E.2. Questions and Comments from Audience

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Lisa Sumi, Environmental Mining Council of BC
Benthic recolonization at Island Copper site took 25 years. Only benthic colonization was examined. However, the effect on whole ecosystem must be examined to determine effect of mine waste disposal. For example, did the composition of the benthic and other communities change, and what impact did that ultimately have further up the food chain?

Tom Pedersen
Derek Ellis interviewed fishermen for study. Crab fishers and salmon fishers noted no problem; catches were not affected and remained at an approximately constant level. Increased fishing pressure in area is a growing problem. Benthic recolonization occurred during the last 25 years at times when the mine shut down; since 1996 the benthic community has become reestablished and is approaching a normal assemblage for this type of fiord. However, Rupert Inlet is now different from what it was pre-mining. Rupert Inlet used to comprise rocky walls and a soft bottom. The strips of rocky walls that were populated by shrimp are not there any longer because of the accumulated tailings, so there has been a change from hard to soft bottom in places.

Catherine Coumans, Mining Watch, Ottawa
It is clear that there are problems with land-based disposal of mine tailings related both to what is not yet known about AMD, its onset etc. and to ongoing technological failures such as dam breaks etc. But as outrage over failures and damage due to inadequate land-based methods is increasing the industry seems to be jumping onto the new bandwagon of disposal in oceans and lakes. While this "out-of-sight" out of mind solution, which is also relatively cheap, may appear attractive and certainly seems to solve the most obvious problems of AMD there are serious problems here too. Technology is still a problem as the pipe failures at the Rescan designed and Newmont run Minahasa mine in Indonesia shows, where the pipes in the sea have broken three times and spread tailings all along the coral coast. There is also still a problem of lack of sufficient knowledge about the physical, chemical and biological properties of the sea and how they interact to be sure this method is safe. And finally, by simply dumping tailings into seas we are not forcing technology, we are choosing the simplest solution but if it fails there is little that can be done to recover from a disaster in the sea environment.

Tom Pedersen
Replied with a question. What disposal options are you prepared to accept to allow mining to continue? What do you see as the most environmentally responsible way to dispose of tailings. Challenge for everyone to face. Other decisions to consider in tailings disposal is underground mining (less waste) versus open pit (more waste; but safer). Mining practices - want to reduce disruption; reduce the number of pits. By depositing in sea we are reducing the pressure on land disposal.

Bruce Downing, Downing and Associates
Milling approach may provide solutions. If sulphides are removed at the mill, the tailings would be non-acid generating. Possibility of bioleaching to produce a goethite, limonite - benign material. Need the input of mineral processors for the generation of benign tailings prior to disposal.

David Chambers
How to make benign tailings - metallurgical problem. First question that is usually asked is "Is this process (i.e. making the tailings benign) economical"? Acid mine generation is major problem in gold (sulphides). Removing sulphide from tailings doesn't necessarily make the tailings inert - oxides in the tailings have also led to water contamination when discharged into natural water bodies, so that aspect must be carefully investigated. Economic models, like most models, can be tweaked to give the desired answer. Need to make economic projections that are not weighted toward the result the project proponents (industry and/or regulatory) desire.

Tom Pedersen
Not solving the problem by depyritization. Need to have a model to predict the environmental costs of such options. The economic model must include the environmental liability associated with removing the sulphides.

Wayne Knapp, Department of Fisheries and Oceans
The Policy for Management of Fish Habitat is there for a reason (i.e. to ensure the long-term sustainability of fish and fish habitat. The intent is to apply the policy equally to all industry sectors. In some cases, subaqueous tailings disposal may simply be an expedient means of disposal and unless there are certain pressures applied there will be no push to get innovative solutions. MEND led to great improvement in prediction and treatment of ARD and should continue to look at all means of control (not just disposal into natural waterbodies). If industry wants to go to subaqueous disposal (to natural water bodies) additional multi-disciplinary evaluation needs to be done. Investigators/projects such as Derek Ellis/Island Copper provided important assessments of the impacts of unconfined tailings disposal, however, a full and comprehensive ecological examination was not necessarily conducted. Also there are concerns about whether the studies were sufficiently rigorous to show before and after effects. For example, crab managers took cursory look at the data and questioned whether the statistics supported conclusions derived. To conduct a proper evaluation would require extensive commitment and collaboration of both government and industry; government has completed some basic research, but it is unlikely to fully evaluate the subject (particularly given the current prohibition against unconfined tailings disposal i.e. the Metal Mining Liquid Effluent Regulations).

Stella Swanson
Emphasis on responsibility and value-of-information. Limited amount of money for these studies; therefore, the data should give the largest benefit possible to the environment. Regulations in Canada are often placed in advance of science. Research dollars may not be well used unless the research question is clearly related back to the regulatory issue. A review of statistically significant results should be a first step. However, statistical differences may not mean that there will be changes at the fish population level. Several lines of evidence from chemistry, toxicity tests, and field measurements should be used to build a weight of evidence regarding whether there have been significant ecological changes.

Wayne Knapp
As per the previous comment, this type of research would require lots of money and would need agreement on end point.

Glenda Ferris, Environmental Council of BC
Water Quality Modeling is unreliable, especially for Metals Leaching. The receiving aquatic systems take the risk if the models are wrong. Physical properties such as lake temperature (seasonal overturn), currents, wave action and biological uptake mechanisms are not usually 'known' during EA process, only through monitoring. Baseline work on these issues is not done in enough detail or over long enough timelines. Each decision must be site specific, assessing risk and conditions and design.

Bill Price
One obvious concern in water quality modeling and prediction is the degree of precision/accuracy with which waste composition can be predicted prior to mining. A common problem is the difficulty in predicting the volume and sulphide content of the tailings. These details may depend on processing modifications and changes in mill throughput, information which is unknown until the mill is operational. Similarly there may be significant uncertainty regarding final mine waste production volumes.

The Eskay/Albino Lake study presented earlier in the day provides a good example of the challenges faced, as well as the benefits of underwater disposal in a lake. Eskay has relatively high soluble contaminant levels eg. Sb in the waste rock and tailings. The mine is located in an extremely inhospitable environment (e.g., huge snow falls). Despite the small volume of the lake and the high metal levels in the waste, the drainage discharged from Albino Lake passes quarterly toxicity testing with rainbow trout*, *Ceriodaphnia dubia* and *Selenastrum capricornutum*. There has also been no significant difference in taxonomic richness of the benthic communities within receiving streams (EVS Consultants. 2000. Environmental Effects Monitoring Program: 1999 Interpretive Report, Eskay Creek Mine). In using lake disposal, Eskay has avoided dams, paste backfill, and drainage treatment, mitigation measures that at this site would have created far greater long term environmental risk. Lake deposition has also increased the extent of post-mining site reclamation and reduced the economic/environmental liability, and maintenance and monitoring associated with geochemical or geotechnical issues.

There are no fish in Albino Lake, therefore the goal at Eskay is to meet water quality objectives at a point downstream that provides considerable dilution of the lake discharge. This site specific condition affords some leeway in the precision of water quality prediction and permits in-lake mitigation (e.g., sediment curtains). Natural lake deposition would not have been possible at Eskay if the mine had had to meet contaminant concentrations resembling the provincial water quality criteria for aquatic life at the deposition site. However, it is conceivable that a mineral deposit with far lower contaminant levels and soluble minerals may be able meet very stringent water quality objectives and permit requirements within a lake it was depositing waste. What is less clear are the circumstances, the distance from waste deposition at which those objectives would be achieved and the degree to which compliance could be ensured.

*Lake benthic communities ARE impacted, but not tested. Albino Lake sediment has been altered, and with low sediment loadings within the system, mine waste will be exposed for some time.

Gordon Ford, BC Ministry of Environment, Lands and Parks
Obtaining representative samples is an example of the problem (i.e. cores, reverse circulatory drill, underground mine). Representative samples taken from underground mine workings were used for metallurgical testing and supernatant characterization but the talc that was present in the ore was missed until pilot testing started. When ore was processed in the pilot plant the problem emerged. Metallurgists had to remove talc (flocculants). Getting a proper sample to design the mill is a challenge.

Bill Napier, INCO Limited
The Eskay Creek was throughly reviewed by the governments during the assessment phase. Elevated antimony was not picked up during the assessment phase because the attention was on the potential for ARD related seepages. However once the antimony was detected immediate steps were taken to address the problem.

Marlin Murphy, Homestake Canada
No permit level was exceeded for antimony at the Eskay Creek Albino subaqueous disposal site. Eskay had some minor chronic toxicity from the mine/mill effluent discharge. This was picked up with the EEM Program and then we used Toxicity Identification Evaluation (TIE) approach and determined that a mill reagent (collector – aerophrine) caused a minor chronic impact. This was corrected with a reduction in mill consumption of aerophrine. Thus one can be proactive and react before impact on environment.

Stella Swanson
The importance of considering post-closure downstream monitoring for people living in mining drainage basins was noted. Quality of water downstream needs to be confirmed. Tolerance small, especially for some chemicals of concern such as arsenic- reduce uncertainty by well-planned post-closure monitoring. There are quite a few closed and abandoned sites that could be used to build a database around water quality post-closure versus abandoned. This would also help document the benefits of formal closure procedures and actions.

Bill Napier
One possibility that could be considered is leaching the sulphides by flushing the accumulated salts from the waste piles. At Gibraltar, sulphuric acid was added to increase the leaching. Equity - a pilot project was completed looking at recovering the metals from the leaching solution. This was also considered for Mine Doyon in Quebec. Using the acidic leaching approach was a "No go".

F. BRIEF UPDATES OF RESEARCH PROGRAMS