CONCLUSIONS AND RECOMMENDATIONS

The documentation and characterization of historic mine sites in British Columbia remains largely incomplete. The preliminary scoping of historic mine sites undertaken for this project, although rudimentary, has provided the Ministry of Energy and Mines a starting point in better understanding the issue. The work of this project also provides a basis by which future programs can be developed in an efficient and practical manner.

The concerns with historic mine sites principally relate to environmental degradation and public health and safety issues. Environmental issues include mining disturbances that have resulted in impacts to water quality from metal contaminated effluent. Health and safety issues include mine workings that pose threats to the public and include open shafts, adits, unstable ground and other mine infrastructure such as old buildings, structures and equipment.

Based on the water quality results coupled with the mine inspections, the following sites have been identified as having the greatest potential for environmental impacts. Follow up field investigations are warranted to comprehensively characterize these sites and potential off site impacts as candidates for future remediation.

- **Midway (082GSW021)** - Metal leaching and acid drainage concerns, including the two oxidized waste rock dumps and the drainage from the two adits. The lower adit drainage flows through the lower dump, which is an additional contributor to the ML/ARD.
- **Lenora (092B 001)** - Metal leaching and acid rock drainage is a major concern for the waste rock dump, as indicated by the geochemical seep sampling. Also, the tailings are strongly oxidized in patches and have been eroded and transported from the tailings facility.
- **Bralorne-Takla (093N 008)** - Concerns of mercury contamination in soil on site, particularly in the area surrounding the processing mill. Unprocessed mercury remaining in the calcine tailings may also be a potential environmental problem. The shaft is accessible and contains water with mercury concentrations above the BC Water Quality Guidelines for aquatic life but below the Guidelines for drinking water.
- **Ymir tailings (082FSW067-68)** - This highly oxidized tailings impoundment is located on the east bank of the Salmo River. Geochemical results indicate there is a high potential for metal release from the tailings in addition to the concern over the tailings washing down the Salmo River.
- **Second Relief (082FSW187)** - Alkaline rock drainage and metal leaching are issues at this site. The chemical interactions between the drainage and the dumps and tailings are the source of elevated metal concentrations, not the direct adit drainage. The tailings are strongly and pervasively oxidized. Solid mercury, a relic of the early 20th century gold recovery process employed on site, has been found near the mill site.
- **Sultana(093M061) -** Although this historic mine site is remote and small (approximately 600 m^2), water quality results indicate there are metal leaching and acid rock drainage issues on site. The waste rock is pervasively and strongly oxidized and warrants metal leaching and acid rock drainage characterization.

RECOMMENDATIONS

- Another method for prioritizing the scale of an operation, which was not employed in the 2000 field program, is basing inspections around known historical tailings impoundments. A map, "Historical Tailings Disposal Locations" (Eaton and Fournier, 2000) depicts all known tailings impoundments in the province. Tailings are indicative of metal concentration activities and may also contain contaminants introduced in the milling process.
- Conclusions identify priority sites for follow up field inspections. The priority for future field work, however, is to continue characterizing historic mine sites that have not had preliminary inspections.
- An alternative approach to ML/ARD investigations taken in the 2000 field season is to study historic mine sites on a watershed basis. This approach is being employed throughout the United States as it is considered to be the most cost effective and efficient method in terms of reclamation and remediation (Buxton et. al, 1997; Norman, 2000). This approach can be applied here in British Columbia in watersheds with a high density of historic mining activity, such as the Sheep Creek watershed in the Kootenays region. A GIS system would be essential in mapping the various attributes of the watershed (geology, water samples, mine components, TRIM map sheet data, the Geological Survey Branch's Regional Geochemistry Survey (RGS) data, etc.).
- Historic mine sites situated in community watersheds should have priority in terms of inspections, as they pose a direct threat to human health and safety. A GIS would be essential in determining these sites.

- The Ministry of Water, Land and Air Protection (WLAP) has a rating of the sensitivity of watercourses. This data would be a beneficial addition to the Historic Mine Sites Database. A GIS system would be a necessary tool in assessing historic mine site locations that are proximal to these high risk watercourses.

- Exploration for new ore bodies often occurs in the vicinity of historic mining camps. Exploration companies are proprietors of water quality data for some historic mine sites, as they have analyzed the adit drainage to determine if it could be used for drinking water (pers. comm., D. Alldrick, 2001).

- As the overall aim of the Historic Mine Sites project is prioritizing mine sites requiring remedial works, standardized, quantitative methods should be employed when inspecting sites. The creation of a field inspection form, which addresses the various components and hazards on site, is recommended. The form would standardize the information collected as well as facilitate data entry into the Historic Mine Sites Database. Integral to the form would be a ranking system assessing the types of risks (environmental, human health and safety etc.). A ranking system would provide a quantitative method of prioritizing sites for reclamation as well as create a standard in which inspections performed by different people can be compared and assessed.

- Site accessibility was the primary constraint in site selection; many sites were excluded, as they required specialized modes of transport, such as helicopters or ATV motorbikes. In some cases, such as the Reno property in the Kootenays, the sites were accessible by truck but the traveling was time consuming and took the better part of the day. An expanded field budget is crucial if the issue of historic mines is to be approached thoroughly and systematically.

- It is crucial to maintain the ML/ARD analytical budget. The analytical results of the mine drainage provide a quantitative measure of the ML/ARD and are a necessity to the project. However, not all mine sites had drainage or alternatively, the waste rock dump or tailings facilities appeared to have ML/ARD concerns. The analytical program should include provisions for analyses of tailings and waste rock dump material, so that these components can also be assessed for ML/ARD quantitatively.

- The Mining Division's Mines Inspectors as well as the Geologists from the Geological Survey Branch are potentially proximal to historic mine sites during the course of their inspections and field work. Provided a standardized field form and ranking system are in place, these people could assist in the inventorying of historic mine sites in BC. Kits containing supplies for water sampling and physical parameter tests (pH paper etc.) would be required.

- Collaborate with other agencies. The nature of the project is multi-disciplined. Other agencies with potential roles in this project include the Ministry of Water, Land and Air Protection (WLAP), the Mining Association of British Columbia (MABC), Environment Canada and the Federal Department of Fisheries. MELP and MABC have viewed the Historic Mine Sites project presentation.

- Another field season of site inspections will better position the ministry to develop an accurate list of high priority historic sites.