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Environmental Review for the Human Rights Impact Assessment – Marlin Mine Guatemala

Table of Contents

Note: This report was revised March 6, 2010 based on additional data provided from monthly management reports for February, April and May, 2009.

1. Executive Summary

The Marlin mine operates to a good standard of practice within the mining industry world wide with a few exceptions. They operate according to the Goldcorp Environmental and Sustainability Policy, but without standards and performance measures to guide them. They are currently certified to the International Cyanide Code and are working toward compliance with the ISO 14001 environmental management system.

The management of air, water and waste is consistent with good practice in the sector. The water treatment facility has yet to demonstrate its full capability having not yet been required to discharge water to the environment. This aspect needs ongoing monitoring and review. Marlin manages the site water balance to best practice standards recycling in excess of 85% of site water.

Groundwater remains un-impacted and the containment systems show very slow rates of migration of seepage. The flows are small so that even if they intercept an aquifer they will likely be undetectable.

Tailings and waste rock management meets good practice and plans are well defined to ensure long term stability of the closed site with appropriate covers and revegetation

There is no clear exit strategy for Goldcorp to manage their departing from the community once closure plans have been implemented. The closure plan is an aspect that lacks rigour in a number of aspects and does not meet good practice. It appears under funded for the amount of work projected. The timeline for closure is short and likely overly optimistic. There is no provision of funds and resources for long term post closure monitoring and maintenance after operations cease. There is no provision of independent financial means for closure of the facility at any time should it become necessary. Closure is the weakest aspect of Marlin's plans and has the potential to leave the community vulnerable to the long term impacts from the mining activity.

2. Background

On Common Ground has been contracted to conduct a Human Rights Impact Assessment (HRIA) study of the Marlin Mine in Guatemala by the Steering Committee established for the purpose of managing that study. To support the technical aspects of the HRIA, On Common Ground has retained Denis Kemp of Denis Kemp Consulting to undertake a technical review of environmental and technical issues of the company's environmental management.

This report is a review of data from various documents, reports and discussions with individuals. The areas of review related to matters of organisation, management and performance of the environmental area and general safety.

3. Approach

The policies, plans and performance measures established and used by Marlin were compared to a good standard of practice used by other mining Companies. This assessment is based on the authors opinions formed from the available information and was limited by the materials that were provided. A complete facility benchmarking evaluation was not conducted and no site visit was undertaken.

The review was conducted from a technical aspect but considered specific issues that may have a short and long term impact upon the well-being of the nearby communities. To the extent that some technical issues need greater evaluation and consideration, these points have been highlighted for further review.

Environmental reviews of mining facilities typically focus on key elements that may influence the short and long sustainability of surrounding communities. Specifically these are:

- Noise from the facilities

- Dust and other atmospheric emission
- Water discharges and influences on groundwater
- Wastes and tailings impoundments
- Closure plans including post closure maintenance and the availability of financial resources to maintain the site in a sustainable condition

Other issues that can have an impact but may not be a significant issue for a short life mine are:

- Emergency preparedness and response planning
- Biodiversity
- Human Health & Ecological Risk

4. Policies, Plans & Performance Measures

Goldcorp Environmental and Sustainability Policy establishes 7 points that the Marlin Mine operations must fulfill (see Appendix reference). However, Goldcorp corporate policy does not appear to have any publicly reported environmental or sustainability performance measures or performance standards.

It is usual for corporate policy to establish standards for all operations such that individual operations develop consistent measures/performance indicators and report performance against those standards. Goldcorp requires each operation to implement a management system consistent with ISO 14001 and Marlin is working toward compliance. It appears that Goldcorp is relying on ISO 14401 to measure performance of its various operations, instead of developing a set of standards consistent with the corporate Environmental and Sustainability Policy that reflects the corporate culture.

At this point, Marlin has not made a decision to seek certification and will consult with the Guatemalan Government on the benefits and implications of doing so, prior to making the decision. This is a sound approach to avoid perceptions that Marlin may be using the ISO certification to deflect community concerns. Experience from another mine that sought certification in the Dominican Republic was very positive and the Government was very supportive. However, implementation of ISO 14001 did not change community attitudes to the mine. Nonetheless it became a valuable vehicle for mine management to raise standards. It was also a valuable tool to improve attitudes among all employees to ensure issues and concerns were addressed. A sense of pride developed with certification such that nobody wanted to lose this recognition, and performance continued to improve. I would recommend that Marlin not only comply with ISO 14001 but seek certification if this is seen as positive by all communities of interest.

Marlin has established the Marlin Environmental Management System consisting of 4 phases. At this point Phase 1, 'Policy and Planning', has been completed for 5 subjects. Phase 2, 'Implementation', has been completed following a review. Phase 3, 'Evaluation', has been implemented, at least in part in all mine areas. The final Phase 4, 'Review and Improvement' is not fully implemented and a more structured and documented review of issues is currently being implemented.

The internal key indicators used by management to monitor performance on measures are an important component of the Environmental Management Plan, and are primarily tied to the budget and annual plans. They are reviewed informally on a monthly basis and quarterly on a formal basis and changes made to continuously improve performance.

The use of key indicators at the mine is very positive but because there are no corporate performance standards linked to the Sustainability Policy there is a potential disconnect between site and corporate expectations. The ideal flow of standards, from the corporate sustainability policy to individual mine operations and reporting back against those standards would ensure a consistent management approach regardless of where an operation is located.

Goldcorp does report according to GRI (Global Reporting Initiative) criteria for all sites but that does not assure a commonality of management. This leads to the potential for different standards being used, particularly where regulatory environments are less stringent. Some leading international mining companies are implementing standards that not only meet World Bank/IFC and country of operation standards, but also meet those of the home country of the corporate entity. This results in very rigorous design and operating standards. Occasionally inappropriate standards are derived by this approach due to unique local conditions. In these situations a site standard may be set that, at a minimum, meets national standards (often exceeding it) but may be more lenient that that of the home country. This approach ensures that community and non government organisations have less of a basis to critique the standards being used. Goldcorp does not appear to have adopted this practice for standards and is open to criticism when comparisons are made with Canadian operations.

Marlin has used reputable international companies to undertake work that is critical to providing good evaluations and recommendations on how to manage the long and short term impacts from mining. In particular the report on waste characterisation is of a quality considered good practice in the industry. The closure plan is sound but lacks rigour in post closure monitoring and long term environmental maintenance, as a consequence financial considerations are underestimated.

However, Goldcorp does not appear to require independent site environmental audits. These are a very valuable tool through which to evaluate compliance with corporate standards and good industry practice. Use of regular audits is also a valuable tool to identify changing trends and risks and is of particular value at an operation where management turnover can result in loss of continuity. The 2003 Executive Summary of the ESIA stated there would be audits as a part of the environment, health and safety mitigation measures. There appear to have been no audits since 2006, perhaps in favour of pursuing ISO 14001 certification. This does not mean that Marlin is not performing to corporate policy and good standards, but it does make it more difficult to demonstrate compliance to such requirements. Communities usually consider independent audits a more reliable measure of performance than data reported by the company.

The commitment to conduct a screening level environmental risk assessment (SLERA) was honoured somewhat late and critiqued in the CAO report. The basis of the water quality standards that have been set is from this SLERA. A hydrocensus of the local communities was performed in September 2006, which included collection of information

on local area water users and beneficial water usage. These sources of information were used as a basis for developing site-specific beneficial use goals and water quality targets. In developing the standards they considered WB/IFC, US-EAP, States of Michigan and Nevada, CCME and of course Guatemala standards. The beneficial uses downstream were detailed and higher water quality objectives were set than the quality of many the existing sources. This approach is considered good practice but the timing of these actions definitely was not and was far too late. Such standards need to be set well in advance of operations in conjunction with the communities of interest to provide reassurance.

5. Noise

Measured noise levels in the community and along the access road compare well with measurement in background locations, not impacted by the mine. Daytime measurements vary from 45-59 dBA in the communities near Marlin compared to values of 51-61 dBA in background locations. Night time measurements vary from 40-66 dBA in the communities near Marlin compared to values of 44-59 dBA in background locations. The majority of these measurements are above IFC World Bank Guidelines that set residential receptor values at 55 dBA day time and 45 dBA night time. For reference purposes, typical city street noise levels vary from 55 dBA on quiet streets to 70+ dBA on busier streets.

6. Dust & Emissions

Measured particulate emissions in the communities in 2008 shows improvement over 2007, indicating increased effort has been applied to managing dust. Values of 5-130 $\mu g/m^3$ in 2008 in the communities compare favourably with background measurements of 12-126 $\mu g/m^3$. There were no measurements cited above the US EPA 24 hr standard of 150 $\mu g/m^3$in 2008. On this basis, the operation is well within compliance and meeting good practice.

Particulate emissions are a concern and nuisance to communities and dust suppression on internal access roads is practiced by Marlin. It is not clear if Marlin also conducts dust suppression on community roads used by service vehicles but this would be good practice and aid in reducing community complaints. Some mines with similar problems pave the roads within the communities to reduce nuisance dust.

It is expected that during operation in dry periods there will be visual evidence of dust from the mine, rock piles, roads and possibly the tailings. This is frequently a concern for mining communities and ongoing particulate measurement and communication of the results is essential to reassure people that emissions off property are within standards.

There are no measurements of $PM_{2.5}$ (particulate matter <2.5 micron) which is now considered of greater concern for human health, because fine particulates can pass beyond the nostrils and enter the respiratory system. This problem is more typically an urban problem due to smog from industrial and vehicle emissions. It is not usually a concern for rural communities because values are low. Some measurements of this particulate fraction would be valuable and provide further reassurance to the stakeholders that there are no issue attributable to mine operations.

7. Water

The hydrology review conducted by WMC in 2006 characterized the groundwater flow conditions of the area. The flows are fractured meaning that continuous flow between surface water and groundwater is unlikely. Early in 2004 Marlin decided to source water from deep wells rather than the Tzala river. According to the WMC report, deep groundwater will not be impacted post closure when operational demands cease and the well recharges.

The main production well PSA-1(MW5) has water chemistry different from the adjacent Rio Tzala indicating the well pumps from a separate deep ground source. There have been some changes in water quality of the well over time, possibly due to drawing from a deep geothermal reservoir. This well appears able to supply the mine operational needs that according to the WMC water balance average about 6.8L/sec. According to David Atkins, an independent consultant to the CAO, a 10 day pumping test in 2004 at a rate of 16L/sec showed that the yield of the aquifer was greater than the pumping rate (MEC, SRK and Vector 2004). Data supplied by Marlin confirms that well levels vary, but from seasonal recharge have remained relatively constant since commencement of operations. The well appears to recharge following wet seasonal periods when well consumption is low and pond recycle water is the dominant supply to operations.

However more recent data from Marlin management reports of January & February 2009 suggest that water levels in PSA-1 are declining, creating concern. The need to commission the second well, PSA-2, was under consideration. The April 2009 management report indicates that a "new system of water distribution is being planned" suggesting water needs may limit future production. The annual monitoring report of 2008 indicated that consumption of fresh well water averaged 5L/sec for the year The May 2009 management report confirms that well water consumption during that month averaged 10.15L/sec which is supposedly within the pumping capacity of well PSA-1(MW-5). The overall site water consumption during this period was 2067 m3/day compared to the 2006 WMC water balance of 2938 m3/day, a 29.6% lower overall consumption. Some seasonal variation in well level is to be expected due to the influence of meteorological variations that impact groundwater flows. The effects of changing climate may also be having an influence on overall precipitation which will impact well replenishment. Continued close monitoring of the level of this well together with diligence in managing 'new' water consumption is necessary to avoid impacts on the aquifers. A new study of the recharge rate of the aquifer should be considered, however on site water use management appears to be under control.

Two models were used by the consultant to evaluate seepage through the containment structures and the base of the waste containment areas. Results show that seepage is controlled by the underlying volcanic material with seepage rates less than 1 litre per second. At this flow the impact on downstream receivers is likely to be minimal and difficult to differentiate by analysis.

Measured water quality in wells and surface water samples does not at this stage reflect any contamination from mine operations and thus confirms the model predictions. The program of groundwater and surface water monitoring is good practice and should

continue throughout mine life and at a reduced frequency post closure. This will ensure that, should significant migration of the water from within the pore spaces of the tailings or the closed waste repositories occur, it will be identified early so that appropriate remedial action can be taken.

Baseline surface water data collected prior to commencement of mine development (2002 – 2004), indicated that samples taken from stations on the Tzala River, Quivichil Creek and Cuilco River exceeded guidelines for different uses. In particular drinking standards were exceeded (elevated levels) for a number of elements and likewise irrigation, livestock and aquatic life standards or guidelines were exceeded for a number of elements.

From the hydrocensus conducted by Water Management Consultants, most households use water from spring water distribution systems or shallow wells that have tested to be good quality. However, most households also use river water as a backup source. Because quality standards for water use are not met by the rivers in the area, either prior to mining or now, occasional use of surface water for drinking, irrigation and livestock could be a reason for water related complaints. It is ill advised to use such sources unless tested and evaluated for the particular purpose. As an example crop irrigation may be acceptable depending on the uptake of elements by a specific plant species. It is possible that complaints about human, animal and other health effect from water could be linked to uses from such sources.

Establishing the Community Environmental Monitoring Association (AMAC) in 2005 was a decision in line with best international practices and the independence of this group should lend credibility to the water quality measurements for the communities. The sampling is conducted 4 times a year during different seasons and 12 sample points across the communities are covered. All analyses have been carried out by ALS Laboratory Group which is a fully accredited laboratory. To date the monitoring results are in line with company data and results indicate that water quality meets World Bank standards. The 2008 AMAC Annual Report states that the independent data collected does not show any substantial changes in water composition that can be attributed to mining activity. Marlin should continue to support the independent activities of this association, and share in house data with them.

All impacted water is diverted to the tailings pond and that contains the only point of discharge from the site. The water treatment plant associated with the tailings pond discharge is designed to contain and control water from a one in one hundred year, 24 hour precipitation event. This is a reasonable design basis for a mine with this length of life. During such an event the tailings impoundment pond will still maintain a freeboard of 2 metres thus preventing discharge of untreated water. Any precipitation event that exceeds this criterion would be handled by the emergency spillway of the tailings pond to protect the integrity of the dam.

Based on reports and the maps showing sample locations points, an attempt was made to compare various sample points as measured during the baseline work, the annual monitoring reports and the COPAE report. The most likely comparisons for the sample point referred to in the press release by COPAE as SW-3 should be compared to SW8 as reported by Water Management |Consultants in their 2007 compilation for baseline data prior to start of operations. It also appears the sample point in the Marlin 2008 Annual Monitoring Report with the closest comparison is SW3. [Note that SW-3 is not

necessarily the same as SW3]. Since the geographical coordinates were not available it is not possible to confirm these points.

Assuming the assumption is correct the following table compares these three sets of data. Though not clear in the COPAE report, it is assumed that the values are total (includes dissolved and insoluble).

	BASELINE DATA 2004 - 2006	BASELINE DATA 2004 - 2006	ANNUAL MONITORING REPORT 2008	COPAE REPORT	CANADIAN DRINKING WATER GUIDELINES	WORLD BANK
ELEMENT	MAXIMUM	AVERAGE	HIGHEST VALUE (SW3)	AVERAGE (SW-3)		
Copper	0.027	0.0089	0.14	0.55	1.0	0.5
Arsenic	0.006	0.00323	0.00409	0.027	0.01	0.1
Zinc	0.176	0.0845	0.051	0.29	5.0	2.0
Aluminum	64.3	24.02	35.9	0.4	0.1	0.1
Iron	34.5	12.38	17.8	4.58	0.3	3.5
Manganese	0.585	0.257	0.318	0.39	0.05	

All results in mg/L

It appears that the COPAE data is significantly different from the other two sets of data for 5 of the 6 elements they have listed. Their stated values for Copper(Cu), Arsenic (As) and Zinc(Zn) are much higher; the values for Aluminium(Al) and Iron(Fe) are much lower while the values for Manganese(Mn) are comparable.

It is possible to rationalise the total values for Manganese and Iron being lower because the COPAE samples may have been taken during a very dry period when sediment levels in the river were low. In comparison the elevated values for Copper, Arsenic and Zinc are less easily explained with this rationale. Zinc can be a highly mobile metal and it may be that conditions at the time prior to sampling were amenable to the mobilisation of that metal. As far as Copper and Arsenic the values given by COPAE are totals and there are no dissolved values.

One possible explanation is that the sample point of COPAE may have been at a turbulent point of the river or during a rainy period. Also sediments could have been disturbed during sampling. The latter seems unlikely if a professional approach to sampling was undertaken.

Manganese by comparison is quite consistent across all three sets of data. The higher values for Cu, As and Zn in the COPAE sampling is difficult to reconcile as other data has been consistently lower than these values since sampling began back 2004. There is no indication that elevated values are originating from mine contamination. Groundwater sampling data shows no degradation resulting from mine water. Since the mine does not discharge from the treatment plant and some seepage that occurred at an early stage was contained and is now prevented from migrating off site there is no basis to attribute the elevated values in surface water to these origins.

Overall the results are not at a level that should be of concern to anyone as far as drinking water needs. The values of some metals are elevated for select beneficial uses and as stated previously should be carefully evaluated before some streams are used for the purposes of irrigation and agriculture.

The water treatment plant has not yet discharged to the environment as any water that is treated is being recycled. According to notes provided by site the treatment plant is being moved late in 2009 to accommodate the raising of the dam to increase the capacity for additional reserves that have been identified and the fact that final tails density is slightly less than the design. They also indicate that the treatment plant is not expected to discharge water till 2010 and likely only then during heavy rain events in the rainy season. The site has optimised their water balance and improved recycle and thus does not expect to discharge routinely. The Marlin mine has very high water recycle rates exceeding 85% which is best practice for the industry.

The author had access to only two sets of monitoring data from the recycled water generated during March and April 2009. Hence the values noted below have not been compiled from an extended period of monitoring, and therefore may not be statistically representative of the ultimate discharge. They should be verified with further testing results.

These initial results indicate some possible elements of concern. Values of total ammonia (84 mg/L), total nitrogen (90 mg/L), selenium (0.0178 mg/L), cobalt (0.10 mg/L) and mercury (0.5 µg/L) are elevated for complete protection of all aquatic life. Aquatic protective guideline values vary between jurisdictions and are dependant on other water parameters. The values reported should be carefully reviewed for their adequacy to protect aquatic life before actual discharge occurs. None of the parameters listed are elevated such that they would exceed standards for human consumption

Other elements of concern in alkaline waters are arsenic, manganese and nickel, which can all mobilise under these pH conditions. The long term monitoring of metal mobilisation is key to ensuring that the waste repositories do not become a major environmental issue.

On a positive note, the treated effluent meets IFC standards for WAD Cyanide and total cyanide according to the data.

8. Wastes and Tailings Impoundments

A small test area referred to as Area 5 was used to evaluate PAG and other matierials. It contains about 100,000 tonnes of materials and has been closed out using a three layer cover consisting of 1.0 m of non acid generating material, 0.5 m of clay and 0.5 m of growth media. This is a standard type of closure cover and thus far no seepage has been measured at sample point D9 immediately down from Area 5. This is a good indication that the cover system is working. However it is essential that sampling of point D9 continues throughout operations and for an extended period post closure. Should contaminated seepage be identified at this point in future, it is feasible and common practice to pump such seeps back to the TSF for treatment.

All other tailings are being deposited in a single repository. The settled tailings density has been shown to be slightly lower than predicted in the initial design. Also, since 2005, additional reserves have been identified and these two points have necessitated an increase in pond volume requirements. Consequently final dam height will be 8 m higher than the original plan, with an increase from 74 m to 82 m. Like all dams in a seismically active area, dam height is a concern. Both elevations present a significant risk and a major consideration in operation and long term maintenance.

The tailings area has been designed so that water covers the surface of the impoundment through much of the year, with beneficial effects. Water flows off the waste rock repository located immediately up from the TSF and into the tailings impoundment, which flows over the tailings, maintaining them in a saturated state for long periods, thus limiting the contact with oxygen, reducing oxidation and ARD generation. During the dry season, the static water cover over the tailings limits oxygen transfer to the tailings and erosion. Further the approximately 20% clay minerals found in the tailings have a high affinity for water thus holding moisture for extended periods should the water cover totally evaporate.

For closure, a cover design was developed by the consultant MWH that addresses important aspects such as erosion, oxidation and maintaining the tailings deposit near saturation. It involves applying a rock cover prior to a revegetation cover. This is an effective solution to reduce erosion and mechanical degradation of the underlying tailings. The rock cover is also necessary to provide sufficient mechanical support to enable materials application using vehicles.

The closure design also includes drains within the tailings to remove slowly percolating waters from the surface to a collection area. A drainage feature like this is counter beneficial to maintaining potentially acid generating materials at more than 90% saturation (a way to reduce acid generation). A design that does not require drainage of the tailings along with a cover that could provide a maximum period of storage of moisture prior to release (store and release cover) would be an improved solution.

The report by SRK Consulting on the Geochemical Characterisation of Tailings, December 2004, was reviewed. This was the only report source provided on this topic and comes from a respected consultant with a history of providing sound recommendations. There are three key questions for the long term management of tailings:

- Do the samples and test work correctly identify the potential to generate acid from the waste rock and tailings;
- Is the storage containment method sound and physically stable,
- Does the planned method of remediation of waste rock and tailings impoundments provide adequate long term protection of the environment

The methodology employed in the study complies with good industry practice and provides the most likely prediction for the long term. It is based on accelerating the geochemical processes under laboratory conditions to attempt to quantify reactions that would take place in the field over many years. As there is uncertainty implicit in the methodology, a very conservative evaluation is applied to the data. However, there is

always a possibility that the reactions do not occur as predicted. This is one reason why post-closure monitoring is required.

The critical criterion determined by SRK is that the neutralisation potential to acid potential ratio (NP/AP) should be greater than 2.0 for unsaturated samples. The readily available acid neutralisation ability (NNP) of the samples is also a critical measure. This value is often quite variable across a deposit, because it is linked to changing mineralogy. The combination of these two numbers is a common determinant in classifying both waste rock and tailings as to whether they are likely to be potentially acid generating (PAG) or Non PAG. The potential for Uncertain materials to generate acid and dissolve metals is therefore very unlikely if the separation criteria established by Marlin (see below) are followed diligently.

Using data developed from the SRK geochemical testing, the Marlin mine has chosen to classify waste rock according to the following criteria, which includes materials with uncertain qualities:

- Non PAG: 20 > NNP > -20 or NP/AP>3 ;
- Uncertain: NNP >20 or NP/AP >3; and
- PAG: NNP < -20 or NP/AP < 1.

This is a sound and more conservative approach than the criteria proposed by SRK. It is also more protective because field operational controls rarely ever match those used for the design basis. On this basis the waste rock classification approach is best practice.

Waste rock that is definitively acid generating is used underground for fill and includes the addition of cementicious materials. Based on current estimates of quantities, all acid generating waste will be reused underground for fill. Any excess PAG and Uncertain rock left at surface will be encapsulated within clean waste rock. This has proven to be a sound approach at other operations. At closure, a 1.0 m clay or silt cover will be placed over the waste rock facility followed by revegetation, This is a common practice. The adequacy of this cover design can only be determined through monitoring and verification during post closure. The location of the waste rock above the tailings area, with drainage flowing to the tailings impoundment is beneficial. Furthermore, locating a storage pond to collect the waste rock discharge that lays above the tailings serves to regulate water flow to the tailings and maintain saturation during extended dry periods.

Marlin has a number of ongoing field geochemical tests of the various waste rock types. This is good practice. The use of ”barrel tests” for long term evaluation of drainage from waste samples is a good way to monitor gradual changes that may occur that cannot be readily identified from drainage off the main piles.

The final dam height of 82 m is a concern since it is an active seismic area. The sustainability of large dams whether for water, tailings or other purposes is always a community concern. There are many instances of dam failures of all types (water, mine waste, hydroelectric, etc) and a rigorous program of inspection is one way to bring reassurance of the integrity of the structure. To ensure risks are minimised, a regular independent review of the Marlin dams is carried out by a well respected authority on dams. These reviews are reported in the annual monitoring reports. It appears that recommendations are reviewed and implemented by Marlin.

Other wastes including hazardous waste are handled separately and sent for recycle or disposal in a controlled system. General wastes are disposed on site in landfill or by incineration. These practices were not reviewed.

9. Closure Plans

The closure plan developed by MWH in May 2009 was reviewed. It appears comprehensive and covers all aspects of closure of a site, but only addresses a short period of post closure monitoring and management. The CAO assessment conducted in 2005 clearly identified the need to publicly report closure plan details and financial provisions. It also suggested the establishment of institutional monitoring of the post closure infrastructure and capacity building to meet these requirements. From the review undertaken by the author it does not appear this has commenced.

All surface facilities will be removed for salvage or handed over to the community for beneficial use. Contaminated facilities, such as cyanide equipment, will not be handed over to the community and non salvageable waste will be buried in the tailings repository. Underground mine equipment will be removed, portals and openings sealed by backfilling and shafts sealed for safety as appropriate. There will be some rebound of the water table once mining ceases but levels appear unlikely to rise to a point where the mine will 'overflow' based on the historic table levels.

Based on the closure plan developed by MWH the following comments are pertinent.

A closure period of 18 months seems very tight, but the writer is not familiar with local conditions such as equipment resources, engineering contractors, seasonal issues etc. A period of 2 -3 years would be normal based on previous experience. The plan may not adequately consider the difficulty of equipment trafficking on poor surfaces like tailings and other unexpected delays due to such things as bad weather. Local conditions such as equipment resources, engineering contractors, seasonal issues etc, might justify the shorter period to complete closure activities. However, a more conservative estimate would consider potential delays that could extend the time required for closure to 2-3 years as mentioned above.

Closure costs are also low compared to norms. As an example, the cost to revegetate disturbed areas in North America is in the range of \$4-8/m^2. The unit cost cited in the MWH report varies from \$0.67-1.32/m^2. This low value is likely due to the very low overall labour costs detailed in the plan. Another reason for lower costs may be that the estimated material coverage per working shift is high. On the other hand, energy, fuel and equipment costs are similar to North American values, which is a reasonable assumption. Further investigation on these closure costs should be undertaken.

The post closure monitoring period is very short and does not reflect any long term monitoring or maintenance costs for the site. Good practice varies on a case by case basis but for potentially acid generating materials, a 25 year period of monitoring post operations, and perhaps longer, should be considered for planning purposes. Though acid generation may not cease after this time, 25 years provides sufficient time to

stabilise site conditions and formulate a very long term strategy. There should also be provision for continued care and maintenance of the facilities for a very long time, often defined as 100+ years. The actual period may be much longer but because financial tools used to asses obligations (e.g. Net Present Value or NPV) result in a very small amount of additional surety after 100 years this is often considered the long term obligation period.

Long term maintenance costs would include items such as;

- Annual dam inspections
- Periodic dam investigations and maintenance
- Treatment of impacted waters until they meet discharge criteria
- Tailings facility and waste rock pile inspections and maintenance, especially for areas of damage to covers and vegetation
- Periodic groundwater sampling and testing to ensure no migration of seepage into surrounding water tables
- etc.,

None of these cost have been included in the overall updated closure costs.

The adequacy of financing to cover closure cost is a critical issue to communities who live within the vicinity of the mine. Practice in countries where government closure regulations exist, assume that closure could be necessary at any time due to declining market conditions, mine integrity issues, corporate bankruptcy, political issues, etc. Financial requirements must therefore consider that unplanned closure requires that the full cost of rendering the operation into a safe state for abandonment is available at any point during the life of the mine. This does not necessarily mean that the full amount of the funds listed in the plan is available, but only those appropriate to the conditions at the time. Hence as waste quantities accumulate, more funds would be required and likewise, as progressive reclamation takes place, fewer funds would be required for assurance.

Under US and Canadian regulations a company, such as Goldcorp, is required to determine the outstanding retirement obligations of facilities that may be required to close. It is difficult to determine what asset retirement obligations (ARO) have been attributed by Goldcorp to the Marlin Mine based on the corporate documents available. The ARO is a corporate financial statement of the corporation's obligations expressed on a present value basis. Based on the closure plan developed by MWH, a present value cost of the $13.06 million estimate should be included in the Goldcorp ARO.

This full estimated closure cost of $13.06 million is considered low for a number of reasons as noted above. The community and government should expect to have access to adequate financial resources to close the mine in the event of failure for any reason. This may be provided via various means such as secure bonds, a letter of credit or other financial vehicles that could provide the necessary security to the Government and Communities of Interest living in the area. In general the combined aspects of the closure plan do not meet the standard of practice used by international companies.

Historically mining has a bad history of closures without adequate resources to clean up and close the facilities safely. For this reason many jurisdictions have introduced measures frequently referred to as 'financial assurance' to ensure adequate funds are

available to them to place the mine in a state of closure, should it fail. The basis on which companies are required to post this assurance varies, often depending on the overall corporate health and history of the corporation. In some situations full assurance is required while in others only partial or progressive assurance is required up until actual closure.

In remote and poorly serviced communities such as the Marlin mine location, access to supplies and infrastructure will rapidly decline after mine operations cease. Establishing post mining infrastructure in such cases is difficult and many mining companies now develop novel approaches in association with the local communities and Government. Some of these post closure concepts are suggested in the Marlin Mine closure plan and it would be a worthy exercise to develop more detail well in advance of closure. The actions that Marlin plans to take should be formulated on the basis of consultation with the appropriate communities and government authorities, at least 5 years before the actual date of closure. With the current estimated closure date in 2016 that would mean initiating discussions in 2011, leaving approximately 2 years for developing these measures.

The long term sustainability of the area around the Marlin Mine is important to the communities. Goldcorp is a short term partner and resident within the community and as such would no doubt like to ensure that corporate presence is limited to a reasonable timeframe. To reduce its long term obligations, Goldcorp needs to develop community skills to secure and maintain long term closure plan integrity. This would be beneficial to everyone. Much of the monitoring and maintenance functions could come under the responsibility of the community, with funding provided through a community foundation using resources contributed by Marlin/Goldcorp. There have been bad experiences in developing countries where foundations set up to manage post closure have been poorly managed or misused and Marlin would do well to conduct a review of such practices prior to any approach to the community and Government. Regrettably these less successful arrangements have not been publicised, presumably for the protection of both the Community and the Company involved.

Some specific areas of expertise that need to be developed within the community are:

- Establishment of key individuals (more than one) with adequate expertise and authority to decide on key issues such as post mining land use. Inappropriate use that would destroy rehabilitation efforts needs to be controlled and managed.
- Water monitoring and sampling including maintenance of sample points, and equipment.
- Data collection and compilation for trending and periodic review by experts
- Monitoring of dams on a regular (monthly/quarterly) basis with ability to report against a set of criteria and submit to an expert for review
- Ability to repair erosion in access roads, tailings covers and other features.
- Capability in revegetation as well as removal of harmful intrusive vegetation.
- Capacity to operate water treatment system to treat impacted water before discharge
- Other

Some technical reviews such as formal dam inspections would require resources from outside the community, but in country capability could and should be developed.

Goldcorp should retain an oversight role for a number of years (perhaps 10-20) to ensure that care and maintenance standards are maintained and substandard practice corrected. This is also a safeguard to ensure that poor practices do not reflect badly on Goldcorp's corporate image.

10. Emergency Preparedness and Response Plans (EPRP)

Marlin is certified to the International Cyanide Code which includes emergency preparedness and response planning for all aspects associated with the use of cyanide. In addition there is a complete EPRP for other risks associated with the Marlin mine and activities that impact the local communities. The plan was originally prepared by consultants but has been modified to reflect site changes and needs. The plan meets good practice and addresses all typical emergencies that could arise from the operations. The plan calls for periodic testing of the emergency plans through desktop and actual field simulations. from Marlin staff, field simulations are carried out by Marlin.

The original loan agreement with the IFC called for a Hazardous Materials Management plan and for Emergency Preparedness and Response plans. These requests have been fulfilled.

11. Biodiversity and Risk Assessment

Data from the current ecological monitoring programs does not indicate any impacts attributable to the mine. These programs should continue throughout the life of mine and for a period of a few years post closure. Once there is no clear evidence of on-going concerns attributable to the mine, they can be discontinued.

Unless air monitoring identifies contaminants leaving the property at a level of concern, there is no need to conduct any health risk assessments. The life of the Marlin mine is relatively short and with the controls in place, it is highly unlikely long term effects can be quantified for such a short period of exposure. Health risk assessment, unless acute, depends on assessing all the factors that can contribute to health issues over the normal life span of an individual. Since the Marlin has a short life of approximately 10 years it would be very difficult to quantify the risks associated with the operation considering that emission are for the most part in full compliance with good practice.

A similar situation exists for ecological impacts unless they are acute. Small influences to local flora and fauna will occur but these can be expected to recover relatively quickly once mining ceases.

12. Conclusions

Overall the environmental policies, procedures and actions of the Marlin mine alone are close to operating at a good level of practice. The lack of corporate performance standards places a lot of responsibility at site level for actions that should be guided by executive management.

The lack of independent audits on environmental management and systems means there is no verification of Montana's claims, and makes the mine vulnerable to criticism that cannot readily be defended. The implementation of ISO 14401 is in progress and the mine should seriously consider certification. Certification would go a long way to supporting the many good actions that have been undertaken and provide confidence to all stakeholders.

Air and water monitoring and management are good practice and results indicate thus far, that the Marlin mine is having no impact on local communites or the hydrology.

A thorough waste evaluation has been performed and materials management is being handled consistent with best practice. Hazardous waste is handled separately and disposed of through independent, specialised services.

The closure plan is lacking in a number of matters. Besides appearing to be under estimated, the plan lacks clear actions and financial resources to support the long term monitoring and maintenance required for the reclaimed facilities post mining. This is an important aspect for long term sustainable land use by the community.

The provision of adequate independent financial assurance to bring the operation into a safe state for abandonment at any time is uncertain. Similarly there is a lack of financial resources for long term monitoring and maintenance. The monitoring and maintenance period is difficult to predict but a minimum 25 years should be considered in cases where acid generation is possible.

Based on the documents reviewed there appears to be no formal requirement for Marlin or Goldcorp to provide independent financial means for closure of the facility should the mine fail at any time. Practice in well developed regulatory regimes requires provision of a bond, letter of credit or similar secure financial tools that the community and Government can use for closure. This lack of financial assurance leaves the community vulnerable to market forces and other risks.

Marlin is certified to the International Cyanide Code standards and has emergency preparedness and response plans which are good practice and provide security to the communities that could potentially be affected by an incident. Marlin is also working toward compliance with the ISO 14001 environmental management system.

There are no identified risks to human health and the ecology based on the activities and monitoring to date.

Appendix

Document References:

- Goldcorp Environment and Sustainability Policy (www.Goldcorp.com/corporate_responsibility/environmental_policy/)
- Terms of Reference for the Sustainability, Environment, Health and Safety Committee - Goldcorp Inc Board Manual
- E&SIA Study - June, 2003

- 2002 Summary Review of Baseline Studies by SRK – January, 2003
- Environmental Audits for 2004, 2006
- CAO-Marlin assessment – September, 2005
- Response to CAO Marlin Mine Assessment – R. Moran September, 2005
- CAO follow up assessment – May, 2006
- Annual Monitoring Reports (AMR) for 2007 and 2008
- Marlin mine water report 2007 – Water Management Consultants March, 2007
- Marlin Mine Project Water Quantity and Quality Assessment by Water Management Consultants – March, 2007
- Goldcorp 2008 Sustainability Report
- Environmental Management Plan - April, 2008
- Cyanide Code Principle 2, Transportation Audit – February, 2009
- Marlin's new water treatment system – Engineering and Mining Journal, April, 2009
- Marlin Mine Updated Closure Plan – MWH Consultants May, 2009
- Informe Anual 2008 Asociacio de Monitoreo Ambiental Comunitario (AMAC 2008 Annual Report)
- Documents on the web site - www.Goldcorp.com/operations/marlin/reports/

Communications (written and verbal):

- Regional Environmental Director of Montana Exploradora

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Denis Kemp is the Principal of Denis Kemp Consulting with over 40 years of experience in a variety of roles in the extractive industry including base metals, refractory metals and alloys.

He has worked in operations, process technology, R & D, technical services, environment and sustainability. He held the position of Director of Falconbridge's Corporate Technology Centre with a primary focus on developing new technologies in support of their operations world wide. Prior to retirement he held the position of Director Environmental Performance with specific emphasis on the application of technologies to improve process environmental performance consistent with the sustainable development policy. His role included site environmental performance evaluation, due diligence and risk management. Mine environmental management plans and closure planning were an important part of the role.

He has worked on acquisition due diligence evaluations and environmental impact assessments. He held positions on industry organisations and committees and was part of the Mining Association of Canada team that developed the Toward Sustainable Mining (TSM) program. He is past Chair of the International Network for Acid Prevention (INAP) and was instrumental in development of the Global Acid Rock Drainage Guide (GARD Guide). He continues to support and assist initiatives that improve sustainability and environmental performance.

He continues to work with mining companies and consultants in the areas of process performance improvement and environmental performance development.