uses of receptors downstream of TSF to be determined. • WBG requires WAD CN level at a determined mixing point downstream of discharge to be less that .02ppm for aquatic life. Project still to determine the mixing zone and rationale for this determination. • Aquatic life exists in Quivichil downstream of TSF according to ESIA • ICMC has yet to develop specific auditing process, but this will be adopted once it has.
Cyanide from accidental spill during transport or handling or expose at pool. Potential risk to human health and environment.	• Commitment to principles of ICMC; Specifics of ICMC and implementation and auditing still being completed. • Completion of emergency response (contingency) plan scheduled for August 2005, draft completed June 15, 2005.	• Contingency Plan to be finalized in August 2005. Monitoring plan to detect releases into the environment during transport is included in Contingency Plan.	
Acid Rock Drainage Potential risk to human health and the environment from contamination of ground and surface water.	• Management of potential acid-generating (PAG) rock. • Characterization of waste rock (including acid-base-accounting) began in October 2004. The mine began to generate waste rock and construct the waste rock facility in May 2004. • Waste Characterization and Waste Rock Facility Feasibility Design and Cost	• Groundwater monitoring at four wells on a monthly basis, one is near waste rock facility, one at toe of dam; surface water monitoring at six stations. • Monitoring seepage from waste rock dump will occur at least quarterly at the toe of the dump when and where the seepage appears. • Seepage form dam and pump back system	• Commitment by Montana to implement mitigation measures if any significant deterioration of groundwater quality is observed compared to baseline monitoring. Baseline water quality will be used to determine standards for groundwater quality. • Data on the operational geochemistry (acid base accounting) monitoring of waste rock produced since facility

Potential contaminant	Proposed mitigation	Monitoring Plan	Additional information
	Estimation completed in November 2003. • Waste Rock Management Plan that will include ARD management scheduled for completion and review by independent tailings dam reviewer in August 2005. • No discharge from TSF into the environment for one year and only after TSF water quality determined to meet WBG and possibly other standards, depending on determination of receptors • After one year of testing TSF water and definition of water quality standards, company will determine if water treatment plant is needed at TSF discharge point. • Commitment to install acid water treatment plan if levels found to exceed WB standards of 6 to 9 pH. Field data from monitoring will be compared to the WB effluent water quality guidelines and identified risk posed to downstream receptors, to determine the need for water treatment. • Five control wells along east embankment of dam, will pump any seepage from the TSF back into the TSF and reduce pressure on dam. • Commitment to modify closure plan if acidic seepage from waste rock dump detected.	will be monitored. • Data reported quarterly to both the MARN and the MEM, and annually to the IFC.	construction began in October 2004 is internal.
Sediment Potential risk to aquatic life, blockage of irrigation channels.	• Erosion control measures currently being implemented and upgraded. • Sediment and erosion control EMP completed in April, 2005. Implementation of the plan scheduled for completion by end July 2005.	• Surface water monitoring at six stations measuring total suspended solids (TSS) conducted at least quarterly, and in some cases monthly depending on the season. • Data reported quarterly to both the MARN and the MEM, and annually to the IFC.	• One complaint has been expressed about sedimentation of water intake from Quebrada Seca. • Erosion control measures found to be insufficient in 2004 Environmental Audit and Review and CAO site visit and new erosion control measures currently being implemented. • Some declines in aquatic life detected below TSF and in Tzala, explained in MARN October 2004 quarterly monitoring report. Whether declines from natural fluctuations or mine-induced sedimentation undetermined.
Other contaminants (e.g.	• Potential treatment plan installation if levels	• Ground water monitoring at three	

Potential contaminant	Proposed mitigation	Monitoring Plan	Additional information
arsenic, ammonia and nitrates) from TSF discharge Potential risk to human health and the environment from contamination of ground and surface waters	found to be high in discharge from TSF. Criteria for acceptable levels will be WBG standards for effluent in addition to beneficial use standards still to be determined. • No discharge from TSF into the environment for two years and only after TSF water quality determined to meet at least WBG standards, and in addition beneficial use standards downstream depending on determination of receptors.	monitoring wells on a quarterly basis and surface water monitoring at seven stations on a quarterly basis. Some stations monitored more frequently than the quarterly commitment depending on the season, and other factors. • Data reported quarterly to both the MARN and the MEM, and annually to the IFC. • June 2005 Monitoring Plan sets forth thorough monitoring criteria for all potential contaminants.	• Range of all potential contaminants still to be determined through modeling and testing of the TSF water. • Determination of water use and/or risk based standards that will apply to project to be determined. • Determination of criteria for installation of additional water treatment facilities to address any water quality exceedences. • Company will define point of compliance at receiving water body and water quality standards that account for: receptors and their sensitivities, water uses, and the baseline water quality.

TABLE 2: DAM SAFETY, INSTITUTIONAL RESPONSIBILITY, MINE CLOSURE OF MARLIN MINE AND PROPOSED MANAGEMENT

Concern	Proposed management	Additional Information
Safety of the dam; fear of dam failure	Review of safety of the tailings dam by an Tailings Dam Review Board (comprised of one independent expert, the tailings dam reviewer). Two reports have been issued for 2004 and 2005. 2005 report has been made public. Changes have occurred in dam design and testing as a result of these reviews. The following plans pertinent to IFC requirements completed in January 2005 TSF design: • Quality Assurance Testing and Inspection for first phase of construction. • Instrumentation Plan. The 2005 Tailings Dam Review Report sites several areas requiring follow-up • Quality of material used for first phase of construction. • Grout curtain qualitative assessment. • Stability of waste rock dump re-evaluation. • Design for phases 2 and 3 of dam construction. 2004 AMR says follow-up to the 2005 Tailings Dam Review Report recommendations will be incorporated in subsequent design and management plans. Review report does not identify plans that are required by IFC for completion.	Last draft of dam design completed in January 2005, including monitoring plan. Dam review includes of design and construction progress but not of monitoring plan set forth in TSF design report. Regular monitoring of construction of dam to design specifications and monitoring and review of hydraulic data during life of mine to be determined. Dam monitoring data to be included in AMR. The following plans completed in August 2005. • Operation and Maintenance Plan. • Emergency Preparedness Plan. The following plans being reviewed by dam safety reviewer: • Operation and Maintenance Plan. • Emergency Preparedness Plan. • Instrumentation/Monitoring Plan. • Construction Supervision and Quality Assurance plan for first phase of construction.
Institutional Responsibility for Contamination or Disasters including • Accident spill during transport or on-site use of cyanide. • Dam break. • Emergency release of excess water from TSF • Unanticipated groundwater plume under the tailings impoundment and waste rock dump. • Geotechnical failure of the waste rock dump. • Break of the tailings delivery line resulting in a release of cyanide and tailings.	Determination of liabilities in the case of disasters to be determined. Further determination of institutional responsibilities underway. Commitment to require proper insurance for transporter as required by ICMC.	• Contingency plan for cyanide still being drafted. Emergency Preparedness Plan for dam safety still being drafted, as discussed above. • Financial provisions for disaster response yet to be made public.
Mine Closure Potential risk of long term environmental impacts of	• General mine closure plan including specification of management of potential long term risks included in the ESIA.	• Bond for planned closure and unexpected closure proposed to MARN by company in May

mine tailings and waste rock after planned closure or after unexpected closure.	The closure plan specific to the TSF still being drafted and updated.; expected for completion in August, 2005. • Closure plan will be reviewed annually and updated every two years. • Bond with Guatemalan government has been proposed and is under consideration. • Project states that area will be productive post-closure for use by flora and fauna and for natural resource management.	2005 Still under discussion. • Company commitment to funding at any point in the mine life to cover for early closure. Commitment still to be formalized.

TABLE 3: MARLIN MINE WATER USE AND POTENTIAL FOR COMPETITION WITH OTHER USERS

Water Demand of Marlin Mine	**Water Source**		**Characterization of Source or affected water body**	**Use by mine**	**Other users**	**Potential Competition with other users**	**Additional Information**
Operational Use (includes water for ore processing, reforestation and personnel facilities**)** **Total mine operational consumption: 48-69 l/s**	**Production Well** Average 15% of water supply	Well: PSA-1/MW5	305m depth Well located 50m from the Tzala river. Project study (June 2005) Indicates well water from geothermal source unconnected to Tzala river.	10-15 l/s during construction and operations.	None known	None expected given assumptions that the geothermal source and surface waters are not connected.	• Project sponsor will continue to test assumptions that surface and ground waters are not linked through monitoring of flow of Tzala to detect any changes in flow. • Contingency plan if decreased flow found to be determined.
	Tailings Storage Facility Average 85% of water supply.	Rain that falls directly on TSF pool, and rainwater run off from surrounding land that leads into the TSF.	• Annual rainfall estimate of region is 1000mm; project estimates rainfall onto TSF in addition to runoff as 2 million m3 per year during average rainfall years.[4] • Flow rates of Quebrada Seca drainage (immediately downstream of TSF) unknown, but is currently being monitored for flow. It is an ephemeral drainage. • This discharge flows to the Quivichil river, as the Quebrada Seca joins the Quivichil, during the rainy season, which shows flow of about 680 l/s.		• No users were recorded during survey conducted for ESIA. • Two pipe uptakes form Quebrada Seca have been identified by project since that time.	• Unconfirmed planned discharge rates from TSF • At least one complaint reported from users of water uptake from Quebrada Seca as a result of sedimentation.	• Discharges begin after two years of operation. • Discharge will vary based upon climatic conditions and occur during rainy season only. Average discharge during rainy season will be approximately. 300l/s.

Water Demand of Marlin Mine	Water Source		Characterization of Source or affected water body	Use by mine	Other users	Potential Competition with other users	Additional Information
		Rainwater from dewatering of open pits.	• Tzala River: 6,680 l/s in wet season; 300 l/s in dry season. • Quivichil stream: 680 l/s in wet season; 40 l/s in dry season. • Part of rainwater would otherwise run off to Tzala river and tributaries and Quivichil watershed. Water from pits will be pumped into TSF and then discharged into the Quebrada Seca in the Quivichil basin.	Will change over life of the mine, from 5 l/s initially to 25l/s[1] as the pit grows.	No users of Tzala reported downstream of mine site; some users reported in Quivichil basin, though unlikely to be close to the area affected by dewatering.	None expected given the small proportion of water when compared with streamflows and that there are no reported users of the Tzala river.	Annual rainfall estimate may change as on-site data is collected over time.
		Groundwater from dewatering of underground mine.	Water may recharge both Tzala and Quivichil basins watershed.	1.3 l/s[2]	No users of Tzala reported downstream of mine site.	No significant impact likely given the small proportion of water when compared with stream flows, likely lack of connection between the surface and deep ground water, and that there are no reported users of the Tzala river.	
		Water from tailings slurry (a.k.a decant water) recycled	Recycled from TSF.	60 l/s in average over a year[3].	None	None	
Road Watering		Cuilco river	Large river flowing in to Mexico 31,680 l/s in wet season 3,200 l/s in dry season.	Not calculated; Reported during peak of dry season as	Some irrigation users reported downstream of extraction site;	Extraction is small proportion of water compared with total stream flow;	• Water demand for road watering not included in current water balance of

[1] "Tailings Storage Facility Design Report" January 2005
[2] "Usos del Agua por el Projecto Marlin" April 2005

[3] "Tailings Storage Facility Design Report" January 2005

Water Demand of Marlin Mine	Water Source		Characterization of Source or affected water body	Use by mine	Other users	Potential Competition with other users	Additional Information
				17 trucks/day but trucks of varying size filling at unrecorded frequencies.	demand unknown.	significant impact unlikely and monitoring and reporting of this extraction would confirm level of use and detect unanticipated impacts.	project; water extraction levels to be determined. • Project plans to use alternative dust suppressant in future.
Expanded Community Use		Springs in Sipacapa, San Miguel and potentially other municipalities.	Communities have traditionally purchased water from one another. Montana is assisting some impacted communities that draw water from sources in both San Miguel and Sipacapa to improve their water systems and has a project to purchase additional water near Chinguitz, San Miguel.	• Details and impacts of expansions unknown. • Increases in demand likely from direct project support and from indirect effects of mine presence, though extent unknown.	Unknown who other users of these sources are.	• Already documented dispute over planned new purchase of water in Chinguitz, San Miguel. • Potential for some competition though degree and scope unknown.	• Projected future demand of mine for potable water sources to be determined. • Projected future local demand for water to be determined. • One recent incident reported in which damage to water systems of towns near the mine was reported, apparently as a result of groups in opposition to the mine.

TABLE 4: OTHER CONCERNS ABOUT WATER QUANTITY

Concern	Details and Discussion
Damage to potable water systems	**Tzalem:** A report of damage to the town of Tzalem's potable water system was contained in the written complaint sent to the CAO. Montana contractors reportedly damaged and did not repair in a timely manner the town's potable water system. A group of women from the town protested on the road as result. The details of the extent of water shortages that resulted and for how long are still not known. The CAO team was unable to visit the site during the assessment trip. Montana acknowledged the occurrence of this accident and explained that the incident had been resolved. **Other incidents**: At least two other incidents have been reported in Agel (sited in project documentation) and by residents of Guancache (explained to CAO during its site visit). The CAO did not investigate the details of these incidents and understands that they have been resolved.
The water quantity effects of deforestation caused by mine	Local concerns exist about the hydrological effects of the deforestation that results from the Marlin mine's establishment. There is a general perception locally that trees are important to the stability of water quantity levels as well as favorable micro-climatic conditions for the area. The CAO heard the concern from several local residents that without trees, there will be less water. In response to these concerns, community concerns, the local demand for firewood and the requirements of the government to replace trees, Montana has began to implement a reforestation program. The project reported in March 2005 that it had reforested about 117 acres and that it will monitor the forest and vegetation cover every year to determine the level of revegetation and reforestation.

TABLE 5: MARLIN MINE POTENTIAL IMPACTS, MITGATION AND MONITORING OF AIR QUALITY

Potential contaminant	Proposed mitigation	Monitoring Plan	Additional Information
Dust/particulate matter (PM10, particulate matter) Limited risk to human health	Dust suppression on roads; increased during the 2004/2005 dry season.	• Seven-ten air quality monitoring stations, monitoring PM10 on a quarterly basis as required by the ESIA, but can also be conducted on a monthly basis as Montana determines. The company has committed to meeting WB standards of 150 µg/m3. • Data reported quarterly to both the MARN and the MEM, and annually to the IFC. • Annual testing conducted of dust composition to determine if any harmful harmful constituents are contained in the dust, including arsenic and lead in PM10. • Plans to monitor ambient air quality annually for arsenic and lead in PM10.	• Dust from traffic has been noted as a problem in the 2004 Environmental Audit and Review. • Use of alternative suppressant has been proposed and is to be implemented for the next (2005/2006) dry season. • Monitoring system may change and occur on a monthly basis. • Company has proposed to change these ten stations to three (upwind and downwind) fixed monitoring stations. Negotiations between company and government on this matter are not final.
Emissions from explosions at mine Limited risk to human health		PM10 currently monitored at seven to ten air quality monitoring stations.	Monitoring system may change to be based on determination of wind patterns and potential affected populations.
Emissions from smelting furnace Limited risk to human health	Baghouse and mercury retort unit; both used for controlling any emissions.	• No stacktesting for monitoring currently planned for emissions from baghouse. • Planned maintenance schedule will evaluate efficiency of bag house.	• Baghouse recently determined in new project optimization, but not in project design documentation. • Mercury gas generation expected to be very low, detected in only 5% of the ore.

TABLE 6: MARLIN PROJECT SOCIO-ECONOMIC IMPACTS, MONITORING AND PROPOSED MITIGATION MEASURES

<table>
<tr><th>Type of Impact Characterization</th><th colspan="2">Observed, measured or predicted Impact</th><th>Monitoring and Proposed Mitigation</th></tr>
<tr><td>Characterization of impacts and proposed mitigation in the ESIA and IPDP</td><td colspan="2">ESIA characterizes socio-economic impacts as follows:
• San Jose Ixcaniche, San Jose Nueva Esperanza and Agel and Tzalem to a lesser extent will be directly impacted.
• Villages along the main transportation route would be affected by traffic, noise and dust.
• The towns of San Miguel and Sipacapa will receive indirect impacts (primarily induced economic growth).
• Local hiring of labor and contractors will result in largely positive induced economic impacts (contractors will stay in the towns of San Miguel, Huehuetenago and Sipacapa).
• New workers may change patterns of interaction among community members.

ESIA discusses potential royalty and tax benefits and makes some estimation to national and local governments. It states that San Miguel and Sipacapa will receive royalties from the Marlin project that both municipalities can invest in social infrastructure and that royalties will go to Sipacapa when extraction begins at the end of the project.</td><td>ESIA states that monitoring of social impacts will occur, monitoring indicators and protocols not specified.

Indigenous People Development Plan discusses plans for community development and the Sierra Madre Foundation (FSM in Spanish) (see below), as well as monitoring of socio-economic indicators including health, education, housing, infrastructure, economic development and some social problems.</td></tr>
<tr><td>Current understanding of socio-economic impacts, mitigation measures and monitoring plans</td><td>Directly from mine operations</td><td>Employment
• Company policy emphasizes hiring local people, especially ex-landowners.
• Employment has grown from approximately 200 workers in May of 2004 to 1500 workers in December of 2004 (approaching to peak of construction period).
    • 179 people employed in December of 2004 from Sipacapa municipality.
    • 694 people employed in December of 2004 from San Miguel municipality.
• 2004 total payroll for the Marlin Project totaled Q38,705,944 or about US $5,007,000.
    • 84 percent was paid to Guatemalan employees
    • 50 percent (approximately US$2.4 million) has been paid to employees from San Miguel and Sipacapa.
• Employment projected to decrease to about 400 local workers after construction period ends in August 2005; Montana has offered to pay</td><td>Monitoring of employment numbers has occurred since project construction began in 2004. Figures on wages and employee characteristics are presented in the 2004 AMR.</td></tr>
</table>

		salaries of local workers for an additional two years on a rotational basis and provide these workers for the municipal projects to be implanted in the two municipalities.	
		Land Acquisition • Price per "cuerda" at about Q4,000, or US$4500 per acre, estimated by the company at eight times higher than market price at the time of purchase. Price paid per acre was same to all landowners and did not change over time. • Montana purchased 395 parcels from 254 people. Parcel sizes ranged from .01 to 50 acres. The average parcel size was 4.5 acres. • 40 primary residences were sold to Montana or, in the case of four landowners, exchanged for houses in a development established by Montana. 7.5% were located in Sipacapa, the rest in San Miguel. About three-quarters of these people have stayed in the same community.	• Over half of former landowners reportedly employed by mine. • Some landowners have reportedly purchased land on the coast.
		In-migration: • Unknown numbers of contractors staying in San Miguel and nearby camps and in Huehuetenago. • One complaint was lodged regarding a new bar in Sipacapa which was closed. Several new bars reported in San Miguel. • Some influx of migratory workers or job-seekers to the area reported by company, but not determined as significant. Employment priority given to locals. Exact numbers of jobseekers unknown. • Some local economic impacts from non-local worker purchase of goods and services.	• In-migration understood to be minimal and summarized as such in the AMR; exact figures not presented in the AMR. • Community Relations Group expected to observe and report any significant local complaints. • HIV/AIDs workshops reported in San Miguel.
		Procurement: • During 2004 Montana spent Q2,145,614 ($270,000) on goods and services in the area that includes San Marcos, Huehuetenango and Quezaltenango, and Q797,628 ($100,309) in San Miguel and Sipacapa. Disaggregated figure for each town are not reported. • Over the life of the project, capital and operating costs are estimated at $363m of which $135m is expected to be spent within the Guatemalan economy and an additional $5m will be spent on community programmes.	Monitoring of local, regional and national procurement since 2004.

		Indirect socio- economic effects: • Avoided migration: Particularly in these three villages, people have chosen to stay in the area throughout the year rather than migrate to the coast, as a result of direct or indirect employment associated with the Marlin project. • School Enrollment in four town schools has increased (between 14 and 31%) over the past year as a result of increased permanence of residents. Three towns are in San Miguel and one town, Tzalem, in Sipacapa. • Some local inflation, with positive as well as negative impacts for local inhabitants. Company states that inflation has been limited to land prices (which have increased substantially near the project), housing (few people rent) and perhaps a few commodities. Not being monitored. • Non-migration of existing residents extends the period of demand for local services including social infrastructure and environmental resources. Not considered significant by project. Not monitored. • One house in Sipacapa was intended to be rented to Montana but was never occupied due to threats made to owner by people against renting of house to the Montana. • Contractors that rented approximately three houses in Sipacapa left after threats of intimidation and violence in early 2005. • 49 new businesses are recorded in 7 towns (2 towns from Sipacapa and 5 towns in San Miguel). • 111 new houses have been built in the area as a direct or indirect result of the mine, 12 of these are Sipacapa (Tzalem) and the rest in San Miguel.	• Monitoring of various socio-economic indicators is planned for every three months, as elaborated in the AMR. • No monitoring of inflation, projected as minimal by project. • No monitoring of strains on resources (firewood or water).

	From company investments in Community/social infrastructure US$1.3 million to date; commitment to funding $5 million in community improvements over the next 10 years, based on a planning and needs assessment recently conducted by Montana	**Social infrastructure** • Installation of chlorinators in the municipal water systems of San Miguel Ixtahuacán and Sipacapa. • Purchased and equipped an ambulance. • Funded salaries of teachers for schools. • Support for school materials. **Economic development** • Facilitated establishment of Banco de Desarrollo Rural in San Miguel Ixtahuacán. • Construction of roads from La Hamaca to Salitre, a road from San José Nueva Esperanza to Sipacapa, and a bridge across the Tzala river. The roads are not project related but rather a contribution to the municipality. • A wide range of small donations, totaling over US$740,000 from company in response to village solicitations are recorded in the 2004 AMR Annex B. Donations range from school and health support to support for celebrations and sporting events. No public criteria or system for managing and responding to solicitations presented.	

	From activities of Fundación Sierra Madre (FSM)
	US$400,000+ annual budget(, IFC has contributed US$89,000,)
	
	• Established in 2004
	
	• Over the life of the project it is expected to
		Integrated Community Development Plan (ICDP) developed in 2004. Goals include:
		• Improve access to and quality of health services
		• Increase economic opportunities by strengthening family/micro economic production.
		• Promote environmental awareness.
		• Develop institutional capacity and visibility of Foundation Sierra Madre, its partners and strategic public institutions.
		• Community Advisory Councils composed of local people who will help guide the work of the FSM were proposed in early 2004 but have not yet started. Plans to initiate their work in 2005.
		• Municipal capacity building support for San Miguel in form of one consultant to aid municipality as first step in local capacity building plan.
		
		Expanded activity on scope of ICDP into Sipacapa in late of 2004. Projected division of budget between San Miguel and Sipacapa still
			Established to address health, education, reforestation and economic concerns. Numbers of projects reported in AMR; not disaggregated between municipalities.
			
			• Socio-economic monitoring indicators include
			  • Health
			  • Education
			  • Small businesses
			  • Housing
			  • Crime

	spend roughly $4 million on community projects. • Two offices, one in San Miguel (est. 2003), the other in Sipacapa (est. 2004). • Working with various other NGOs to implement programs	undetermined. **Health care support** • Provided health services to more than 10,000 people primarily in San Miguel during five company-sponsored Health Fairs and three health campaigns; worked with APROSAMI, a Guatemalan health NGO. • Elaborated health censuses for San Miguel and Sipacapa. • In conjunction with its partner APROSAMI, has renovated 12 health care centers and 9 medicine supply stores in the small villages near the project site. • Trained 118 midwives on maternal health topics; primarily in San Miguel. • 14 rural first aid centers functioning, with local trained staff. • With government and NGOs has begun to establish a health baseline in both municipalities. Resistance form Sipacapa to participate. **Small business/economic development** • Established 18 communal banks for women, primarily in San Miguel, in coordination with a Guatemalan NGO FAFIDES. • Trained more than 250 people in vocational skills such as carpentry, sewing, cooking, and bread-making, primarily in San Miguel. • Helped establish 15 new businesses. **Reforestation** • Employed 50 people in local reforestation projects in San Miguel. • Transplanted or donation to the community 105,000 saplings to the reforestation areas in the Marlin project and surrounding areas. • The 2004 reforestation activities involved 78 land owners (from San Miguel), and included the planting of trees as well s payment of an "incentive" to use the land for reforestation. This incentive will be paid for five years.	
Characterization of tax and royalty benefits of the Marlin mine	Benefits from taxes and royalties calculated from the Marlin project by IFC have been described by IFC in a document sent to Bishop Monsignor Ramazzini on May 31, 2005. • Royalties were estimated at $10m in June 2004, this has now been revised to $14m. • Profits taxes were estimated in June 2004 at $99m; this has now been revised to $54m as a result of a change in the Guatemalan tax law. • Additional taxes are now estimated at $12m.		Tax and royalty figures have changed substantially over time since the June 2004 WB Board approval. The agreement to pay Sipacapa a voluntary royalty is not yet formalized.

	Disaggregating this figure by regions: • The central government will receive $54m in profits taxes plus $3.9m in royalties and $12m in additional taxes at total of $69.9m over 11 years or $6.4m per annum. • The municipality of San Miguel should receive $3.9m in royalties over 11 years or approximately $350,000 per annum. • The municipality of Sipacapa should receive $778,000 in royalties over 11 years or approximately $70,000 per annum. The municipality will receive this based on a "voluntary" .1% royalty if the agreement reached with the company becomes official. The announcement of this royalty was made by MEM in December 2004. There is discussion of a trust fund to be established for the department of San Marcos. This fund is yet to be determined through negotiations between the company and the government. Based on these data, financial 'benefits' to the Guatemalan economy are expected to be $220m over the 11 year life of the mine. For Glamis, the IFC estimates: Gross revenues to Glamis are estimated at $778m over the life of the project (11 years) The net financial benefits accruing to Glamis over the life of the mine are expected to be $175m.	

TABLE 7: REPORTED DISCLOSURE AND CONSULTATION ACTIVITIES UNDERTAKEN BY THE MARLIN PROJECT

Project Stage	Time period	Activity
Prior to approval for Marlin exploration license	1996-1998	• Montana (owned at this time by Montana Gold Corporation a Canadian company – not Glamis) conducts preliminary exploration in the region and discovers the Marlin deposit in late 1998. • No records relating to disclosure and consultation are available for this period. • No evidence that municipalities of San Miguel or Sipacapa or landholders were consulted or notified before/during granting of exploration license was provided to the CAO. **October 1998:** Montana exploration activities including soil sampling undertaken in Sipacapa (los Chocoyos)
During exploration and first land transactions	1999-Septumber 2002	**January 5, 1999:** MEM grants reconnaissance license to Montana for Marlin region (approximately 500km^2). **August 16, 1999:** MEM grants Montana initial exploration license for Marlin region (subsequent licenses for smaller areas within this region are granted in 2003, see below). Public disclosure unknown. **Unknown date:** Peridot, a Guatemalan company hired by Montana, begins to acquire land. **Mid- 2000:** Exploratory drilling begins. **December 2000:** Francisco Gold acquires Montana, thru acquisition of Montana Gold Coporation (Canadian). **2002:** Glamis acquires Francisco and Montana. **April 19-22 2002:** Beginning of negotiations with landowners in San Jose de Nueva Esperanza and Agel San Miguel municipality. **April 22 2002:** First recorded meeting with mayor and secretary of San Miguel municipality. **May 9 2002:** First recorded soil sampling in Sipacapa (in the town of Cancil). **May 9 2002:** First recorded meeting in Chuena and Horcones, towns which would be impacted by road traffic from the project. **June 26 2002:** First recorded meeting with municipal corporations of San Miguel and Sipacapa

Project Stage	Time period	Activity
		(11 people attending) about the Marlin project; water chlorination systems were the focus of the meeting. **July 2002:** Preliminary environmental baseline data begins to be collected by CTA for the ESIA. No records relating to community disclosure and consultation are available for this period, though Montana reports and has records for some land transactions. Montana states that it was in frequent informal contact with local communities working on issues of mutual concern such as support for community projects.
During drafting of ESIA and land purchasing for Marlin; exploration of Clio areas in Sipacapa	September 2002-June 2003	**Sept 2002, Feb 2003:** Two socio-economic studies are conducted by CTA in three directly affected town in San Miguel, which include public opinion surveys of 21 and 45 leaders and residents of these three towns. **January 2003:** Geologist mapping in Poj and los Chocoyos begins. **February 2003:** Community Relations Group formed, made up of two groups of 6 local people each from both municipalities. **February 2003:** • First records of public meetings of CRG in communities available. • Between February and June 2003 recorded CRG meetings held in three directly affected communities (records state about development projects) and with workers at the mine, including many local residents. **February 27 2003**: First trip to Glamis's San Martin gold mine in Honduras with people from corporation of San Miguel. **March 2003:** Montana begins to distribute flyers about the project. Scope of distribution unknown. **March 2003:** Anthropological study conducted of three communities: San Jose de Ixcaniche, San Jose de Nueva Esperanza, and Agel. **April 2003:** • Participatory Diagnostic Studies conducted of three directly affected towns in San Miguel. • Preliminary EIA submitted to MARN and given feedback with requirement of social impact assessment and disclosure stipulations. **May 2003:** Series of meetings in Sipacapa about exploration in Poj and Pie de la Cuesta, for the

Project Stage	Time period	Activity
		Clio concession. **Summary before June 2003:** 13 recorded CRG meetings held with 963 participants, principally in three local communities in San Miguel. Meetings also held with workers and with two other communities.
Prior to Approval of ESIA and during land purchasing; exploration of Clio areas in Sipacapa.		**June 1, 2003:** First recorded open public meeting in San Miguel municipal building. **June 2003:** Final ESIA submitted to MARN. **June-August 2003:** Soil sampling in the Poj area occurs with presence of auxiliary mayors. **June 20, 2003:** First recorded site visit by Municipal Corporation of San Miguel. **June 24, 2003:** First recorded meeting in Tzalem, Sipacapa. **June 27, 2003:** • Disclosure of full ESIA in MARN offices in San Marcos and Guatemala City for 20 business days; announcement run one day in regional newspaper. • Radio announcements in Mam and Spanish run three times a day for seven days (until July 3, 2003) about EIA availability in San Marcos and Guatemala. • One person reported to have reviewed document in Guatemala City. **Unknown date:** MARN reports people from Sipacapa visit MARN office in San Marcos to inquire about the project and environmental impacts**.** **June 2003:** EAP completed. Disclosure on IFC website in March of 2004. Local disclosure unknown. **July 3, 2003:** First recorded visit of Sipacapa municipal corporation and other representatives to mine site. **July 8, 2003:** First recorded meeting with general public of Sipacapa in the municipal building. **Various dates July 2003:** First concerns about environment and cyanide specifically recorded in San Miguel and Sipacapa. **August 26 2003:** The MEM and the MARN visit the site with some local representatives and civil society leaders of San Miguel.

Project Stage	Time period	Activity
		Unknown date in August/September: ESIA and executive summary recording in Mam delivered to Montana offices in San Miguel and San Jose de Nueva Esperanza. First presentations made in communities in October (see below). Project documents delivered to municipal offices in February 2004 (see below). **September 8 2003:** Municipal act signed by San Miguel Mayor and approximately 30 representatives from villages in San Miguel expressing support for the project. The minutes of the meeting discuss the ESIA, reforestation, mitigation of environmental impacts and provision of benefits for the communities. This municipal approval is apparently a requirement for MARN approval of the ESIA. **September 12, 2003:** MEM grants Montana a license for exploration for Clio I on and for Clio II. Public disclosure of license granting unknown. **Sept 18 2003:** Municipal act signed by Sipacapa mayor and 5 council members expressing support for the project. The minutes of the meeting state that the project will benefit the community of Tzalem and roads and infrastructure in Sipacapa but does not specifically mention the ESIA. This municipal approval is apparently a requirement for MARN approval of the ESIA. **September 29, 2003:** MARN approves ESIA. **June 2003- Sept 2003:** • Meetings by the CRG reported to have been to some extent about the ESIA and other issues of community concern: 30 meetings in San Miguel, 17 meetings in Sipacapa. • Total CRG meetings during this time period: 61 meetings with 3654 people. • CRG-led site visits during this time period: 13 visits with people from San Miguel, 4 visits with people from Sipacapa. **Summary February 2003 - September 2003**: 74 meetings with 4617 people recorded by CRG. The vast majority of these meeting are held in San Miguel.
Prior to approval for exploitation license and during and purchasing and exploration in other areas (la Hamaca, Los Chocoyos)	2003/2004	**October 2003:** MEM issues an edict in newspaper (about exploitation license solicitation. 30 day objection period starts. No objections received. **October 13-15 2003:** Video about the mining process, the executive summary of the EIA in Mam and diagrams of various stages of the mining project were first presented by Montana in San Jose de Nueva Esperanza, San Jose Ixcaniche and Agel (San Miguel).

Project Stage	Time period	Activity
		November 17 2003: First public announcement on internet against the project. First record in project documents of resistance from Sipacapa attendees to general meeting. **November 27 2003:** • MEM grants Montana 25-year exploitation license for current project. • MEM grants Montana an exploration license to Montana for Marlin I. Public disclosure of license granting unknown. **Unknown date:** Initital exploration in La Hamaca area begins. **Summary September -November 2003:** CRG records 5 community meetings attended by 595 local residents.
Prior to beginning of construction and during land purchasing, exploration in Marlin II area	Nov 2003-May 2004	**January 9, 2004:** MEM grants Montana an exploration license for Marlin II area. Public disclosure of license granting unknown. **February 2004:** Disclosure of full ESIA locally in San Miguel and Sipacapa municipal buildings. **February 2004:** First recorded protest event against the Marlin mine in Sipacapa. **February 24 2004:** Three documents completed by Montana and submitted to IFC: • Indigenous Peoples Development Plan (IPDP) • Public Consultation Disclosure Plan (PCDP) • Land Acquisition Procedures document (LAP) **March 24, 2004:** IPDP, LAP, IPDP, ESIA executive summary make available in English in World Bank Infoshop. **March 26, 2004:** IPDP, LAP, IPDP, made available in Spanish San Miguel and Sipacapa municipal offices. **March 29 2004:** Discussions between CRG staff and some La Montanita community members about conducting perforations for exploration of Los Chocoyos deposit. **March 2004:** “Compliance of Marlin Project with ILO 169” document completed in Spanish. Local disclosure status unknown. **May 2004:** Mine Construction begins.

Project Stage	Time period	Activity
During construction, land acquisition, and acquisition of the right of way for the power line	May 2004-Current	**June 3, 2004:** World Bank Board approves IFC loan for Marlin project. **June 2004:** Perforations for Los Chocoyos exploration had been planned in Pie de la Cuesta. Access denied to Montana by at two property owners. **July 19 – 21 2004:** Montana holds a seminar program on mining in Guatemala City for the Guatemalan MEM, MARN, various universities and CALAS (a Guatemalan environmental non-governmental organization). **July 28, 2004:** Montana holds an informational meeting in San Marcos city (department capital) with representatives from the municipality, NGOs, and government agencies. **September 2004:** EIA for the construction of the 27km power line from the town of Tejutla to the Marlin I project completed. **September 3, 2004:** Newspaper add run in national newspaper announcing availability of power line EIA in at MARN offices in Guatemala city and 20-day comment period. **October 26 2004:** ESIA of power line approved by MARN. **December 2004**: Independent Vigilance Committee for Mining (*Comisión de Vigilancia Independiente de la Minería)* initial visit to mine site. **January 2005:** Land purchasing for the 5km^2 mine site is essentially completed, though according to company some non essential purchasing continues within and outside of Marlin project boundaries. **April 8 2005:** Entre Mares is granted a six-month reconnaissance license for an area of approximately 500km^2 around Marlin I and Marlin II concessions, spanning San Miguel, Sipacapa, Comitancillo, Concepcion and other municipalities. **April/May 2005:** Acquisition of the right of way for the 27 km powerline completed. **May 3, 2005:** Posting on the Glamis website.of environmental documentation, including • The 2004 Annual Monitoring Report prepared for the IFC. • The 2004 third party environmental audit and review. • The second (2004) independent board review of dam safety. **May 5 2005:** First quarterly monitoring report for 2005 presented to MARN and some civil society

Project Stage	Time period	Activity
		representatives in Guatemala city. **May 10 2005:** • Spanish version of the 2004 AMR posted on the Glamis website. **May 2005:** Montana submits ESIA for La Hamaca. MARN conducts site visit. **From February 2003 thru June 2005:** • 111 CRG meetings in San Miguel with 7632 attendees. • 82 CRG meetings in Sipacapa with 4325 attendees. • Total of 193 CRG meetings with 11,957 attendees. • 190 visits by 3,329 people led by CRG to the mine site. • Montana leads 14 visits to Glamis's San Martin mine in Honduras, for 126 national and local Guatemalan leaders.

ANNEX B - INDEPENDENT CONSULTANT REPORT

Water Quality Concerns at Mining Sites: Some Questions and Answers

Prepared for: Compliance Advisor/Ombudsman Office of the IFC and MIGA
Prepared by: David Atkins, Independent Consultant [4]
Date of draft completion: July 12, 2005
Date of finalization: August 31, 2005

1.0. Introduction and General Considerations

Water quality at mining sites is influenced by a number of natural and human-caused factors. When assessing impacts from mining sites, it is important to consider how these factors can influence water quality as well as the types of mining activities that can influence water quality. Water quality at a specific mining site can then be evaluated in comparison to a pre-mining baseline so that impacts can be assessed.

1.1 Natural influences on water quality

Under natural conditions, the quality of water in streams is affected by the chemical composition and chemical and physical weathering of bedrock and soils. Natural physical processes that can degrade water quality include erosional processes such as landslides, stream bank collapse, and runoff-induced erosion of topsoils and subsoils. These processes introduce sediment into surface waters, discoloring streams and rivers, and adversely affecting aquatic life. Sediment inputs can increase water turbidity (decreasing the clarity of the water) and concentrations of iron, aluminum, and other naturally occurring metals. When mineralized soils and highly altered clays are eroded, concentrations of metals carried in suspended and dissolved sediments can be elevated.

In areas where rocks are highly altered and naturally mineralized, chemical weathering can produce water with naturally high concentrations of metals and naturally low pH. The oxidation of sulfide minerals present in bedrock can form natural acid drainage. Acid drainage is formed by a series of geochemical and microbial reactions that is initiated when water and oxygen come in contact with pyrite (an iron-sulfide mineral), certain other metal sulfides, and certain metal salts. If the rocks that surround the acid-producing minerals do not have sufficient buffering capacity (the ability of rocks or minerals to neutralize acid), acidic metal-rich drainage can form, potentially adversely affecting surface waters.

---

[4] David A. Atkins is a consulting hydrologist and environmental scientist with 15 years of experience. He has conducted numerous evaluations of the effects of mining on water resources in North, Central and South America. He recently managed a large-scale investigation of water issues related to the Yanacocha gold mine in northern Peru. This work involved collecting, analyzing and interpreting field data, hydrologic modeling, and presenting methods and results to a diverse group of interested parties (including citizen, university and industry groups, government agencies, and non-governmental organizations). His areas of expertise include: surface and ground water hydrodynamics and modeling; metals, organic compound and nutrient fate and transport; sediment transport; effects of hard rock mining on water quality and quantity; environmental impact assessment for extractive resource projects; and stakeholder engagement and conflict resolution though independent technical assessment. Mr. Atkins holds an MS in water resources and environmental engineering and an MS in physics, both from the University of Colorado at Boulder, and a BS in physics and mathematics from the University of Missouri at Columbia.

1.2 Non-mining human influences on water quality

Human land uses can accelerate natural rates of chemical and physical weathering, and can have adverse affects on water quality. Construction and disturbances that remove vegetation that stabilize soils, including, in particular, road building and agriculture, increase erosion and sediment loading in streams. Streambed mining for gravel and cobble destroys stream structure, mobilizes fine sediments, and creates an unstable river channel. Dumping of wastes, including oils, solvents, and domestic and industrial wastes, and washing in streams introduce potentially toxic chemical and biological pollutants to surface waters. Untreated human and livestock wastes introduce bacteria and other potentially harmful microorganisms to streams via runoff and direct discharge.

1.3 Mining-related influences on water quality

Mining-related processes that can influence surface water quality include physical disturbances and removal of vegetation that increase erosion of soils and sediment loading to streams. Construction of mine roads, pits, tailings impoundments, waste rock dumps, and processing facilities involves removal of topsoil and subsoil. The topsoil and subsoil is typically stockpiled for future use in reclamation. Disturbed areas and stockpiles at the mine are highly susceptible to erosion, and serve as sources of runoff and sediment loading to surface waters.

Chemical changes in water quality related to mining can result from discharges of treated and untreated process and waste water (including cyanide process water as described below), and runoff and seepage from mine facilities. In addition, formation of acid drainage and the rate of geochemical reactions such as pyrite oxidation are enhanced by mining activities. The increased reaction rate is a result of greater exposure of acid generating materials to air and water as rocks are broken in the mining process. If waste rock and tailings do not contain enough carbonate minerals or other types of buffering material, acid drainage generated in waste rock dumps is not neutralized, and water that seeps through waste rock is likely to be acidic with elevated metal concentrations. Similarly, exposure of sulfide minerals in open pits that intersect groundwater or have surface runoff can result in the formation of acid water.

Gold mines often use cyanide to remove gold from ore. Cyanide process solutions are typically treated so that the cyanide concentration is below a specified level before discharge to natural watercourses. Because cyanide is a highly toxic substance, its use at mining sites receives much attention.

The remainder of this document will answer several questions concerning mining and water quality.

2.0 Question: Does the use of cyanide in mining pose a risk to human and environmental health, and where and why is it banned in some places?

2.1 Cyanide use in the mining industry

Cyanide is a general term for a class of chemicals that contain a single carbon and single nitrogen (CN^-). Cyanide compounds occur naturally in organisms such as plants, insects and algae. Cyanide compounds are also produced in chemical plants for use in pharmaceuticals, and metal finishing and is a common raw material for the production of nylon and other plastics, fertilizers, and herbicides. Less than 20% of the total cyanide manufactured globally is used in the mining industry (Logsdon et al. 1999). The United Nations Environment Programme states that as of the year 2000, “Of the current 875 gold- and silver-mining operations, about 460 use cyanide (as sodium cyanide) to extract the metal. About 37% is used for conventional cyanidation, heap leaching about 15%, and other methods about 48%” (UNEP 2000).

The cyanide process was first used for mining in the late 1800s. Currently, cyanide is used in mining to extract gold and silver, often from low-grade ores. Due to its efficiency and low cost, cyanide leaching is now the preferred method for gold extraction (Logsdon et al. 1999). Starting in the 1970’s, refinement of the cyanide process together with the development of larger earth moving equipment allowed the mining of large-scale, low-grade gold deposits that were previously uneconomical. Modern gold mines are often open pit and generate large volumes of non-economic waste rock, spent ore on leach pads for heap leach operations and tailings for vat leach operations. The waste rock, ore, and tailings can contain sulfide minerals, generate acid drainage, and can cause a concern for surface and groundwater resources.

Cyanide is transported to a mine site in solid form as sodium cyanide. A dilute (100 to 500 parts per million) cyanide solution is formed by mixing sodium cyanide with water. This solution is put in contact with ore through vat (in a contained vessel) or heap (in a lined pile of ore) leaching. Cyanide leaches gold and other metals from the ore by forming a water-soluble complex called the pregnant solution. Gold and other metals are removed from this solution via a variety of metallurgical techniques and the barren solution is recycled for further leaching after the concentration of cyanide is brought back up to the optimum concentration for the process. Under normal operating conditions, cyanide is released to the environment in a controlled way through the discharge of tailings slurry for a vat leach process or through the release of excess water for a heap leach process.

2.2 Cyanide chemistry and toxicity

Cyanide can be present in several forms in water. Free cyanide is composed of the cyanide ion (CN^-) that forms when sodium cyanide is made into a solution as well as hydrogen cyanide (HCN) that forms in the solution. These forms of cyanide are the most toxic but they are also easily removed from water via volatilization or oxidation to the less toxic cyanate (OCN^-). Cyanide also forms weak and strong complexes with metals. Weak complexes form with cadmium, copper, nickel, silver and zinc. In analytical terms, these compounds are called “weak acid dissociable,” or WAD, and can dissociate under mildly acidic conditions to form the more toxic free cyanide. Strong complexes form with iron, cobalt, mercury and gold. These complexes do not dissociate readily to form free cyanide and are not considered to be toxic. Strong cyanide complexes do not break down readily in natural environments (Logsdon, Hagelstein and Mudder, 1999)_and have been found to persist for more than 25 years at former mining sites (Moran, 1998)..

Mine sites typically analyze for free cyanide, WAD cyanide and total cyanide (total cyanide includes free, WAD and strong complexes). The concentrations of breakdown products such as cyanate and thiocyanate are seldom measured but are generally considered to be much less toxic than free cyanide (although chronic toxicity data is limited; Lanno and Dixon 1996). In some instances, WAD cyanide measurements have been below discharge limits for mine process water, but cyanate and/or thiocyanate concentrations in the process water have been above levels that may be toxic (Moran 2002).
Cyanide degrades rapidly in the environment to less toxic compounds and does not accumulate (it generally does not cause chronic effects on living organisms that come into contact with it).

This means that if animals, fish or people come into contact with cyanide and live, there are typically no long term health effects.

2.2.1 Cyanide and human health

Cyanide is toxic to humans and mammals because it binds to iron-containing enzymes required for cells to use oxygen. The tissues are then unable to take up oxygen from the blood, resulting in suffocation. Cyanide is an acute toxin and does not accumulate or biomagnify. People generally recover fully shortly after a single sub-lethal exposure.

It is important to consider the type and duration of exposure when considering the effects of cyanide on human health. Humans can be exposed to cyanide in air through inhalation, in water or food through ingestion, or in air and/or water through absorption through the eyes and skin. Exposure can be from a single incident (acute if the incident concentration exceeds a safe threshold) or from repeated exposure (chronic).

The United States Environmental Protection Agency has specified a Maximum Contaminant Level (MCL) for drinking water of 0.2 mg/L (no specification of type but generally interpreted as WAD; USEPA 2005a). EPA specifies that: “lifetime exposure at levels above the MCL [could cause] weight loss, thyroid effects, [and] nerve damage.” The World Health Organisation (WHO) has specified a maximum concentration of 0.07 mg/L in drinking water, though the WHO does not specify the type of CN to which this standards applies (http://www.who.int/water_sanitation_health/dwq/guidelines/en/index.html).

Cyanide use at modern gold mining sites is not likely to lead to human health problems or death. A search of nearly 100 years of accident records in Australia, Canada, New Zealand and the United States revealed only three deaths at facilities that use cyanide, only one of which could be directly attributable to exposure during gold recovery (Logsdon et al. 1999).

2.2.2 Cyanide and waterfowl

The concentration in ponds containing cyanide process water such as tailings impoundments must be kept below a level that would be lethal to waterfowl landing on the ponds. Generally, concentrations of WAD cyanide below 50 mg/L in process solution ponds are considered to be protective of waterfowl (Mudder and Botz 2001; Logsdon 1999; USEPA 2005c). This value is also specified by the World Bank (World Bank 1995). The European Union has proposed reducing the allowable concentration of WAD cyanide in tailings ponds to 10 mg/L over a ten-year period, but this proposal has not yet been approved (see section 2.5 below).

2.2.3 Cyanide and aquatic life

Aquatic organisms are much more sensitive to cyanide than humans or waterfowl. The US EPA has established the following criteria for free cyanide in water (USEPA 2005b):

- Acute toxicity: 0.022 mg/L
- Chronic toxicity: 0.0052 mg/L.

Although cyanide itself does not cause long term problems for the environment (because it does not bioaccumulate or biomagnify), it complexes readily with heavy metals, so a release of cyanide solution can also contribute persistent toxins such as cadmium, copper, silver and zinc that can effect downstream receptors such as fish.

2.3 Types of mining accidents involving cyanide

A number of incidents have occurred that have lead to unplanned releases of cyanide at gold mining sites. These incidents fall into several categories including tailings dam breaks, release into the environment as a results of malfunction of the solution containment and recycling system, unexpected climatic event resulting in unplanned discharges, and accidents during transportation.

Common factors in all of these incidents are poor handling, improper engineering design and insufficient contingency backup systems to ensure that cyanide is not released to the environment. More complete lists of accidents are presented in Mudder and Botz 2001.

The greatest risk in mining is failure of tailings facilities to contain water and/or solids deposited in the facilities. The Commission of the European Communities reports that: "Since 1975, tailings storage facility failures have accounted for around three-quarters of all major mining-related environmental incidents worldwide" (CEC 2003).

According to the United Nations Environment Program review of 25 years of data on cyanide use in mining (UNEP 2000), "In gold mining incidents (of cyanide release), the main causes were: tailings dam failures (43%); dam overtopping (29%); pipeline failures (14%) and transportation accidents (14%)."

2.4 Cyanide regulation in the mining industry

The World Bank has established guidelines for cyanide use in open pit mines as follows:

"The following are recommended target guidelines for discharges below which there is expected to be no risk for significant adverse impact on aquatic biota or human use. In no case should the concentration in the receiving water outside of a designated mixing zone exceed 0.022 mg/l [the USEPA acute aquatic life limit for free cyanide].

Free Cyanide 0.1 mg/l
Total Cyanide 1.0 mg/l
Weak Acid Dissociable 0.5 mg/l

Measures to prevent access by wildlife and livestock are required for all open waters (examples tailings impoundments and pregnant leach ponds) where WAD cyanide is in excess of 50 mg/l. "

The mining industry and the United Nations Environment Programme are in the process of developing the International Cyanide Management Code (the ICMC ; http://www.cyanidecode.org). The ICMC is a voluntary program to which mining companies become signatory. It establishes "principles and standards of practice" for all phases of use, including production, transportation, handling and storage, operations, and decommissioning. It also establishes principles for worker safety and emergency response. Companies that are signatory agree to have an independent third party perform an audit according to a verification protocol. The code and the auditing procedures are currently under development and the principles do not establish specific limits on cyanide exposed or released to the environment.

2.5 Cyanide bans

Several national and local governments have considered bans on the use of cyanide in open-pit mining. In the United States, such bans have been proposed in the states of Colorado and Wisconsin and have been implemented in Montana and several counties in Colorado. Bans have also been proposed or implemented in the Czech Republic, Germany and Costa Rica, although the current status of actual and proposed bans in these countries is unclear. The Territory of New South Wales in Australia has considered a cyanide ban and a province in Argentina passed a moratorium on cyanide use in mining. Both of these initiatives were intended to stop specific projects.

The “Berlin Declaration” is often cited in support of cyanide bans. The declaration was prepared by a group of scientists (Prof. Dr. Paul Muller, Prof. Dr. Friedhelm Korte and Petra Sauerland) in October 2000 (after the Baia Mare accident in Romania). The declaration states: “Considering economics, water conservation, chemical and protection of nature, gold mining using cyanide in the open field under German and EU law is not authorized.” It is often interpreted from this statement that cyanide use in gold mining is banned in Germany and the European Union. Based on a review of current EU and German regulation, the statement is a recommendation rather than a reflection of legal requirements applicable to cyanide use in the European Union and Germany. The EU, in a 2003 draft Directive on the Management of Wastes from the Extractive Industries, has proposed a phased-in reduction in the allowable concentration of WAD cyanide in tailings ponds from 50 mg/L to 10 mg/L in two steps over a 10-year period after acceptance of the Directive (CEC 2003). The proposal is currently being evaluated by the European Parliament and Council (see http://europa.eu.int/comm/environment/waste/mining/ for updates).

Because the ban in the State of Montana is frequently cited and has effectively stopped the development of new cyanide process mines in the state since 1998, the remainder of this section will focus on this ban.

2.5.1 The State of Montana, United States

The State of Montana in the United States has one of the longest standing cyanide bans (implemented in 1998). This ban is also unusual in that Montana has a long mining legacy. Mining both contributed to the economic growth of the state and degraded land and rivers, as exemplified by the 120-mile long Clark Fork River Superfund site. To help understand the purpose and intent of other bans, the circumstances around this ban are explored below.

Two factors led to the referendum in Montana to ban cyanide use that was enacted after a statewide election in 1998. First, with gold prices at near-record lows, Pegasus Gold declared bankruptcy in 1998 and closed its mines in Montana, leaving the state to assume the responsibility for cleanup. The Pegasus-owned Zortman-Landusky mine began operation in 1979 and was one of the first large-scale cyanide process heap leach mines in the United States. Environmental problems at the site included cyanide solution that entered surface and ground water from leaks in heap leach liners and acid drainage problems. Currently, Montana Department of Environmental Quality personnel state that cyanide is no longer a problem at Zortman-Landusky, but rather acid rock drainage will require perpetual water treatment that will have to be funded by the state. The failure of Pegasus mobilized a large movement against gold mining in Montana.

The second factor contributing to the ban was the proposed development of the Seven-Up Pete/McDonald project near Missoula. The mine was to be located near the Big Blackfoot River, an important and revered recreational resource in the state. A coalition of environmentalists and recreational users mobilized to stop the mine through the cyanide ban and were successful. An industry-led effort to overturn the ban (spearheaded by Canyon Resources, the Seven-Up Pete/McDonald Project proponent) failed in the statewide general election of November 2004 and the ban remains in place.

The boom and bust legacy that has historically plagued mining and that led to the bankruptcy of Pegasus Gold led to skepticism in the general population about the industry. This factor, added to the clash between the traditional economy that relies on resource extraction and an emerging new economy that relies on environmental quality for recreation, created the atmosphere that led to the statewide referendum. Ultimately, the cyanide ban appears to have been a means to stop the project on the Big Blackfoot River that some people viewed as enabling a process (cyanide leaching) that could result in the degradation of another river by hard-rock mining.

2.6 General Conclusions: Cyanide use in Mining

Cyanide is the chemical reagent of choice for the gold mining industry largely because it has enabled the economic mining of large-scale, low-grade ore deposits. It is also a controversial industrial chemical because it is a highly toxic substance and has resulted in a number of well-publicized environmental disasters when it has been accidentally released.

As mentioned previously, accidents at mine sites involving cyanide tend to be related to transportation, failure of the solution containment system in the processing circuit, or release of solution from or failure of tailings dams. These types of accidents have a very low probability of leading to the loss of human life, but can have a catastrophic effect on the downstream environment, and, in some instances, spills have devastated aquatic life in the receiving stream.

International agencies have acknowledged the risk from cyanide use in mining and have implemented several review processes and initiatives to ensure that it is safely used and disposed of, including the United Nations Environment Programme review of cyanide in mining and the creation of the International Cyanide Management Code (ICMC). When fully implemented, mining companies that subscribe to the ICMC will be subject to rigorous auditing to ensure safe use.

To ensure that cyanide is safely used at mine sites, it is essential to have detailed management plans with careful implementation, and contingency procedures that limit risks in transport, handling, use in the mining circuit and disposal. If procedures are properly implemented, the risk from cyanide to human health and the environment can be minimized.

3.0 Question: What is the risk to human health and the environment from acid rock drainage?

If mining activity causes rocks that contain acid producing minerals such as pyrite (an iron-sulfide mineral), certain other metal sulfides, and certain metal salts to be exposed to air and water, it can create a risk of acid rock drainage. This risk can be eliminated or mitigated through proper management of the acid rock such as mixing it with neutralizing material.

If the acid drainage generated in tailings and waste rock dumps is not neutralized, water that seeps through these materials can become acidic with elevated metals concentrations.

Similarly, exposure of sulfide minerals in open pits and underground workings can result in the formation of acid water with elevated metals concentrations.

Acid and metals resulting from ARD could have negative impacts on downstream users of surface and ground water such as human consumption, agriculture, irrigation, or aquatic life. The distance that this effect would span downstream depends on the concentrations of the contaminant and the flow rate of the surface or groundwater receptor.

4.0 Question: What other contaminants can affect human health and the environment?

Besides cyanide and metals associated with acid rock drainage as described previously, other compounds that can pose a risk to human and environmental health, include nitrates and ammonia that result from blasting and cyanide destruction and elements that are mobile at neutral pH such as arsenic, molybdenum and selenium. Arsenic, molybdenum and selenium are mobile in the environment, at neutral pH and, thus, are a concern even when acid rock drainage is not a concern.

5.0 Question: Can sedimentation adversely affect drinking water and harm aquatic life?

In general, sedimentation can affect aquatic life, whether the water can be used for certain human uses, and the intakes for irrigation channels. If sediments contain suspended solids that are harmful to human health, they pose an additional risk. Total metals in unfiltered samples are associated with sediments and these can cause human health concerns if raw, unfiltered or untreated water is consumed.

6.0 References

Botz, M.M., 2001. Overview of Cyanide Treatment Methods. *Mining Environmental Management*, Mining Journal Ltd., London, UK, pp. 28-30, May 2001.

The International Cyanide Management Code. http://www.cyanidecode.org.

Lanno, R.P. and D.G. Dixon. 1996. Chronic Toxicity of Waterborne Thiocyanate to Rainbow Trout. (*Oncorhynchus mykiss).* Canadian J. Fish. Aquat. Sci. **53:** 2137-2146.

Logsdon, M.J., K. Hagelstein, and T.I. Mudder. 1999. The Management of Cyanide in Gold Extraction. Prepared for the International Council on Metals and the Environment, Ottawa, Ontario, Canada.

Minerals Council of Australia (MCA). 2005. Fact Sheet: Cyanide Destruction Processes.

Moran, R.E. 1998. Cyanide Uncertainties: Observations on the Chemistry, Toxicity, and Analysis of Cyanide in Mining-Related Waters. Prepared for the Mineral Policy Center, Washington, DC.

Moran, R.E. 2002. De-coding Cyanide: An Assessment of Gaps in Cyanide Regulation at Mines. Submission to the European Union and the United Nations Environment Programme.

Mudder, T. I. and M. Botz. 2002. A Global Perspective of Cyanide. www.mineralresourcesforum.org/initiatives/cyanide/docs/mudder.pdf.

Muller, P, F. Korte and P. Sauerland. 2000. International Meeting on the effects of the cyanide mining gold recovery process on the ecology and humanity. Berlin. www.uni-trier.de/~biogeo/pdf/Berlin-Deklaration.pdf

Pincock, Allen and Holt (PAH). 2001. Financial Implications in Tailings Dam Management. From Pincock Perspectives Issue No. 24.

Commission of the European Communities (CEC). 2003. Proposal for a Directive of the European Parliament and of the Council on the Management of Waste from the Extractive Industries. Brussels, Belgium.

United Nations Environment Programme (UNEP) with assistance of the International Council on Metals and the Environment (ICME). 2000. A Workshop on Industry Codes of Practice: Cyanide Management. Paris, France.

United States Environmental Protection Agency (USEPA). 2005a. Ground Water and Drinking Water Fact Sheet: Cyanide. http://www.epa.gov/safewater/contaminants/dw_contamfs/cyanide.html

United States Environmental Protection Agency (USEPA). 2005b. Water Quality Criteria for the Protection of Aquatic Life. http://www.epa.gov/waterscience/criteria/wqcriteria.html

United States Environmental Protection Agency (USEPA). 2005c. Overview of State Regulatory Requirements. www.epa.gov/superfund/programs/aml/policy/app_e.pdf

World Bank. 1995. Environment, Health and Safety Guidelines: Mining and Milling – Underground. http://www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines

ANNEX C - INDEPENDENT CONSULTANT REPORT

Review of Water Quantity and Quality Issues and the Tailings Storage Facility at the Marlin Mine Site

Prepared for: Compliance Advisor/Ombudsman of the IFC and MIGA
Prepared by: David Atkins, Independent Consultant[5]
Date of draft completion: 14 July 2005
Date of finalization[6]: August 31 2005

1.0 Introduction

This review focuses on potential mine effects on water quantity and quality (including the coverage of baseline monitoring sites). It also discusses the design and construction of the waste rock facility (WRF) and the tailings storage facility (TSF). Sources used for this review are listed below. They have been produced by Montana Exploradora de Guatemala, S.A. (MEG) and three consulting firms: Consultoría Técnica Ambiental (CTA), SRK Consulting (SRK) and Marlin Engineering and Consulting, LLC (MEC). Several critical documents (such as the waste rock facility feasibility design report and the tailings facility design report) were not publicly available when this assessment was prepared and were provided to the CAO and its independent reviewer by the company upon the CAO's request.

The currently permitted Marlin Project has a 10-year mine life, during which it is expected to produce 250,000 ounces of gold per year. The mine area encompasses two micro basins, the Rio Tzala (covering an approximate land area of 60 km^2) and Riachuelo Quivichil (33 km^2). The Virginia fault runs parallel to a ridge that separates the two micro basins and inhibits circulation of water between the two basins (CTA 2003). Mine facilities include two open pits (the Cochis and Marlin pits), underground workings, mill and plant facilities, a tailings storage facility (TSF), and a waste rock disposal facility (WRF; MEC 2005a). Mine facilities straddle a divide between the Rio Tzala and the Riachuelo Quiviquil, two tributaries of the Rio Cuilco. The Marlin pit and underground workings and the Cochis pit are primarily in the Rio Quivichil basin (personal communication from MEG). The milling and processing facilities, and waste rock and tailings facilities are in the Riachuelo Quivichil basin (inferred from design drawings in MEC 2005a)

[5] David A. Atkins is a consulting hydrologist and environmental scientist with 15 years of experience. He has conducted numerous evaluations of the effects of mining on water resources in North, Central and South America. He recently managed a large-scale investigation of water issues related to the Yanacocha gold mine in northern Peru. This work involved collecting, analyzing and interpreting field data, hydrologic modeling, and presenting methods and results to a diverse group of interested parties (including citizen, university and industry groups, government agencies, and non-governmental organizations). His areas of expertise include: surface and ground water hydrodynamics and modeling; metals, organic compound and nutrient fate and transport; sediment transport; effects of hard rock mining on water quality and quantity; environmental impact assessment for extractive resource projects; and stakeholder engagement and conflict resolution though independent technical assessment. Mr. Atkins holds an MS in water resources and environmental engineering and an MS in physics, both from the University of Colorado at Boulder, and a BS in physics and mathematics from the University of Missouri at Columbia.

[6] Annex C was provided for factual comment with the CAO confidential draft assessment report to parties involved in the CAO complaint. MEG was the only reviewer to make factual comment on this Annex.

The project sponsor has indicated that it will expand mining operations within the Marlin district to the La Hamaca deposit, and the Environmental Assessment (EIA) is currently under review by the Ministry of Environment and Natural Resources (MARN). The La Hamaca EIA has not been reviewed as part of this assessment. However, the need to address cumulative impacts from mine expansion is briefly examined.

2.0 Baseline Monitoring

Surface water data have been collected monthly at five locations since July 2002 (CTA 2003; CTA 2004; MEG 2005c). Analyses include flow rate and sediment and water chemistry (including conventional parameters and total and dissolved metals). Sample locations include:

- SW1: Rio Tzalá, upstream of the Project, south of Agel;
- SW2: Rio Tzalá, downstream of the Project at the bridge Xejoj;
- SW3: Riachuelo Quivichil, upstream of the union with the Rio Cuilco;
- SW4: Rio Cuilco, upstream of the Riachuelo Quivichil;
- SW5: Rio Cuilco, water below the Riachuelo Quivichil.

For the 2004 quarterly monitoring, an additional site located on the Quebrada de las Colas, SW-8, (also called the Quebrada Seca in the TSF Design Report) was sampled for water quality (CTA 2004). In addition, the Environmental Monitoring Plan (MEG 2005c) lists an additional site (SW1-2: Rio Tzalá, near the Project) for monthly monitoring but does not list SW-8.

Aquatic biota samples, including fish and macroinvertebrates, are also collected semi-annually (twice a year) from five surface water sampling locations (SW-1, SW-2, SW-3, SW-4, and SW-5).

Groundwater quality is monitored at monthly at three wells for conventional parameters and metals (CTA 2003; MEG 2005c):

- MW2: West of the tailings impoundment and waste rock facility;
- MW3: North of the tailings impoundment and waste rock facility;
- MW4: North of the tailings impoundment and waste rock facility;

According to MEG personnel, another monitoring well was recently installed near MW3. In addition, 5 wells are installed near the tailings dam east embankment for extracting poor quality seepage and pumping back to the impoundment,if necessary. Monitoring well MW-4 was dry during the quarterly event of 2004 (CTA 2004).

3.0 Water Quantity

This section examines potential impacts to area water resources and discusses the extent to which the overall water balance and the two sources (the groundwater well and the TSF impoundment) have been characterized.

3.1 Overall Water Balance

During operation, Montana estimates that 50-70 L/s will be required for processing ore and making the tailings slurry (MEG 2005d; MEC 2005a). Water stored in the tailings impoundment is intended to meet 85% of this need through recycling tailings slurry water and collecting precipitation and runoff in the TSF catchment, with the remaining 15% (10.2 L/s) required for fresh water makeup supplied from a deep groundwater well (MEC 2005a). The ESIA discussed taking the 15% portion from the Rio Tzala (10 L/s would be approximately 25% of the dry season flow of the Rio Tzala in a low precipitation year). In May 2004, Montana changed the freshwater source from the Rio Tzala to well water.

The Tailings Dam Conceptual Design and Cost Estimate prepared by SRK in February 2003 contains the first documented reference to the assumption that 85% of the water required will come from the tailings impoundment (SRK 2003a). This report states that: "Process requirements will likely limit the maximum recycle rate from the TSF to 85%. This results in an assumed minimum 15% fresh water supply requirement." The water balance presented in the Tailings Facility Design Report (MEC 2005a) also assumes a maximum recycle rate of 85% from the TSF pool.

3.2 Groundwater Supply

3.2.1 The Groundwater Extraction Well

The mine has established two wells in the Rio Tzala basin (the production well PSA-1 and the adjacent monitoring well MW-9), An additional monitoring well (MW-7) was dry and never developed (MEG personal communication). Three monitoring wells were developed in the Riachuelo Quivichil basin (MW-2, MW-3, and MW-4; CTA 2003; MEC 2005a). Well logs have been provided for the monitoring wells (CTA 2003), and for the production well (MEC, SRK and Vector 2004). Both aquifers appear to be low permeability (~10^{-7} m/s), semiconfined, with flow predominantly in fractures (secondary permeability; CTA 2003).

As mentioned above, the mine plans to extract approximately 15% of its water needs or approximately 10 L/s (160 gallons/min) from a deep well in the Rio Tzala basin. The total depth of the well is 305 m, and the water has "geothermal characteristics" (MEC 2005b). This water is intended primarily to provide a fresh source of water for the ore processing and to fulfill freshwater needs for human use on the mine site (MEC 2005a). A 10-day pumping test was conducted in 2004 using a pump with a capacity of 250 gpm (16 L/s; MEC, SRK and Vector 2004; MEC 2005b). The yield of the aquifer was greater than the pumping rate so the transmissivity, storage capacity and specific yield of the aquifer could not be determined. The yield appears to be greater than the required pumping rate (10 L/s), indicating that the well can supply the flow required for operations. The temperature and chemistry data also suggest that the well is geothermal and distinct from the flow in the Rio Tzala during baseflow conditions (when river flow is likely to come from groundwater), indicating that the well pumps water from a hydrogeologic unit that is distinct from that of the river (MEC 2005b).

Production from fractured aquifers depends on the interconnectedness of the fracture network, and production from wells in these types of aquifers can decrease with time as the fractures are dewatered. It will be important to continually monitor the water level, temperature and chemistry in the production well to ensure that the characteristics of groundwater produced remain distinct from those of the Rio Tzala (MEC, SRK and Vector 2004; MEC 2005a).

3.2.2 Pit and Underground Workings Dewatering

The open pit and underground workings will have to be dewatered for mining. MEG estimates that the pumping rate from the pit will be between 5 and 25 L/s depending on the point in the mine life and the season (MEC 2005a). The majority of water pumped from the open pit is predicted to be from rainwater runoff to the pit.

To summarize, based on the data provided it appears that the production well PSA-1 can provide the required 10 L/s with minimal impact to surface water resources. Continuous monitoring of ground water conditions throughout the life of the mine will enable detection of any significant changes and is proposed in the monitoring plan.

3.3 Water Storage in the Tailings Storage Facility

The mine proposes utilizing the tailings storage facility (TSF) for two purposes:
to store tailings and to accumulate and store water that will be used for mine operations. The TSF is designed to provide 85% of total water recycle needs, primarily for ore processing. Water in the TSF comes from several sources: direct rainfall and runoff, water pumped from the open pits and underground workings, seepage from the waste rock dump and water sent to the TSF in the tailings slurry (about 60% water by weight; MEC 2005a). The TSF will be constructed using the downstream method. The height of the phase 1 starter dam is 50 m from crest (top) to downstream toe (bottom), while the second and third phases are 70 m and 80 m from crest to downstream toe, respectively (MEC 2005a).

The dam is designed to store the first two years of tailings and process-affected water before any water is released. After this period, the dam will be managed for “containment” with “a managed release” in the event of a storm during the rainy season. During the rainy season, the dam is designed for an average rate of release of approximately 300 L/s with the ability to release up to 1300 L/s maximum (to accommodate the 100-yr, 24-hour storm or 350 mm over a 10-day period; MEC 2005a).

The TSF Design Report (MEC 2005a) has a rudimentary water balance that relies on a series of simplifying assumptions, including:

1) All surface water runoff in the catchment will be captured in the impoundment
2) 80% of rainfall in the catchment becomes runoff
3) The tailings are 60% water by weight
4) After compaction, the water content of the tailings will be 37%
5) Seepage from the impoundment is negligible.

The tailings dam review report from 2004 (RGC 2004) calls for refined estimates of parameters that would help refine this series of assumptions, including: climate data (especially evaporation data), runoff coefficients, evaporation coefficients, entrainment/ retained moisture content, seepage losses, maximum recycle rate, and discharge feasibility. The TSF Design Report refines these parameters somewhat, but for the most part relies on the feasibility report estimates and parameters will be refined during operation (MEC 2005a). Parameters include:

- Dewatering from the pit and underground workings;
- Site specific climate measurements;
- Losses from the impoundment, including water entrained in the tailings material (the amount depends on the particle size and flocculation characteristics of the tailings);

- Evaporation;
- Consumptive use in the processing circuit;
- And seepage out of the impoundment.

The TSF Monitoring Report specifies monitoring systems that are designed to fill data gaps during the operational life of the TSF (MEC 2005a), and data from these systems will help refine water balance parameters.

The impoundment will be unlined, and thus it is important to evaluate seepage characteristics to protect downstream groundwater resources. In general, it is best if tailings impoundments are constructed on low permeability (hydraulic conductivity<$1X10^{-8}$ m/s) foundation materials (USEPA 1996). The upper, weathered bedrock underlying part of the impoundment has higher permeability than the above design criterion and thus the impoundment requires seepage control and collection. A grout curtain at the Main Dam and the low permeability east Saddle Dam are designed to control seepage. Five groundwater extraction wells near the east embankment and a downstream seepage collection pond are designed to collect any seepage bypassing the grout curtain (MEC 2005a).

Two models were developed to evaluate seepage conditions and collection requirements: a regional model using the code MODFLOW and a model of seepage through the embankment using SEEP-W (MEC 2005a). These codes represent the industry standard and although this review did not include a thorough analysis of model input parameters, calibration, sensitivity and predictive capabilities, model development and implementation appears adequate. The regional model was used to simulate seepage through the east and west ridges and through the base of the impoundment. Results indicate that the seepage rate from the impoundment is controlled by the underlying volcanic material and is likely to be low (less than 1 L/s) and have minimal impact on downstream receptors such as the Rio Cuilco. The embankment seepage model predictions indicate that seepage should be less than 0.2 L/s and collect in the seepage collection pond downstream of the impoundment dam.

Because the TSF is designed to collect runoff from a large catchment area, it will likely reduce flows in the downstream Quebrada Seca and Riachuelo Quivichil.

4.0 Water Quality

Mine features such as open pits, underground workings, waste rock dumps and tailings impoundments can affect water quality at the site in several ways:

1) Ground disturbance generates sediment and exposes fine-grained materials to the environment that can contaminate water;
2) Sulfide minerals in the walls of pits and underground workings, waste rock, and tailings will produce acid when exposed to oxygen and water, and this acid can mobilize metals from exposed surfaces that rainwater can leach into surface and ground water;
3) Process solutions entering the tailings impoundment can have elevated metals and cyanide concentrations.

There are three major water quality concerns for the site: erosion and sediment transport, acid rock drainage (ARD), and other constituents not related to acid rock drainage (principally cyanide, nitrogen compounds and metals that are mobile under neutralizing conditions).

4.1 Erosion

Procedures for limiting erosion and sediment movement are briefly addressed in the ESIA (CTA 2003). According to the 2004 Environmental Audit and Review (Dorey and Associates 2005), erosion problems have occurred during the construction phase. The Audit and Review discusses the need to identify areas subject to erosion and implement best management practices before the next rainy season. The report also discussed areas where sediment has reached natural channels and the necessity to stabilize or remove these sediments. These statements indicate that erosion control and sediment management at the mine has lagged during construction.

4.2 Acid Rock Drainage

The project will generate approximately 34[7] million tonnes of waste rock (38 million tons; SRK 2003c; MEC 2005a) and 14 million tonnes of tailings (MEC 2005a). The waste rock facility is at a higher elevation in the same drainage as the tailings storage facility. Project documents state that any poor quality seepage from the waste rock facility will be collected downstream in the tailings impoundment (although characterization and modeling to support this assumption are limited).

Environmental impact assessments for mine sites with the potential for ARD to affect water quality typically have three components: 1) static and kinetic characterization of mined materials, 2) geochemical and hydrologic modeling to predict impacts to receptors such as surface or groundwater and 3) an assessment of impact mitigation if necessary. Materials for testing are typically collected from exploration drill cores that are used to define metal contents of the resource. Static testing (sulfide and carbonate content and metals analyses) on drill cores is used to define the acid generating and neutralization potential (AP and NP, respectively) of the waste material and pit and underground workings surfaces. Tailings materials and decant water generated during pilot-scale metallurgy testing are also typically tested for environmental characteristics. Kinetic testing of these materials is used to evaluate weathering characteristics (oxidation of sulfide minerals) under simulated natural conditions. These tests were conducted for the project.

Acid-base accounting, total metals analyses (whole rock analyses), and kinetic test data are typically incorporated into a geologic block model for the mine that specifies geochemical characteristics of waste rock, tailings, and open pit and underground mine surfaces.

SRK prepared three reports to describe ARD characteristics of waste rock and tailings (SRK 2003b, 2004a and 2004b). In addition, the Tailings Dam Design Report (MEC 2005a) provides additional information on acid drainage characteristics. Of these reports, SRK 2004a and SRK 2004b are currently posted on the Glamis web site. The quantitative information in them was not provided in the ESIA. The Corrective Action Plan from the Environmental Audit and Review (Dorey and Associates 2004) states the acid rock drainage management plan will be developed as part of the Waste Rock Management Plan. This plan is scheduled for completion August 2005. A preliminary geologic block model for the site was prepared for the Waste Rock Characterizations and Feasibility Design report (SRK 2003c).

[7] MEG indicated during the comment period that the total mass of waste rock will be 43 million tons.

4.2.1 *Waste Rock Characterization*

Static tests were conducted on samples from the proposed open pit to characterize the acid/base accounting of waste materials, including (SRK 2003b, 2004a, and 2004b):

- 41 samples submitted for static testing using the modified Sobek method (a wet chemistry analytical technical that uses a series of reactions to determine the acid generating and acid neutralizing potential of waste).
- 135 samples for total sulfur, carbonate and metals using LECO (an analytical technique) for sulfur and carbon and ICP (an analytical technique) for total metals.

Samples were collected from oxide, transitional and sulfide zones in three sections through the pit (South, Center and North) up to a total depth of approximately 250 m. The number of samples collected (135 for LECO analysis) compared to the volume of waste (38 million tons) is sufficient for ARD characterization according to commonly used guidance (British Columbia AMD Task Force 1989). Samples were collected from each geologic unit that will be mined, but ARD characterization reports do not present the number of samples analyzed for each geologic unit (this information would be part of a geologic block model).

Results for acid base accounting using the Sobek and LECO methods correlate, indicating that the simpler LECO method can accurately predict ABA. The report states that the larger data set (the 135 samples) will be used to develop a block model of the open pit mine. Block models have the ABA and metals characteristics of each discrete block within the pit. A preliminary version presenting the spatial characteristics of ABA data only for each layer (bench) in the open pit is presented in the Waste Rock Characterization and Feasibility Design Report (SRK 2003c) and a final version will be presented in the Waste Rock Management Plan (to be finalized August 2005.

For the 135 sample set, the overall Neutralizing Potential (NP) was 40 kg $CaCO_3$/tonne of waste rock, and the Acid generating Potential (AP) was 11 kg $CaCO_3$/tonne of waste rock, indicating that on a bulk level, buffering exceeds acid generating potential. The overall NP/AP ratio was 3.6 (NP/AP is the ratio of neutralizing potential to acid generating potential). The State of Nevada specifies that if the NP/AP ratio is less than 3, further geochemical testing beyond static testing must be conducted. Although the overall NP/AP ratio for the site is greater than 3, some individual samples are potentially acid generating, indicating that waste will have to be handled carefully and may have to be blended to ensure that neutralizing potential is sufficient.

Of the 41 samples subjected to modified Sobek, 7 out of 41 (17%) were potentially acid generating (sulfide sulfur >0.05% and NP/AP <1), and 9 out of 41 (22%) were uncertain (sulfide sulfur >0.05% and 1<NP/AP<3). These results indicate that up to 39% of the samples are potentially acid generating (PAG). Of the 135 samples submitted for LECO sulfur and carbon, 15% were potentially acid generating and 13% were uncertain, indicating that up to 28% of the samples are PAG.

In addition, a subset of 6 of the 135 samples submitted for LECO testing was submitted for kinetic testing (humidity cell testing). The tests were conducted for a total of 20 weeks (the standard test duration). One sample was acidic at five weeks and according to the geochemical characterization report, “had very high aluminum, iron, cobalt, copper, nickel, and zinc concentrations” (SRK 2004a).

To summarize, 15-40% (depending on the type of test used and cutoff methods employed) of the total number of samples tested could be acid generating (PAG). Although project data shows that mined waste material has an overall excess neutralizing capacity, it will be important to identify and selectively handle any PAG material to ensure that ARD does not occur. Preliminary procedures are identified in the Waste Rock Characterization and Feasibility Design Report (SRK 2003c) and should be detailed in the final Waste Rock and Acid Rock Drainage Management Plan (which MEG reported has been competed in August 2005).

4.2.2 Tailings Characterization

The tailings report describes testing of 5 samples of tailings generated during mineralogical testing (A, B, C, 1 and 2; SRK 2004b; MEC 2005a). Overall sulfide sulfur ranged from 0.47 to 0.9%. NP/AP ratios ranged from 3.1 to 10.2 (values below 3 are a concern for acid drainage). Whole rock analyses show elevated Ag, As, Cu, Mo, Pb, and Zn. Pyrite content ranged from 1.5 to 2 %. Humidity cell tests show that samples are not acid generating, and test leachate also elevated Al, As, Se, Ag and Zn after the first flush. Samples 1, 2, and C were further evaluated to determine if the neutralizing ability (NP) of the rock will outlast the acid production ability (AP) of the rock under field conditions. Only sample C was borderline as to whether the NP would outlast the AP.

The supernatant (decanted water) from the tests was also evaluated. The supernatant had elevated sulfate, ammonia (likely resulting from cyanide destruction), Sb, Co, Cu, Hg, Mo, Se, Ag, and Zn. The cyanide concentration was <0.05 mg/L and most of this was in the WAD form.

The company has stated that it will monitor the quality of water in the tailings impoundment before discharge for two years and install an acid water treatment plant if necessary (MEC 2005a). In addition, the impoundment seepage modeling described previously indicates that the grout curtain and seepage collection system is adequate to protect downstream resources.

4.3 Cyanide and other Compounds

4.3.1 Cyanide[8]

The Marlin project proposes using the vat leach method for leaching gold-bearing ore with a cyanide solution concentration of 500 mg/L (CTA 2003). This method utilizes a closed circuit where, under normal operating circumstances, cyanide is exposed to the environment only in the tailings impoundment. The cyanide concentration in tailings water will be reduced (detoxified) by the INCO oxidation process (CTA 2003). This process introduces an SO2/air mixture to the slurry and oxidizes cyanide to the less toxic cyanate. Cyanate then further breaks down to ammonia and nitrate.

The tailings geochemistry report (SRK 2004b) states that the concentration of CN in the supernatant from the pilot testing is <0.5 mg/L, principally in the WAD from. The Tailings Dam Feasibility Study (SRK 2003a) estimates that cyanide destruction will decrease concentrations to less than 1 mg/L (presumably in the WAD from because they discuss copper complexation, but not stated). They estimate that this concentration will be diluted 2-3 times when discharge occurs.

[8] A further explanation of cyanide use in mining and associated risks can be found in Annex C of the CAO assessment report, “Water Quality Concerns at Mining Sites:Some Questions and Answers”

Montana and Glamis adhere to the principles of the International Cyanide Management Code (ICMC 2005) and have committed to meeting World Bank Guidelines for discharge (World Bank Pollution Prevention and Abatement Handbook 1998) as follows:

"The following are recommended target guidelines for discharges below which there is expected to be no risk for significant adverse impact on aquatic biota or human use. In no case should the concentration in the receiving water outside of a designated mixing zone exceed 0.022 mg/l [the USEPA acute aquatic life limit for free cyanide].

Free Cyanide 0.1 mg/l
Total Cyanide 1.0 mg/l
Weak Acid Dissociable 0.5 mg/l

Measures to prevent access by wildlife and livestock are required for all open waters (examples tailings impoundments and pregnant leach ponds) where WAD cyanide is in excess of 50 mg/l. "

Adherence to the provisions in the International Cyanide Management Code (ICMC), which Montana has committed to upholding, should ensure any risks from accidents occurring during transportation or from failures of the solution containment system are minimized. As explained in Annex B of the CAO assessment report, "Water Quality Concerns at Mining Sites: Some Questions and Answers", the ICMC and auditing process are still being finalized, and the ICMC principles do not establish specific limits on cyanide exposed or released to the environment. If concentrations of all forms of cyanide in the TSF pool at the Marlin site are at or below the projected concentrations of cyanide in water from the INCO process, then release to the environment in the event of an unforeseen discharge from the tailings impoundment should have minimal impact on the environment.

4.3.2 Ammonia and Nitrates
Nitrogen compounds are used in blasting at mine sites and are residual in waste rock and tailings. In addition, cyanide destruction produces other nitrogen-containing compounds. Ammonia is toxic to aquatic life, and nitrates are harmful to very young children if they drink the water. The Tailings Dam Review Board Report No. 2 (RGC 2005) states that ammonia is present in elevated concentrations in tailings water supernatant, indicating that nitrogen compounds in seepage and water released from the TSF may be a concern.

4.3.3 Elements Mobile Under Neutralizing Conditions
Elements that are mobile at neutral pH include arsenic, molybdenum and selenium. These elements can be a concern even when acid rock drainage is not a concern. Tailings solids analyses showed elevated arsenic and molybdenum, whereas the tailings supernatant water had elevated molybdenum and selenium. It will be important to determine if these elements and any others could be mobile under the neutralizing conditions expected at the site and whether the seepage collection system for the WRF and TSF is sufficient to collect any drainage that may occur.

4.4 The TSF Discharge and Downstream Uses

As described in Section 3.3, the TSF is designed to store water during the dry season and release an average 300 L/s during the rainy season, with the ability to release up to 1300 L/s maximum. Water from the TSF is discharged to Quebrada Seca (also referred to as "De las colas"), a small tributary to the Riachuelo Quivichil. To comply with World Bank Pollution prevention and Abatement Handbook guidelines for cyanide, it will be important to designate a mixing zone and a corresponding compliance point where the free cyanide level is below 0.022 mg/L (the prescribed concentration protective of aquatic life; World Bank 1995). Possible compliance point locations include the Quebrada Seca, the Riacheulo Quivichil, and the Rio Cuilco. Water quality at the compliance point should meet the World Bank guideline for cyanide to protect aquatic life as well as be protective of any other downstream beneficial uses (such as irrigation, livestock watering, and human consumption if applicable) after baseline water quality is taken into consideration.

Aquatic life assessments were conducted in the Riachuelo Quivichil (Station SW-3) and in the Rio Cuilco up and down stream of the confluence with the Quivichil (Stations SW-4 and SW-5, respectively) during the rainy season in September 2002, the dry season in February 2003, and the rainy season in September 2004. The 2002-2003 data are presented in the EISA (CTA 2003) and the 2004 data is presented in the quarterly monitoring report (CTA 2004).

During 2002-2003, Station SW-3 in the Quivichil had the highest number and diversity of macroinvertebrates and the highest number of fish captured in both seasons out of the 5 stations sampled. Station SW-3 also had by far the highest index of biological integrity (a measure of stream health) of any station. The flow at SW-3 is low, with extremely low flow in February 2003 when the dry season biological sampling occurred (0.5 L/s). However, the fish and macroinvertebrate number and diversity were still the highest of any site sampled despite the low flow. In 2004, macroinvertebrate number and diversity and fish numbers in the Quivichil had decreased, but it is unclear whether this decrease results from natural variation or from sediment generated during construction of the TSF.

The TSF Design Report (MEC 2005a) contains several statements that contradict the actual information on aquatic life in the Quivichil described above, including:

- "The Quivichil is an ephemeral stream and does not support aquatic life."
- "Modeling of the cyanate value indicates it to be in the range of 125mg/l in the impoundment at the time of discharge. At the Quivichil the value is in the range of 30 to 40mg/l. There are no commonly used levels of concern related to cyanate however, a level of 50mg/l has been applied to cold water fisheries. Obviously, this cold water fisheries level is not applicable to Marlin yet, the discharge would be less than this level in the Quivichil. Again there is no aquatic life in the Quivichil."
- "As no drinking water or irrigation water use is made in the Quivichil and no aquatic life exists in the river, no adverse effects to the environment are identified related to mercury."

Because the Riachuela Quivichil appears to have healthy populations of macroinvertebrates and fish, aquatic life may be considered a beneficial use in the stream with the appropriate standards applicable.

Further assessment of the aquatic community in the Riachuelo Quivichil is necessary to determine if decreases observed in 2004 are due to natural variation in populations or represent an impact. Furthermore, an assessment of downstream uses in the Riachuelo Quivichil and the Rio Cuilco would give insight into the beneficial uses served by these streams other than support of aquatic life.

5.0 Tailings Storage and Waste Rock Facility Stability

The tailings storage facility (TSF) includes the dam structure, pipelines and spigot equipment, the tailings material itself and the water pool behind the dam. The tailings dam will be constructed using downstream techniques (MEC 2005a), and this construction method is appropriate from stability perspective for dams in seismic areas (ICOLD/UNEP 2001). In downstream dam design, the tailings are at first deposited behind an impervious starter dam. As the dam is raised, the new wall is constructed and supported on top of the downstream slope of the previous section, shifting the centerline of the top of the dam downstream as the dam stages are progressively raised. The dam will be constructed in three phases with progressively higher crest heights (50, 70, and 80 m respectively).

The impoundment will be operated to contain the 24-hr, 100-yr storm (350 mm) and maintain 2 m of dry freeboard, greatly limiting the risk of overtopping during a storm event (MEC 2005a). During the design seismic event, the dam crest could be displaced and settle by up to 1 m while horizontal displacement could be as high as 2 m (MEC 2005a; RGC 2005). The 2 m of dry freeboard should prevent overtopping if settling after a seismic event reduces the crest height.

The size of the embankment and potential impact of failure make the TSF a high-risk facility (Category "A" in the nomenclature of the IFC; IFC 2005). The high seismicity, steep terrain, and seasonal wet climate at the Marlin project site also contribute to the complexity of the required design. Consequently, the biggest risk to the environment from the project is a failure of the tailings impoundment. Because the impact from a failure is so serious, the tailings facility will require extra vigilance during the design, construction, operation and expansion to ensure that it operates as designed and results in low risk to human life and the environment.

5.1 Dam Safety and IFC Procedures

Because of the risk of such facilities, IFC requires that large dams adhere to the Procedures for Environmental and Social Review of Projects, Annex D: Application of EA to Large Dam and Reservoir Projects (IFC 1998). Procedures relevant to this project are:

a) The project sponsor can engage an independent advisory panel (in this case referred as the Tailings Dam Review Board) with the assistance from IFC.
b) Submission of detailed plans to IFC, including: a plan for construction supervision and quality assurance, a plan for instrumentation, an operation and maintenance plan, and an emergency preparedness plan.

This review will focus on how these procedures were implemented.

5.1.1 Tailings Dam Review Board

The Tailings Dam Review Board is comprised of Dr. Andrew Robertson of Robertson Geoconsultants (RGC), and two reports have been issued to date (RGC 2004; RGC 2005)[9]. Based on the scope and content of the reports, the independent review appears to offer a thorough review of technical aspects of the dam construction.

The second report points out several concerns regarding the dam construction that are partially repeated in the Annual Monitoring Report (AMR) for 2004 that was submitted to the IFC (MEG 2005a). These concerns can be summarized into several categories as:

[9] MEG indicated during the comment period that three reports have been issued, but the third report was not reviewed.

1) Construction oversight: due diligence must be maintained for contractors, materials selection, and to accommodate the accelerated construction schedule.
2) Materials: selection and handling of the low permeability core and rock drain materials for the dam need extra supervision and diligence during construction to ensure that proper materials are selected and that segregation is not occurring for the rock drain; some starter dam rock shell materials may not meet design criteria for strength; some of the grout curtain materials may not meet design specifications for low permeability.
3) Filter and drain zone widths should be increased to 3-5 m to ensure stability in the event of seismic displacement.

The Tailings Dam Review Board Report No. 2 (RGC 2005) also describes concerns during the construction of the first phase of the waste rock facility. Specifically, this facility contains weaker material from the mill site excavation and material from the underground mine construction. The review report and the AMR also point out concerns regarding drainage and stability of the waste rock dump and the necessity to mitigate any problems before the next rainy season. It is important to ensure the stability of the waste rock dump, as it will serve as a foundation for future dump material when open pit mining begins. It is also at the head of the drainage that contains the TSF and, hence, a failure of the waste rock dump could affect the TSF[10]. The report states that a revised waste rock facility design and management plan (and corresponding acid rock drainage management plan) is still under development. A draft of this plan was not available for this review.

5.1.2 Required Dam Safety Plans

The ESIA (MEG 2003a) has some preliminary information that could be used for a dam safety emergency preparedness plan, including Annex 13.2-A (Contingency Plan - initial version) which lays out a framework for risks from cyanide, hydrocarbons, fire, sabotage, extreme precipitation, and seismic events, and Annex 13.2-D is an outline of a crisis communication plan. Neither annex is specific to the tailings impoundment. The Environmental Action Plan (MEG 2003b) also presents a preliminary contingency plan and discusses the adoption of the principles of the United Nations Environment Programme Awareness and Preparedness for Emergencies at a Local Level program (UNEP APELL; http://www.uneptie.org/pc/apell/) The TSF Design Report (MEC 2005a) has place holders for required plans. Of the four plans required by the IFC (plan for construction supervision and quality assurance, instrumentation plan, operation and maintenance plan, and emergency preparedness plan), the TSF Design Report presents one (the instrumentation plan; MEC 2005a). An earlier document provides technical specifications for quality assurance testing and inspection for Phase 1 of dam construction (MEC 2004). This plan will need to be updated as appropriate for Phases 2 and 3. The Tailings Dam Review Board reports do not comment on these plans.

The timing for preparation of the four plans, as specified by the IFC Procedures for environmental assessment, is as follows:

1) Construction Supervision and Quality Assurance Plan: provided to IFC during appraisal;
2) Instrumentation Plan: provided to panel (in this case the Tailings Dam Review Board) and the IFC during project appraisal;

[10] MEG indicated during the comment period that a response to the review panel report was prepared, but this document was not reviewed for the finalization of this review.

3) Operation and Maintenance Plan: preliminary plan provided to the IFC on appraisal; final plan provided to the IFC for review and approval not less than six months prior to the initial filling of the impoundment;
4) Emergency Preparedness Plan: provided to the IFC and the Tailings Dam Review Board for review and approval not less than one year before initial filling of the impoundment.

The TSF is scheduled to begin filling in late August 2005, and only the Instrumentation Plan and Phase 1 Quality Assurance and Testing Plan have been finalized and reviewed (the other two plans were recently completed in mid-August and have not been reviewed for this report).

6.0 Cumulative Impacts

An assessment of cumulative impacts from mine expansion was not within the scope of this review. The EIA for the La Hamaca expansion was submitted to MARN in May 2005. Montana has reportedly been undertaking exploration activities in areas beyond the permitted Marlin Project (Marlin I) since 2002 and has plans to expand from the current Marlin I mine site to other identified deposits, including La Hamaca (the most advanced) and other sites in San Miguel and Sipacapa. Any expansion will lead to additional and cumulative environmental impacts on water quality (geochemical and acid drainage conditions may be different for new deposits than the currently permitted project and impacts will spread over a larger area), water quantity (more water may be required for processing) and sediment movement. The plans for additional expansions besides La Hamaca are still preliminary and are not presented in public information; potential impacts of any additional expansions have not yet been identified or assessed.

The mill and TSF appear to have been designed to accommodate additional ore from the La Hamaca and possibly other deposits. Glamis project information states that mill capacity has been expanded to 5,000 tonnes per day to accommodate additional high grade feed recently found in the La Hamaca Zone and other satellite properties. (Glamis Gold 2005)..

7.0 Conclusions

This section presents conclusions on procedural and technical aspects of the Marlin project.

7.1 Public Information

To date, the ESIA (MEG 2003a) and the associated Environmental Action Plan (EAP; MEG 2003b) are the primary documents of public record for the project. The ESIA includes draft plans for:

- Contingency
- Health and Security
- Crisis Communication
- Soils Management
- Erosion Control
- Dust Control
- Surface Water Management
- Hazardous Materials Management

- Management of Waste Rock
- Reforestation
- Flora and Fauna.

The EAP includes preliminary plans for:

- Environmental Management
    - Contingency
    - Sodium Cyanide Management
    - Human Health Security
    - Environmental Security
    - Waste and Emissions Control
- Closure and Restoration
    - Waste Rock Facility
    - Tailings Storage Facility
    - Open Pits
    - Dismantling of Facilities
    - Revegetation.

These plans are based on preliminary data that is insufficient to fully assess the potential environmental impacts of the project. The plans are being updated as noted below. Reports recently made available to the public in May 2005 (the AMR [MEG 2005a], Environmental Audit and Review [Dorey and Associates 2005] and the 2005 Tailings Dam Review Board report [RGC 2005]) contribute substantially to publicly available information on potential impacts and management plans, but do not contain all of the information necessary for the public to comprehensively assess potential impacts and the adequacy of environmental management plans.

Non-public reports available for this review fill many of the information gaps, including:

- The TSF Conceptual Design Report (SRK 2003a)
- The TSF Design Report (MEC 2005a)
- The Waste Characterization and Waste Rock Feasibility Design and Cost Estimation (SRK 2003c)
- The Geochemistry of Waste Rock report (SRK 2004a; posted on the Glamis web site in mid-August 2005)
- The Geochemistry of Tailing report (SRK 2004b; posted on the Glamis web site in mid-August 2005)
- The Production Well characterization reports (MEC, SRK, and Vector 2004 [posted on the Glamis web site mid-August 2005]; MEC 2005b)
- Updated Environmental Action Plans as they became available:
    - Dust Control Plan
    - Environmental Monitoring Plan
    - Forestry Management Plan (to be posted on Glamis website; pending translation)
    - Materials and Waste Management Plan (posted on the Glamis web site in mid-August 2005)
    - Surface Water Management Plan (posted on the Glamis web site mid-August 2005)
    - Wildlife Management Plan (posted on the Glamis web site in mid-August 2005).

In addition, the reviewer is aware of several reports in preparation including:

- The Waste Rock Facility design report and associated Acid Rock Drainage Management Plan
- The IFC-required TSF operating plans (in preparation) described in Section 5.1.2.

It would help to make all these plans and reports that contain specific and detailed information necessary to assess impacts and risks (including the reports listed above) publicly available as soon as they are finalized.

7.2 Design Plans and Environmental Management Plans

Final versions and review of time-sensitive plans were not completed before construction of the waste rock and tailings storage facility began. In addition, implementation of erosion and sediment control measures have lagged during construction. It is preferable if plans are prepared, reviewed and finalized in advance of the start of construction.

It would be helpful to specify which of the older environmental action plans presented in the EISA (MEG 2003a) and EAP (MEG 2003b) are obsolete and superceded by the newer versions currently being developed.

In addition, it will be important that the two plans required by IFC for the TSF (operation and maintenance plan, and emergency preparedness plan) be completed and that all four plans be reviewed and approved by the IFC and the Tailings Dam Review Board before the dam is operational. The construction supervision and quality assurance plan will need to be updated for future phases of construction, as is planned by the project team.

7.3 Baseline Monitoring

Spatial and temporal coverage of the surface and ground water monitoring network appears adequate, but because the locations that have been sampled have changed over time, it is unclear which surface and groundwater sampling locations will be permanently monitored. The recently prepared Monitoring Plan does not specify which locations will be part of the permanent network (MEG 2005c). In addition, the TSF discharges directly into the Quebrada Seca (or de las Colas, monitoring station SW-8). The company states that it will regularly monitor discharge from the tailings impoundment. It will also be important to include SW-8 in future monitoring to ensure that downstream receptors are protected.

7.4 Water quantity

Based on the current understanding of site surface and groundwater hydrology, water use by local inhabitants of the area, and water needs for the mine in its current design, it is unlikely that mining activities will deplete water resources and impact human and agricultural needs in the area. As new information on water users, measured flows in streams during operation, production well and groundwater monitoring, and the water balance parameters of the TSF (site specific climate measurement, runoff and pumped water entering the impoundment, water consumption during mineral processing, evaporation and seepage from the impoundment) are collected during mine operation, as well as new information about mine expansions, potential impacts and cumulative impacts will need to be reevaluated. A basin-scale water budget with a stream depletion study could be used to evaluate cumulative impacts from mine facilities and identify areas where mitigation may be required.

7.5 Water Quality

Water quality concerns at the site include erosion and sediment transport, acid rock drainage (ARD), and other constituents not directly related to acid rock drainage (principally cyanide, nitrogen compounds and metals and metalloids that are mobile under neutralizing conditions).

The Annual Monitoring Report (MEG 2005a) pointed out the need to improve erosion and sediment control at the site and a new sediment management plan was prepared in response. Surface water monitoring data will indicate the effectiveness of the improved sediment control procedures.

Testing data presented in project documentation indicates that mine waste materials (waste rock and tailings) are likely to be net neutralizing, so acid rock drainage should be a low-level concern at the site if the rock is properly handled. The forthcoming Waste Rock Management Plan will present updated procedures for identification, testing, and handling of any potentially acid generating material. Waste rock management plans generally have protocols and criteria for handling materials that are potentially acid generating (such as blending with other rock that has sufficient neutralizing capacity).

Seepage from the WRF is designed to collect in the tailings impoundment, and a seepage collection system downstream of the TSF dam is designed to capture any seepage from the both the WRF and TSF. Proposed WRF and TSF seepage monitoring will provide data to demonstrate the quality of seepage and the effectiveness of the seepage collection system. The forthcoming Acid Rock Drainage Management Plan will describe methods for minimizing acid drainage at the site. Finally, the mine closure plan will address whether there is a potential for acid drainage to occur in the future and how closure activities will minimize or mitigate any potential long-term impacts.

Water will collect in the TSF for two years before being discharged. If testing of the TSF during the first year shows that water at this point does not meet World Bank guidelines, a treatment plant will be constructed before discharge occurs after the second year. It will be important to specify the protocols and criteria that will be used to determine if TSF water needs to be treated before discharge. Similar protocols and criteria would apply to groundwater (if the seepage capture system is not effective). If the mixing zone where World Bank guidelines for cyanide levels will be met takes into account known aquatic life in the streams below the impoundment (the Riachuelo Quivichil and Rio Cuilco), impacts to aquatic life will be minimized.

An assessment of downstream beneficial uses (e.g., human consumption, livestock watering and irrigation) will help to define water quality criteria (within the context of baseline water quality) that ensure downstream beneficial uses are maintained and that risk to downstream users and the environmental is minimal. With an understanding of downstream uses, strict adherence to the principles of the International Cyanide Management Code, and adherence to the World Bank discharge and mixing zone guidance, the risk to most aquatic life and human health from cyanide should be minimal.

7.6 Tailings Storage and Waste Rock Facility Safety

The size of the embankment and potential impact of failure make the TSF a high-risk facility. The design is appropriate for a seismic area and the Tailings Dam Review Board reports indicate that design and construction are adequate. Continued vigilance during construction and operation, including external review, must ensure that safety standards are met and that the dam performs as designed.

Of the four TSF plans required by the IFC, two plans, the Instrumentation Plan and Quality Assurance and Inspection Plan for Phase 1 of Construction were completed with as part of the TSF design report. Monitoring data from hydrologic instrumentation in the dam that is collected during the critical initial filling stage (scheduled to begin in late August 2005) will help to assess dam stability. Therefore, it will be important to implement at a minimum the instrumentation plan and allow for review by the Tailings Dam Review Board (comprised of Dr. Andrew Robertson) before the impoundment begins to fill. It would also be preferable to have an Operation and Maintenance and Emergency Preparedness Plan in place before the impoundment begins filling. MEG has recently reported during the finalization of this review that these four plans are completed and are under review by Dr. Robertson.

It would be helpful for MEG to prepare a narrative response, beyond the Corrective Action Plan chart (Dorey and Associates 2005), to the concerns raised in the Tailings Dam Review Board Report No. 2 (MEC 2005a) and the Environmental Audit and Review (MEG 2005). A description of how the concerns were addressed would demonstrate that the review process is effective and is leading to an improved TSF. It would also be beneficial to incorporate corrective action resulting from the review in the Phase 2 and 3 design and construction reports.

The Tailings Dam Review Board expressed concerns about the placement of materials from the early phase of construction (from the mill area and pit) in the waste rock facility. These materials were placed before the waste rock and acid drainage management plans were complete. It will be important to verify that these materials provide a stable foundation for subsequent materials and that acid generating potential is minimal. The forthcoming waste rock and acid drainage management plans may address these issues.

7.7 Cumulative Impacts

Environmental impact assessments for the future targets will need to consider the cumulative impacts of development and not just view the projects individually. With the appropriate determination of applicable water quality guidelines, downstream receptors, stream depletion information and monitored compliance with IFC, ICMC and other appropriate guidelines, cumulative impacts can be mitigated to a level that poses a minimal risk to human health and aquatic life, and other beneficial uses. Additional review of future project documentation will make a more precise determination of cumulative impacts possible.

8.0 Documents Reviewed

British Columbia AMD Task Force. 1989. *Draft Acid Rock Drainage Technical Guide, Volume 1,* British Columbia Acid Mine Drainage Task Force Report prepared by Steffen Robertson and Kirsten, Norelco Environmental Consultants, and Gormely Process Engineering, August 1989.

Consultoria y Tecnologia Ambiental, S.A. (CTA). 2003. Caracterizacion Hidrogeologica del Rio Tzala y Riachuelo Quivichil. Dated May 2003.

Consultoria y Tecnologia Ambiental, S.A. (CTA). 2004. Informe de Cumplimiento Ambiental del Proyecto Minero Marlin Tercer Trimestre de 2004. Preparado por MEG October 2004.

Dorey and Associates. 2005. Environmental Audit and Review, Marlin Project, Guatemala. http://www.glamis.com/properties/guatemala/AMR/Enviro%20Audit%20and%20Review.pdf

Glamis Gold. 2005. http://www.glamis.com/properties/guatemala/marlin.html.

International Conference on Large Dams/United Nations Environment Programme (ICOLD/UNEP). 2001. Tailings Dams, Risks of Dangerous Occurrences: Lessons Learnt from Practical Experiences. ICOLD Bulletin No. 121.

International Cyanide Management Code for the Gold Mining Industry (ICMC). 2005. www.cyanidecode.org.

International Finance Corporation (IFC). 1998. Procedure for Environmental and Social Review of Projects, Annex D: Application of EA to Large Dam and Reservoir Projects. http://ifcln1.ifc.org/ifcext/enviro.nsf/Content/ESRP.

International Finance Corporation (IFC). 2005. Environment, Health and Safety Guidelines. http://ifcln1.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines.

Marlin Engineering & Consulting, L.L.C. (MEC). 2004. Marlin Project, Guatemala: Phase 1 Tailings Storage Facility Construction Project. Technical Specifications. Section 6 – Quality Assurance Testing and Inspection. Dated December 2004.

Marlin Engineering & Consulting, L.L.C. (MEC), SRK Consulting, and Vector Colorado. 2004. Installation Report: Water Supply Well PSA-1. Dated June 2004. Posted in mid August 2005 to: (http://www.glamis.com/properties/guatemala/cao_docs/psa1_well.pdf).

Marlin Engineering & Consulting, L.L.C. (MEC). 2005a. Marlin Project Tailings Disposal Facility Design Report: Volumes I-VII. Dated January 11, 2005.

Marlin Engineering and Consulting, L.L.C. (MEC). 2005b. Marlin Project Production Well. Memorandum from Rob Dorey to Tim Miller. Dated June 2, 2005.

Montana Exploradora de Guatemala, S.A. (MEG). No date. Usos del Agua por el Proyecto Marlin power point presentation.

Montana Exploradora de Guatemala S.A. (MEG). 2003a. Environmental and Social Impact Assessment Study of the Marlin Mining Project. Dated June 2003.

Montana Exploradora de Guatemala S.A. (MEG). 2003b. Estudio de Evaluacion de Impacto Ambiental y Social: Plan de Accion Ambiental, Proyecto Minero Marlin. Dated June 2003.

Montana Exploradora de Guatemala S.A. (MEG). 2005a. Environmental and Social Performance Annual Monitoring Report (AMR), Montana Exploradora de Guatemala, S.A. Marlin Project. Submitted to International Finance Corporation. Dated March 31, 2005. http://www.glamis.com/properties/guatemala/AMR/Marlin%202004%20AMR.pdf

Montana Exploradora de Guatemala, S.A. (MEG). 2005b. Plan de Manejo Ambiental, Agua Superficial, Final. Dated April 4, 2005.

Montana Exploradora de Guatemala, S.A. (MEG). 2005c. Monitoring Plan, Version 02 Final

Draft, Marlin Project, Guatemala. Dated June 22, 2005.

Montana Exploradora de Guatemala, S.A. (MEG). 2005d. Power Point Presentation to MARN. April 2005.

Montana Exploradora de Guatemala, S.A (MEG) 2005f. Materials and Waste Management Plan. Final Draft. Date June 7, 2005

Moran, R.E. 2005. New Country, Same Story: Review of the Glamis Gold Marlin Project EIA, Guatemala. Dated February 2005.

RGC. 2004. Tailings Dam Review Board Report No. 1. Marlin Project, Guatemala. Dated March 12, 2004.

RGC. 2005. Tailings Dam Review Board Report No. 2. Marlin Project, Guatemala. Dated March 18, 2005. http://www.glamis.com/properties/guatemala/AMR/Marlin%20Tailings%20Dam%20Report.pdf

Saravia R., M.E. 2005. Response letter to Dr. Moran from the General Manager of Montana Exploradora de Guatemala, S.A. Dated March 21, 2005.

SRK. 2003a. Glamis Gold: Marlin Project. Tailings Facility Conceptual Design and Cost Estimate. Dated February 2003.

SRK. 2003b. Memo from Kelly Sexsmith and Danette Schwab to Tom Miller of MEG. Geochemical Characterization of Waste Rock at the Marlin Project, Guatemala, Interim Report. Dated September 23, 2003.

SRK. 2003c. Waste Characterization and Waste Rock Feasibility Design and Cost Estimation. Volumes I-III. Dated November 4, 2003.

SRK. 2004a. Geochemical Characterization of Waste Rock at the Marlin Project, Guatemala. Dated February 2004. Posted in mid August 2005 to: http://www.glamis.com/properties/guatemala/cao_docs/Marlin_WasteRock.pdf

SRK. 2004b. Geochemical Characterization of Tailing. Marlin Project, Guatemala. Dated December 2004. Posted in mid August 2005 to: http://www.glamis.com/properties/guatemala/cao_docs/Marlin_Tailings.pdf

United States Environmental Protection Agency (USEPA). 1996. Technical Report: Design and Evaluation of Tailings Dams. Report number EPA 530-R-94-038.

World Bank. 1995. Environment, Health and Safety Guidelines: Mining and Milling – Underground. http://www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines.

World Bank Group. 1995. Environment, Health and Safety Guidelines: Mining and Milling –Open Pit. http://www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines.

World Bank. 2001a. Operational Manual, Operational Policy Safety of Dams. OP 4.37. October 2001.
http://wbln0018.worldbank.org/Institutional/Manuals/OpManual.nsf/0/C12766B6C9D109548525672C007D07B9?OpenDocument

World Bank. 2001b. Operational Manual, Dam Safety Reports, Content and Timing. BP 4.37, Annex A. October 2001.
http://wbln0018.worldbank.org/Institutional/Manuals/OpManual.nsf/0/1281729955CF0EDB8525672C007D0778?OpenDocument.

ANNEX D
COMPLAINT SENT TO THE CAO IN RELATION TO THE MARLIN MINE PROJECT
(English translation; signatures not included)

Complaint against the International Finance Corporation / World Bank
Open pit mining of metals, gold and silver in Sipacapa, Guatemala.

To the President of the World Bank

Mr. James Wolfenhson

And to the Ombusdman

International Financial Corporation

We, the undersigned, as members of the Guatemalan society, do appear before you with the purpose of **SUBMITTING A FORMAL COMPLAINT AGAINST THE INTERNATIONAL FINANCIAL CORPORATION (IFC) WHICH IS FINANCING THE OPEN PIT METAL MINING EXPLOITATION GRANTED TO MONTANA EXPLORADORA DE GUATEMALA S.A., MARLIN MINING PROJECT, LOCATED IN THE MUNICIPAL DISTRICTS OF SAN MIGUEL IXTAHUACAN AND SIPACAPA OF THE SAN MARCOS DEPARTMENT, REPUBLICA DE GUATEMALA,** about the following

FACTS:

1. The MARLIN project is located in an indigenous area, where people speak their own languages Mam and Sipacapense. These two indigenous peoples were never informed or consulted on the exploration and later exploitation of a gold and silver mine in their territory. This is a grave violation of the 169 Agreement of the International Labour Organization, which guarantees that any exploitation of resources in indigenous territory should be informed to and consulted with the indigenous, not only in its environmental aspect, but also on the social and cultural effects that said exploitation may have on the indigenous population. The government of Guatemala has publicly admitted *that* these *people were never* consulted, therefore there is full evidence of the violation of such international

rule, which binds all the ratifying States such as Guatemala and all international organizations, to respect International Law.

2. The mine was authorized by the resolution seven hundred seventy nine – two thousand four, slash CRMM, slash EM, dated September twenty-ninth, two thousand three. (779 – 2004 / CRMM / EM, September 29, 2003). The Board of Environmental Management and Natural Resources of the Ministry of Environment and Natural Resources, approved the Environmental Impact Evaluation Study of the MARLIN mining project (Montana Exploradora de Guatemala S.A.), located in the municipal district of Ixtahuacán, in the San Marcos department, where an area of twenty square kilometers was considered for the exploitation of mining products denominated gold and silver.

3. On November twenty-seventh, two thousand three, the Guatemalan Ministry of Energy and Mines granted a license for mining exploitation to Montana Exploradora de Guatemala, S.A. for a period of twenty-five years.

4. The Guatemalan society in general was not adequately informed about the way in which the mining company would operate, or about the possible implications that said activity would entail, both for the area exploited and for the rest of the areas involved. The indigenous population was excluded from the design and evaluation of mining exploration and exploitation plans and were not consulted on their priorities for their development, as is guaranteed by Agreement 169 of the ILO.

5. Upon learning about the damage that open pit mining activity has begun to cause in the area, we, as members of the Guatemalan society, are worried about its consequences, and have concluded that we do not agree on the continuation of said activity, either in San Miguel Ixtahuacán and Sipacapa or in other locations in our country.

6. Among the anomalies we have detected in the granting of the license for San Miguel Ixtahuacán and Sipacapa is the fact that the Environmental Impact Evaluation asserts that the population affected was consulted, both by Montana Exploradora de Guatemala S.A. and by the Guatemalan Ministry of Environment and Natural Resources. Said consultations were not of the knowledge of the population affected; moreover, they were not conducted according to the requirements of the Agreement 169 of the ILO on Indigenous Peoples and Tribes, ratified by the Guatemalan State in 1996. Consultations should have been made in the language of the communities, with their own authorities and procedures, since the Sipacapense and Mam are recognized indigenous people.
7. The management and planning process was kept concealed from the public and the population began to realize this after the initiation of the mine's construction works.
8. The mining activity is already underway and according to the Environmental Impact Evaluation the *"Area of indirect influence covers mainly the district of San Miguel Ixtahuacán and, to a lesser degree, the district of Sipacapa. The area of direct influence covers part of the Tzalem river basin, The Quivichil microbasin and the communities of Agel, San José Nueva Esperanza, San José Ixcanichel mainly, and Tzalem to a lesser degree."* Therefore the territory, water and forest resources are being affected.
9. The extension of the area affected (area of indirect influence) can be noticed from the purchases of land in our community to expand mining activities; this is stated in the Environmental Impact Evaluation, where it says: *"The company Peridot S.A. at the request of **MONTANA** initiated, in 1998, the purchasing of land for the Project, which was intensified in 2002 and aims at the*

acquisition of an area of approximately 6 square kilometers. The areas where the project will be located are within the district of San Miguel Ixtahuacán as well as in Sipacapa.

10. In the Environmental Impact Evaluation, Montana Exploradora de Guatemala S.A. asserts that: " *San Miguel and/or Sipacapa are not expected to be affected by noise or dust or any other type of chemical or physical contamination.*" However, we believe that health risks to be suffered by the people in the area have not been objectively evaluated. Although they assure that clean mining will be developed in the area, we know through information from other sources that contamination from cyanide and other products used for this activity, as well as the use of our water and forest resources, will sooner or later cause damage to our health, since our environment has already been affected.

11. As to the use of cyanide, a study by German Professors Paul Muller of Saarbrucken University, Friedhelm Korte of Munich University and Petra Sauerlanda, based on the Berlin Declaration on gold extraction using the cyanide process and various examples of said activity throughout the world concluded:

    1. Important scientific analyses (especially eco-chemical, in biogeographical, hydrological and geochemical ecosystems) emphatically prove that the cyanide process for gold extraction cannot be accepted, owing to its irreversible damage to ecosystems. The necessary technologies for safety (detoxification, neutralization, reduction of availability for ecosystems among other heavy metals) are within limited reach. These technologies cannot guarantee the existence of safe gold mining. Taking into account the economy, water conservation, chemistry and the protection of nature, open pit mines *using the cyanide process are not authorized under the laws of Germany or the European Economic Community.*

2. The analysis of ecosystems in operation sites show that in tropical and subtropical zones there is a periodical recurrence of crises. The technologies to reduce risk are not manageable and cannot be controlled. The breakage of dams, seeping, transport accidents (e.g. Summitville, Colorado/USA 1993; Harmony Mine, South Africa 1994; Philippines 1995; Omai, Guyana 1995; Homestake Mine, South Dakota, USA 1996; Gold Quarry Mine, Nevada territory of Western Shoshone, USA 1997; Kumtor, Kyrgistan 1998; Baia Mare, Rumania 200) and other small accidents, indicate that these companies do not act carefully.

3. Economic analyses show that the activities of the main gold producers(e.g. Anglo Gold, South Africa; Gold Fields, South Africa; Río Tinto, Reino Normandy, Australia) are concentrated in poor countries and regions with low production costs and insufficient legal control standards.

4. The analyses of the social effects on the population and the humanitarian situation show that there are no positive results from gold extraction by cyanide. Short term profits are always followed by a constant deterioration of life quality, as compared with previous standards.

5. This negative balance proves that gold extraction by cyanide permanently contradicts the Río Declaration. Gold mining destroys, in the long run, the basic needs of life and jeopardizes adequate nourishment. The flow of state money assigned by governments to the promotion of gold mining projects must be stopped and, where necessary, the persons affected should be entitled to compensation.

From the information in that study, as well as from different information obtained, as members of society we cannot overlook the licenses granted for the extraction of gold and silver through open pit mining in Guatemalan Territory, because we are at risk that each one of the situations enumerated in such report will happen to us, as we have all the characteristics of those countries where said activity is developed.

12. The 2002 report of Dr. Robert Moran, on the occasion of a proposal for a copper mine in Peru, asserts: *"It is evident that mining activities often bring short term economic benefit to communities and workers (employment, business in general) and that they partly improve the local infrastructure, as roads, electricity and water distribution systems, etc. However, these same activities also produce environmental and health impacts in the long run, which mining companies often avoid paying for. Mining has always been a "globalized" industry, where international companies operate in developing countries, usually as subsidiaries separated from parent companies. If a company has economic problems, possibly as a result of slump in metal prices or business mistakes, and even because of fraud, the subsidiary may be forced to close down unexpectedly or be declared bankrupt. These companies may have caused environmental problems, but so far in many countries the associated entities learn about many of those impacts post-operationally. Thus the contamination is not remedied, serving as a "hidden cost" for the public affected and taxpayers have to pay to clean up the contamination".*

From no point of view does open pit mining for metals bring about any positive aspect to our country. We must learn from other people's mistakes so as not to repeat them and avoid any risk for our population, our territory, water and environmental resources; we have the responsibility to watch over the present and the future of Guatemala.

13. It must be pointed out that one of the worst damaging effects of mining is on the water, since according to the Environmental Impact study itself, it will employ 250,000 liters of water per hour, i.e. 6 million liters a day. The area of the mine has scarcely any rain and that endangers people's survival. The mining company has concealed the fact that 50 women from the small village of Tzalem, Sipacapa, have protested against it because the works of the mine have cut off the drinkable water supply of said community. Moreover, given the use of cyanide, water pollution will be permanent and will forever affect the life of those communities, since water is vital for our survival and our agricultural production system. The right to have water is a fundamental right of the people and the mining exploitation of the MARLIN project goes against that right and our indigenous people's right to survive.
14. For the execution of the project violence has been used; given that this month, before a municipal decision in Sololá, another indigenous town that will be affected by the transport of lethal chemical substances like cyanide, the government sent 1500 soldiers and policemen to shoot and throw tear gas, which resulted in hundreds of injured and the loss of one life. This is not the first time that a project financed by the World Bank is supported by the use of state violence; you may remember the case of the construction of Chixoy Hydroelectric, when the Guatemalan Government committed the slaughter of indigenous people to allow for the execution of the project. That same indigenous group protested again in September last year to obtain compensation for the damage caused by the project, 25 years later. This past violence and the violence

originated by the MARLIN project is a great concern for all of us as Guatemalans and should be a concern for the World Bank. 15. Also, the Catholic Church of Guatemala has stood against said project, owing to the very grave effects it will have on the neighboring indigenous villages.

Messrs. President of the World Bank and Ombudsman of IFC: it is indispensable to revise the financing to be granted to the MARLIN project because open pit mining for metals (gold and silver) is very risky and damaging for Guatemala, because the license to operate in San Miguel Ixtahuacán and Sipacapa was granted without consideration for the relevant procedures for areas where indigenous people are established, without measuring the damage that said activity will cause to water resources, the environment and health and because of the risk that open pit mining represents for health and life.

Guatemala, January 28, 2005