MERCURY CONTAMINATION AT YUKON HYDROMETRIC STATIONS

A Water Contaminants evaluation under the Mercury Project
File 9590-2-9
by

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EXECUTIVE SUMMARY

The study produced a series of evaluations which cover a range of soil types, access scenarios, and micro-climates. Two of the sites were visibly contaminated, while at he third site it was unlikely. It is likely that this ratio of contamination exists across the Yukon, which would leave a total of 30 sites for clean up.

In order to better understand the environmental risk, a soil sampling program at contaminated sites is necessary to understand the methylation rate of mercury with the variation in soil temperature and micro-climate. A comprehensive study of this sort is beyond the scope of the program, but a discrete sampling program would provide initial data for the Yukon. In conjunction with studies reported in the literature, this data would provide a significant insight into the risk associated with past and future mercury deposition.

The costs for disposal and access have only been suggested here in very broad terms, as these sites have enough variation that grouping them at this point is difficult. It is probable that the costing for sites can be refined with a review of site access. The transportation costs are the greatest variable in any clean-up scenario, as the costs associated with disposal and the volume of material required to be removed are relatively fixed. The is a need for more information on the disposition of the buildings which are contaminated in order to assess costs for their disposal or cleaning. It is proposed, as a worst case scenario, that clean-up costs should not exceed an average value of $10,000.00 per site. Any opportunity for bulk disposal or transportation rates would have a considerable effect in reducing this amount.

This review has shown that while the sites where mercury manometers have been employed are likely to be contaminated, the degree of contamination is limited to the hydrometric buildings and the soils under them. This provides for a limited environmental risk and a discrete area requiring decontamination. In turn, these condition reduce costs and public concern. It may well be that the most significant concern to be faced in this issue is First Nation and public perception.

INTRODUCTION

The use of mercury manometers in hydrometric facilities in the Yukon dates back to the 1960's and continues to the present. Methods of preventing mercury spilling from the manometers during operation have been implemented, but previous site and building contamination, and the occurrence of spills, have left up to 80 hydrometric sites in the Yukon contaminated.

Historically the stations have been operated for DIAND by the Water Survey of Canada, of Environment Canada. Over the years, through a hydrometric agreement between DIAND and Environment Canada, Water Survey of Canada was funded to operate stations beyond those operated by Water Survey, as their own network. Since that time, a number of Federal sites have become either jointly funded Federal-Territorial stations, or have been transferred completely to the Territory (DIAND). In these instances, DIAND has supplied the funding and Water Survey has supplied the personnel to maintain and operate the sites.

This survey was initiated to address the issue of mercury contamination of the buildings and lands associated with the operation of hydrometric sites. The results are expected to assist in determining the potential scope of any clean-up in the different eco-systems and soil regions of the Yukon. It is also expected to produce a preliminary estimate of the clean-up program costs. There are also implications for the contamination to have impacts on fiduciary responsibilities and land claims, private lands, and the perception by the public of elevated environmental risk.

The four sites were selected to represent as diverse as possible a number of micro-environments impacted by hydrometric network. The focus is on soil types, soil temperatures, and access. No consideration was given to the degree of contamination. It was clearly understood that the presence of mercury constituted a contaminated site, and the degree of contamination was important only in calculating the cost of remedial work at the site

The summaries presented here have also been distributed under individual covers and this report brings them together in one document, with only minor editorial changes. This report is intended as a current synopsis of our knowledge of the contamination issue.

BABBAGE RIVER HYDROMETRIC STATION (July 1997)

BACKGROUND

The Babbage River originates in the British Mountains and drains a portion of the North Slope of the Yukon, emerging into the Beaufort Sea at Kay Point, some 220 Kilometres east of Inuvik. The Babbage Hydrometric Station is located on a DOE reserve from DIAND on the Babbage River where it is intersected by Caribou Creek (Lat. 68 50 21, Long. 138 40 06). The station was established in 1976 for the Mackenzie Pipeline Study. Recently, the River has been of interest the Inuvialuit, as it is within the Inuvialuit Settlement Region, to Fisheries and Oceans Canada, for arctic char studies, and Parks Canada, as it forms the eastern boundary to Ivavik National Park.

Evaluation

A preliminary evaluation was conducted in July 1997, by DIAND using a Bell 206B helicopter for access through Old Crow. The site was examined for: physical integrity of the building, soil condition, debris, fuel, the presence of a mercury manometer, and visible evidence of mercury contamination. No soil samples were collected as there was no ready access to the area under the footprint of the building.

RESULTS

Building

The building is an older style, with a galvanized sheet metal upper structure, and a wood base (photo A). The upper structure is equipped with "ears" to facilitate lifting the unit by helicopter. It is located some 20 metres from the east bank of the Babbage River and approximately 15 metres North of Caribou Creek. The orifice line was missing from the site and the cable to the rain gauge has been removed and is coiled in the building. The rest of the flow monitoring equipment that remains inside the building includes the mercury catchment pan, base for the recorder, and an air bottle. No attempt was made to open the valve and it was treated as a full bottle for the purposes of this evaluation (photo B). The manometer has been removed and there appears to be no mercury present on the floor or in the metal frame lips where the metallic upper structure is bolted to the floor. There is a small quantity of mercury (<5gm) within the pan located on the floor (photo C). Most of the weather station equipment has also been placed within the building, including the installed data logging

equipment (photo D). The floor of the station is constructed of tight fitted plywood over a frame of undetermined construction but presumed to be entirely of wood. The wood frame base observed outside the building has a single hole through it to allow passage of the orifice line. Construction of the base impeded access to the tundra within the building foot print.

Site

The station is located on tundra at an elevation roughly 5 metres above the observed level of the Babbage River. The surrounding area is rolling and flat with suitable landing room for rotary wing, and possibly fixed wing aircraft, at certain times of the year. The ground cover observed was limited to lichen, some grasses, and forbs including blueberry. The area near the building base was probed and found to have thawed to a depth of 15 centimetres.

Other Equipment

There are two fuel drums, a rain gauge installation, a base for the cable carrier, and a boat remaining within the reserve (photo E). The one unmarked drum is a 22 gallon size and is partially full, while the second is a full 45 gallon container marked as Jet B fuel. The boat appears to be an 18 foot Lund-type craft of aluminum construction and lies on the West side of the Babbage River channel, presumably outside the reserve and within Ivavik National Park. The base for the rain gauge (photo F) is located 5 metres from the Babbage River's east bank, and the base for the cable carrier is located some 10 metres north of the rain gauge.

CONCLUSIONS

There is a small risk, given the type of floor and degree of observed contamination, that mercury has escaped beyond the confines of the building and reached the tundra. Any quantity that might have escaped would be extremely small. Given the conditions at the site, and within the scope of this investigation, the environmental risk posed by mercury at this site is not measurable. The primary environmental concerns at this site are aesthetic and related to the fuel, which is contained for the moment within the drums.

RISK ASSESSMENT

The site is considered to have no risk for environmental impact from mercury.

Babbage River

RECOMMENDATIONS

The remedial work at the site can be conducted without the creation of any contaminated waste. The building, drums and related non-combustible material can be lifted by helicopter from this site to an available fixed wing aircraft runway and barge landing at the Shingle Point Dew Line site (Lat. 69 28 57, Long. 133 38 42). As an option, the site could be left as is, with the exception of removing the fuel, and yet pose no environmental risk. A more constructive use of the site may be to have Ivavik National Park fund renewed operation of the site, as that agency is currently funding the Firth River station and it is on the route from the Water Survey facility in Inuvik.

COST

The expense of removing all the structures and associated material (fuel, boat, etc.) from this site would be high. The 220 kilometre distance from Inuvik and the need to employ a large helicopter makes the commuting between the site, Inuvik, and Shingle Point expensive. The time at the site could be limited to under two hours. The price for large helicopter time from Inuvik is in the range of $1400.00 per hour. There is a consignment of contaminated soil located at Shingle Point at present, so the barge costs could be mitigated if the station material were shipped concurrently. An estimate of the costs associated with remedial site operations, exclusive of labour and disposal costs, would be $10,.000.

PRIORITY

On the basis of cost and risk this site is assigned a low priority for remedial work.

Babbage River

Photo A: Babbage Station and Site

Photo B: View of Station interior

Babbage River

Photo C: Pan containing small quantity of mercury

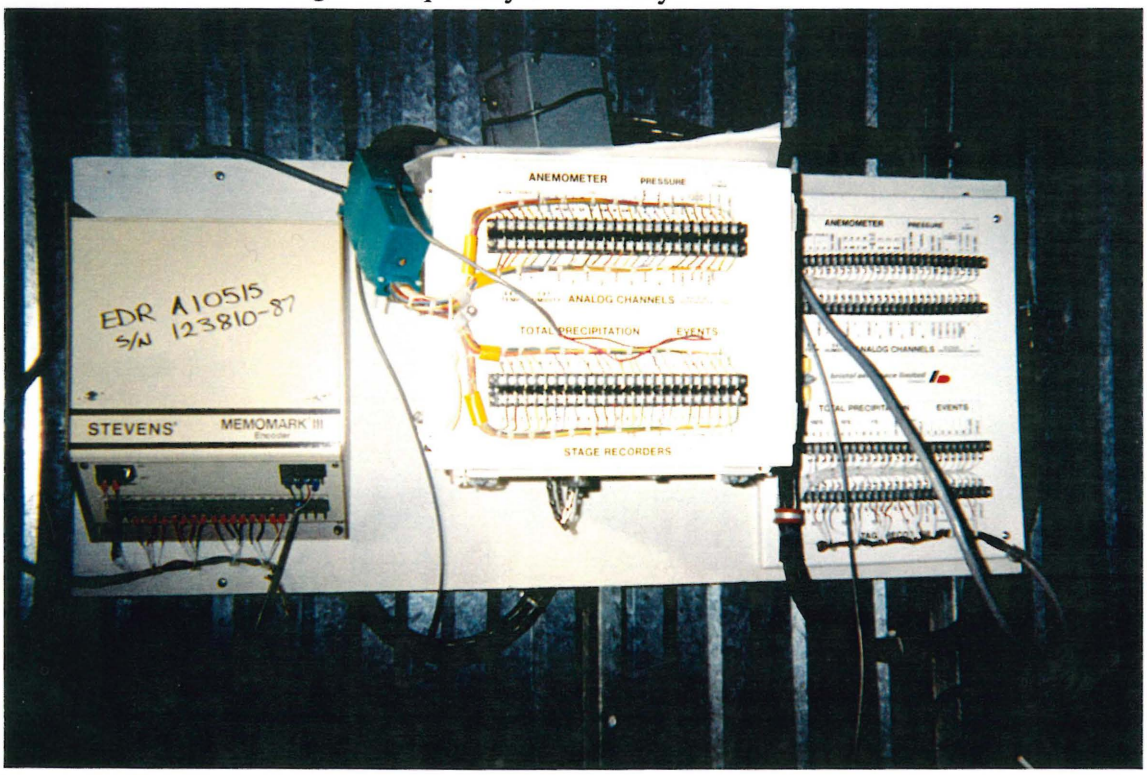

Photo D: Data logging equipment

Babbage River

Photo E: Rain gauge base, fuel drums, and cable system base

Photo F: Rain gauge base and debris

YUKON RIVER AT DAWSON HYDROMETRIC STATION (July 97)

BACKGROUND

The Yukon River flows past Dawson City, some 700 kilometres downstream of Whitehorse, and drains to the Bering Sea. The Town is located below the confluence of the Yukon and Klondike Rivers and is located on the floodplain of the both Rivers. Since 1959 the Town has been protected by a dyke. The station is located on the Yukon River downstream and above the town site in the area of a historical dump site (Lat. 64 04 12, Long. 139 25 30). The station was established in 1945 for the British Yukon Navigation Co. Ltd. And has since been operated as a Federal and later a Territorial site. The most recent site was established in 1996 and replaced a building, which still exists, on a site operated since 1985.

Evaluation

A preliminary evaluation was conducted on the building and site from the 1985 period, as the new structure has never contained a mercury manometer. The work was conducted in August 1997 by DIAND with a Bell 206B helicopter to move the building. The site was examined for: physical integrity of the building, soil condition, and visible evidence of mercury contamination. An attempt was made to lift the building with the helicopter and was unsuccessful in achieving more than a modest shift in location (photo G). No soil samples were collected under the structure, as there was visible contamination of the ground, but background samples were collected from an adjacent area.

RESULTS

Building

The building is an older style, similar to the Babbage River site, with a galvanized sheet metal upper structure, and a wood base (photo H). The orifice line and cable are still at the site but all other equipment has been removed (photo I). There is mercury present on the floor, in the metal frame lips where the metallic upper structure is bolted to the floor, and on the support under the window. There is a considerable gap in the floor (photo J). A small quantity of mercury is located on the base immediately under the gap in the floor (photo K) and there is

more on the ground beneath were this part of the building had been located (photo L)

Site

The station is located on a bench some 5 metres from the east bank of the Yukon River and some 10 metres above it. The area is part of an old dump site and a considerable amount of historic scrap metal and other objects are present in the surrounding soils. Access to the site is by a trail, of three metres in width, or from above via a lot used for a snow dump by the Town. The site is also accessible to rotary wing aircraft. The underlying soils are organic and cold, but not frozen.

Other Equipment

There is a minimum of associated debris which is comprised mostly of cable.

CONCLUSIONS

This site is definitely contaminated and removal of both the building and soils will be required for remedial work. Given that access to the site is good, but public use limited, the exposure risk associated with the area could be considered moderate. The environmental risk posed by mercury at this site is difficult to assess given it's location on an old dump.

RISK ASSESSMENT

The site is considered to have a low risk for environmental impact from mercury, due to the impact on the site from previous usage.

RECOMMENDATIONS

The remedial work of the site can be conducted with the removal of a minimum of contaminated soil. The building, however, is completely contaminated and must be handled as such. Removal can be accomplished easily using an access down the trail and by helicopter. It is recommended that the building be sealed and removed intact by rotary wing aircraft to the

MERCURY CONTAMINATION OF YUKON HYDROMETRIC STATIONS

Yukon River at Dawson

industrial area of the Town for transport to disposal. This will require the use of a helicopter larger than a Bell 206B. It would be possible to access the site with a skid steer loader or a crane, but this would require removal of brush from the trail and the use of heavy equipment on a site of questionable stability.

COST

The expense of removing the structure and associated material would be moderate, with the highest cost associated with the aircraft required to remove the building. The price for a large rotary wing can be as much as $1400.00 per hour, although the time required for it's use would be brief. There is a disposal cost of $1000.00 per barrel for contaminated soils and the site would likely require only one barrel owing to the compacted nature of the soils. The cost for disposal of the building is unknown at this time. Certainly costs, including labour, would be less than $10,000.

PRIORITY

On the basis of cost and risk this site is assigned a moderate priority for remedial work.

Yukon River at Dawson

Photo G: Attempted lift of building

Photo H: View of building

Yukon River at Dawson

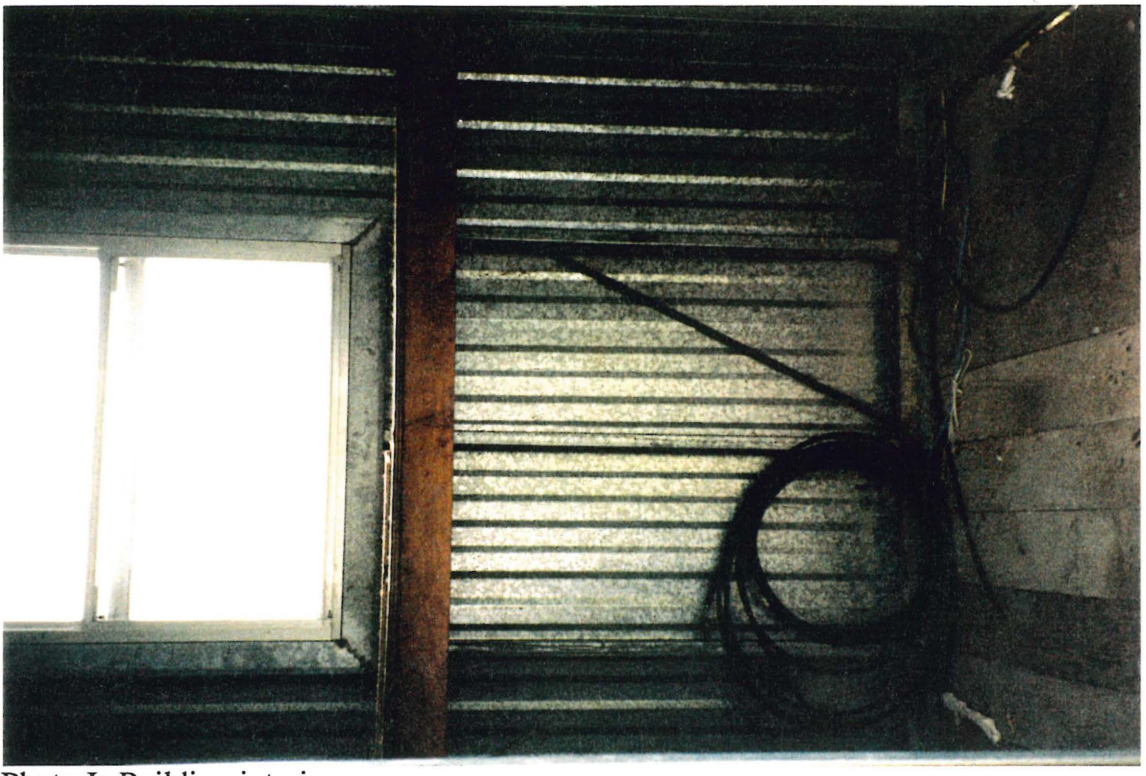

Photo I: Building interior

Photo J: Floor of building

Yukon River at Dawson

Photo K: Mercury on exterior base

Photo L: Mercury on ground

BENNETT LAKE AT CARCROSS HYDROMETRIC STATION
(October 1997)

BACKGROUND

Carcross is located 72 kilometres south of Whitehorse on the Klondike Highway. The Bennett Lake hydrometric site is located on the southwest edge of the Carcross town site just west of the British Yukon Railway bridge (Lat.60 09 50, Long.134 42 27). The station was established in 1947 for the British Yukon Navigation Co. Ltd, as a manual gauge affixed to the rail bridge. In 1968 a recorder was installed and it existed at the current site until replaced in 1985. The newer adjacent building was placed there in 1996. Both buildings currently occupy the site (photo M). The station was operated as a Federal entity until 1985, when it became a shared Federal and Territorial operation. It became a solely Territorial operation in 1995. The building examined in the report was mothballed in 1996 and is the one built in 1987. No record of the disposition of buildings before that time was obtained.

Evaluation

A preliminary evaluation was conducted on the older building and site. The new (1996) structure contains a mercury manometer, but as it is an operating station, only a visual evaluation of the building was attempted. The site evaluation was conducted in October of 1997 by DIAND staff with a front end loader rented for the purpose. The site was examined for: integrity of the building, soil condition, and visible evidence of mercury contamination in both the building and the soil. The building was successfully raised (photo N) and the soil under the base exposed (photo O). Soil samples were collected under the structure to evaluate methylation rates and from an adjacent area for background values.

RESULTS

Building

The older building is of plywood construction (photo M) with a plywood floor (photo P) and

contains shredded material from rodent occupation. The orifice line is still connected to the building and buried (photos N and O) but all other equipment has been removed. There is mercury present on the floor and the recorder support, mixed with the rodent debris. Two drilled holes exist in the floor under the support (photo P). Mercury was observed on the ground beneath the building, below the holes in the floor (photos Q and R).

Site

The station is located on a bench some 2 metres from the edge of the bench above Bennett Lake (photo S) at the head of the Nares River. There is a pipeline running 2.5 metres south of the station site and the centerline of the British Yukon Railway line is 7.5 metres south of the building (photo T). As the rail right of way is 60 metres wide at this point the site is on private BYR land. Conversations with Water Survey of Canada staff, who operate the site, indicate no awareness of an agreement on between Water Survey and BYR on the use of this site. To the best of DIAND staff knowledge the site is unauthorized. Soils at the site are cold, but not frozen, as there is no permafrost in this region. The soils here however may be the warmest in the Territory and should offer the highest rate of methylation available in the Yukon.

Other Equipment

There is a second building adjacent to the existing one (photos M and T) that contains a mercury manometer in operating condition. No contamination of the interior this building was apparent.

CONCLUSIONS

This site is definitely contaminated and removal of both the building and soil will be required for remedial work. An evaluation of the soil at the other building site may be required to insure that both sites are clean. The removal of the mercury manometer from the existing building may be advisable due to it's location within a community as well as the environmental reasons.
The biggest problem to address on the site may be that it is situated on private land held by the

British Yukon Railway Corporation. What the Corporation may require for site clean up and the response of the First Nation and the Carcross community to the site are unknowns.

Access to the site is good and the transportation of soils and buildings can be readily achieved. The site presents few difficulties for total site clean up, other than the presence of an active station on site.

RISK ASSESSMENT

The location of the site within the limits of a community, land use status, and the local First Nation's sensitivity to other environmental problems in the area, represent the most important variables within the risk assessment. Despite the good public access to the site, the contamination is contained under the building and the exposure risk associated with the area should be considered moderate. The environmental risk posed by mercury at this site is low, as even at the relatively warm soil temperatures in the area, the methylation rates should be slow. However, there are no data available at present to support this hypothesis regarding methylation. The local sensitivities and land status present a high risk for Departmental exposure to both adverse media and litigation effects. The combined risk assessment for this site is high.

RECOMMENDATIONS

Despite the moderate environmental and health concerns, the perception of problems and land status should make this site a priority for clean-up. This site can be cleaned with the removal of a minimum of contaminated soil unless the second building site has been contaminated as well. The older building is completely contaminated and must be handled as such, while the newer structure appears to be clean

Removal can be accomplished easily through access down the rail line with light equipment, if permission for such access can be obtained from BYR. It is recommended that the building be sealed and removed intact from the site for disposal outside of the community. The second building may also need to be removed from the site dependent on BYR wishes. At a minimum, the mercury manometer in the operational building should be replaced due to it's potential for future contamination and a renewal of the issue.

COST

The expense of removing the structure and associated material would be moderate, with the highest cost associated with the disposal of the building and soils. The rental of a loader at the

site should not exceed $500.00. There is a disposal cost of $1000.00 per barrel for contaminated soils and the site would likely require only one barrel owing to small foot print of the station, although the status of soils under the second site is unknown. The cost for disposal of the building is unknown at this time, as is the cost to move the operating station to a new location, should that be required. If it assumed that only one building site is involved the exercise then costs, including labour, would be less than $5,000. Removal or relocation of the second building, possible site clean up, and the costs of replacing the manometer and recalibration of the recorder are unknown at this time.

PRIORITY

On the basis of cost and risk this site is assigned a high priority for remedial work.

Bennett Lake at Carcross

Photo O: Exposed soil under building

Photo P: Shelf with rodent debris

Bennett Lake at Carcross

Photo O: Exposed soil under building

Photo P: Shelf with rodent debris

Bennett Lake at Carcross

Photo Q: Holes in floor of building

Photo R: Mercury on ground

Bennett Lake at Carcross

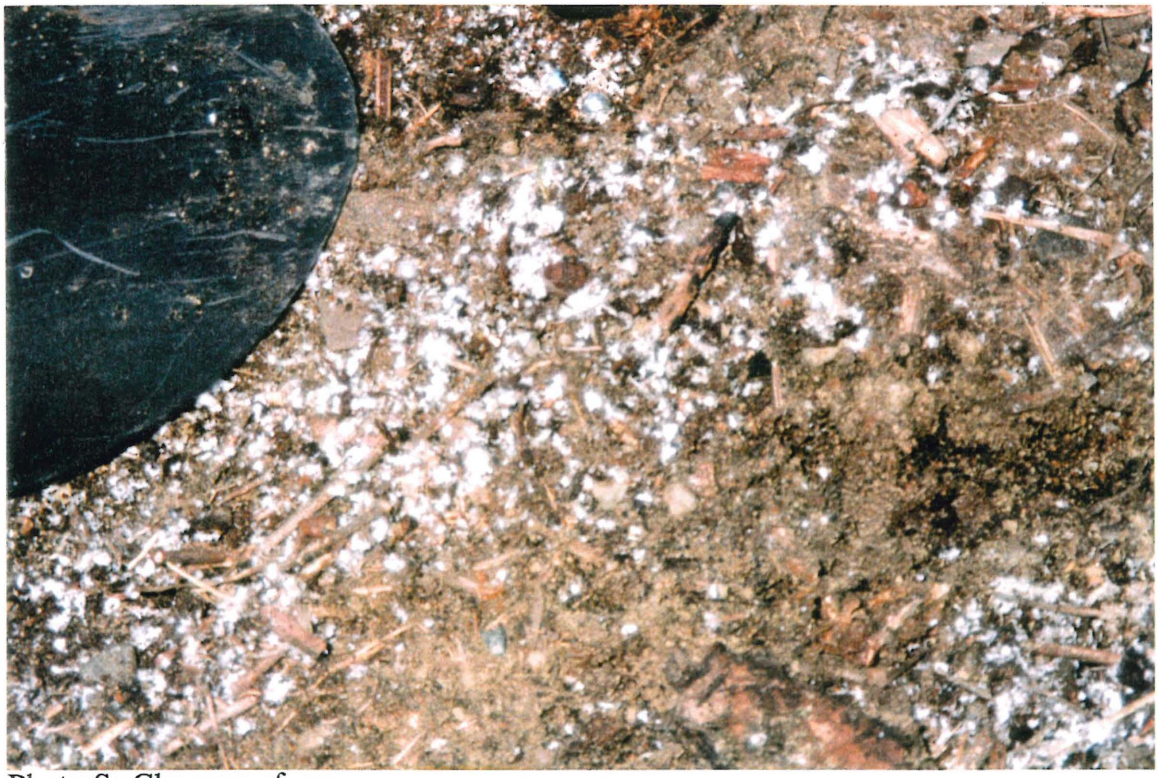

Photo S: Close up of mercury

Photo T: View of buildings on site, rail line, bridge, and Carcross

Bennett Lake at Carcross

Photo U: View of site with rail line and pipe line