



Photo 1 Beach Area POL tanks and pipeline, looking south



Photo 2 Beach Area POL tanks, looking southeast



Photo 3 Barrel Dump #1, looking west

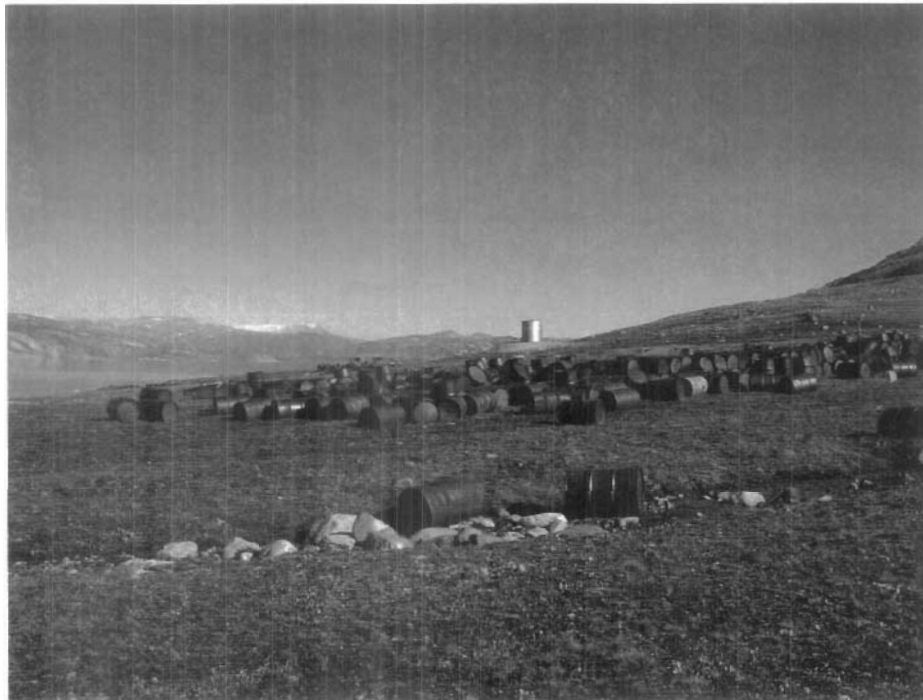


Photo 4 Barrel Dump #2, looking east



Photo 5 Beach area vehicle dump, looking northeast



Photo 6 Beach area vehicle dump

recorded was 81 ppm (less than DCC Tier 2 criteria). The 1994 investigation also included the analysis of two samples for PCBs (below criteria).

The 2004 investigation at this site consisted of the installation of five additional to confirm chromium concentrations in this area. Figure 3.0 shows the location of the boreholes at this site. Testhole BA-1019 was installed in the middle of the barrel dump while boreholes BA-1017, BA-1018, BA-1020, and BA-1021 were advanced around the perimeter of the dump.

Table 2.1 in Appendix D presents a summary of the metal analysis from this site. The analytical data indicates that the highest chromium concentration recorded in this area was 82.8 mg/kg, which is below DCC Tier 2 criteria. It should be noted that this value is similar to the data collected in the background sample. Analysis for the hexavalent form of chromium indicated that these concentrations were all below detectable values or below the CCME criteria in this area.

As was discussed in the findings for Barrel Dump #1, the elevated chromium levels may be an indication of natural levels and not an indication of a contaminant from past land use activities.

4.3.5 Barrel Dump #3/Vehicle Dump

Barrel Dump # 3 consisted of approximately 135 empty barrels as well as a number of abandoned vehicles (7) and various types of equipment. In 1994, RRMCC had collected three soil samples from this area (up gradient) of this vehicle and barrel dump as well down gradient of the barrels. The recovered samples were all analyzed for metals and the data indicated that there were no exceedances above DCC or CCME residential/parkland criteria. One sample was also analyzed for PCBs and was found to be below criteria. Due to the results of the previous investigation at this area and the lack of signs of distressed vegetation or soil staining, the 2004 field program did not include any additional investigation at this area.

4.4 Water Lake Area

4.4.1 General

The Water Lake Area (location indicated in Figure 4) was used as a staging area for base operations. The lake was used as a source of water and trucks would drive down the station road to fill up with water and haul it back to the other station areas. Water Lake is a catchment area for the majority of the runoff from the Upper Station areas. The east side of the water lake consists of a large granular outwash deposit. A number of overland drainage courses, which lead down to the lakeshore, are visible along the western edge of the deposit. Areas of potential contamination include surface staining, barrel dumps, a vehicle dump as well as a large amount of scattered debris between the station road and the lakeshore.

The previous investigation investigated a number of specific locations within this area, including a debris pile, area around the hut, surface stain area, vehicle dump and a barrel

dump. This study did not find any exceedances above DCC or CCME criteria for metals or PCBs in the investigated areas, however it estimated that there was approximately 2,000 m³ of hydrocarbon impacted soils located at a barrel dump and at the location of a fuel stain. Photos 7 through 10 show the barrel dump, vehicle dump as well as the surface stained areas and debris areas. Figure 4.0 in Appendix A shows the investigation locations at this area.

In summary, the 2004 investigation included the installation of a total of eight testholes excavated around the barrel dump and two observed surface stains. Additional investigation activities in this area included the collection of four sediment samples (two from the bottom of Water Lake and two from the sediments in the river between Water Lake and the Beach Area).

4.4.2 Water Lake Barrel Dump

Barrel Dump # 1 consisted of approximately 250 empty barrels, a large amount of wood debris was also observed up gradient of the site. In 1994, RRMCC had collected one soil sample from this area. The recovered samples were all analyzed for metals and the data indicated that there were no exceedances above DCC or CCME residential/parkland criteria however, based on field observations it was estimated that there may be approximately 1,500 m³ of hydrocarbon impacted soils at this site.

The 2004 investigation at this site consisted of the installation of three testholes (WL-1001, WL-1002 and WL-1003). Two of the testholes were installed on the down gradient side of the site and one borehole was installed at the same location of the RRMCC sample location (#62) in order to confirm the depth of hydrocarbon levels at this location. Figure 4.0 shows the location of the boreholes at this site. An inspection of this site indicated no signs of distressed vegetation or surface staining around this barrel dump.

Table 3.1 presents a summary of the analytical data from the samples collected at this site. The analytical data indicated that all the hydrocarbons (BTEX and CWS F1-F4 fractions) were below detection limits or well below CCME criteria.

Based on results from this investigation and from the metal analysis completed in the previous investigation, no additional investigation is recommended at this location. At the time the barrels are removed, it is recommended that the area be re-inspected to confirm if there is any residual hydrocarbon impacted soils located below the barrels that would require remedial action.

4.4.3 Surface Stains

Two large surface stains were observed in the Water Lake area, both of the stains were located on a bench area located above the lakeshore. The 2004 study included the investigation of a stain located near the current helicopter landing pad as well as a stain area located further to the north on the side of a drainage channel. Figure 4.0 shows the location of the two study areas.



Photo 7 Water Lake barrel dump, looking southwest



Photo 8 Water Lake vehicle dump, looking west



Photo 9 Surface stains near helicopter landing pad, looking north



Photo 10 Surface stain in drainage course, north of helicopter landing pad, looking north

Helicopter Landing Pad Stain

In the area that was used as a helicopter landing pad in 2004, a number of surface stains, which covered an area of approximately 90 m², was observed. Photo 9 presents a photo of this area. Other waste debris in the area included, ten barrels, a wooden spool with large diameter cable as well as scattered wood debris. The site is located at the western edge of an outwash deposit that overlooks the lake. Stained areas were also observed in two adjacent drainage courses at the north and south end of the stain.

The 1994 investigation at this site included the analysis of one soil sample for metals and PCBs. This analysis indicated that both the PCB and metal concentrations were below CCME criteria. The 2004 investigation included the installation of four boreholes and the analysis of five soil samples. Two soil samples were analyzed from the center of the stain (WL-1005) and three boreholes were installed to help delineate hydrocarbon contamination up gradient and down gradient of the site.

A summary of all the hydrocarbon analysis is presented in Table 3.1 in Appendix D. The analytical data indicated that elevated F3 concentrations (exceeding CCME criteria) were recorded down to a depth of 0.75 m in the center of the stain (Borehole WL-1005). Due to site conditions, Earth Tech was unable to collect soil samples at depths greater than 0.75 m with a hand auger. Delineation to the east and north was achieved from the data collected in WL-1004 and WL-1007. The F3 concentration in the soil sample collected from WL-1006 (depth 40-60 cm) was only slightly above criteria (838 ppm vs. 800 ppm). The maximum depth of excavation with a hand auger at this location was 0.6 m.

Based on the lateral extent of the stained area and a maximum depth of contamination of 75 cm. The volume of impacted soils in this area is estimated at 75 m³. However, this value should be considered as a rough estimate since the maximum depth of impacted soils was not confirmed in the hand excavated testholes.

Drainage Course Stain

This stain covered an area of approximately 18 m² and was located on the side slope of an overland drainage channel leading off the outwash deposit. Oily rags and dead vegetation were also observed in the area. Photo 10 presents a photo of the stain. One borehole was excavated (WL-1008) at this site. One surface soil sample was collected and analyzed for BTEX, F1-F4 fractions as well as PCBs. Tables 3.1 and 3.3 present a summary of the analytical data from this borehole. The analytical data indicated both the F3 and F4 fractions exceeded the CCME criteria at this location. A second soil sample was collected at a depth of 0.3 m and screened in the field with a Petro Flag kit. The analysis for total petroleum hydrocarbon with this kit indicated a TPH concentration less than 50 ppm. Due to the low concentration for TPH, no additional hydrocarbon investigation was completed at this site.

The analysis indicated that the PCB levels in both soil samples in WL-1008 were less than detection limits.

Based on the results of this investigation, a volume of 6 m³ of hydrocarbon impacted soils has been estimated at this site.

4.4.4 Water Lake Water Analysis

Two water samples were collected from Water Lake. Sample WL-SW01 was collected at the point where the creek, which drains the Upper Station areas, drains into Water Lake and sample WL-SW02 was collected near where Water Lake drains into the river that flow to the Beach Area. Tables 4.1, 4.2 and 4.3 present a summary of the analysis total metals, hydrocarbons and PCBs. The analysis indicates that the concentrations for hydrocarbons and PCBs were less than CCME freshwater aquatic life guidelines for both water samples. The total metal analysis for sample WL-SW-02 indicates that all metal parameters were below CCME guidelines except for aluminum, cadmium, copper, iron, and zinc. The sample collected from WL-SW-02 in 2004 had a high turbidity, therefore the metal analysis may have produced anomalously high values. The total metals in sample WL-SW-02 that exceeded criteria were similar to the values previously recorded in the Gartner Lee surface water monitoring report (Gartner Lee, 2004). It should be noted that the samples bottles for dissolved metals in sample WL-SW-02 as well as the total and dissolved metals in WL-SW-01 were broken during transit to the laboratory.

4.4.5 Water Lake Sediment Analysis

In order to confirm sediment conditions in the bottom of Water Lake and in sediments located in the adjacent river, two samples were collected at both locations. All four samples were analyzed for PCBs, hydrocarbons, PAHs and metals. A summary of the analysis is presented in Tables 5.1 through 5.4 in Appendix D. As indicated in the summary tables, the analysis for all of these parameters was less than the laboratory's detection limits or less than the CCME sediment quality guidelines. Based on the results of this investigation, no additional investigation for sediments is recommended.

4.5 Mid Station Area

4.5.1 General

The available background reports presented very little information regarding any environmental concerns located between the Upper Station area and the Water Lake area. The background reports indicated that a drum storage area as well as a potential dumpsite may be located in the mid mountain area. However, due to snow coverage at the time of the previous investigation, no investigation activities were previously completed in the mid mountain area.

The Upper site and Water Lake area are approximately 4 km apart and are joined with a mountain road that is in very poor condition. Since the area was not accessible with a Quad, access to this area of the site was with a helicopter and by foot. During the initial inspection of this area in 2004 it was determined that environmental concerns in the mid mountain area included a large dumpsite, eight barrel dumps, remains of four Quonset style buildings as well as numerous debris piles and various types of scattered metal and wooden debris. The majority of the barrels at the barrel dumps appeared to be stacked or

piled once they were empty. Occasionally partially full to full barrels were encountered around the barrel dumps.

The mid station area is typically located on the south facing slope of a mountain. This location has very little soil media and there is no vegetation cover. In some locations, small amounts of fine to coarse grained material (weathered) was encountered on the ground surface, however the site is dominated with large boulder sized (> 300 mm) rocks. In some developed areas, sand or gravel sized rock had been imported and used for fill/leveling. Runoff surface water was occasionally encountered, in some locations, this water was visible, however it was commonly located within a gully filled with coarse/fine grained material or below boulder sized rubble.

The areas that were investigated in 2004 consisted of a large dumpsite, an area where barrels had been burned, an area with a large surface stain and three barrel dumps. An examination of the eight barrel dumps in this area indicated that there was only one site where surface staining was observed to be attributed to leaking barrels. Two other barrel dumps were investigated to confirm if there was typically a contaminant concern from the barrel dumps even though they did not show any signs of surface staining. Figure 5 shows the location of the investigated sites in the mid station area and photos of the sites are presented in Photos 11-20.

4.5.2 Dumpsite/Barrel Storage Area

The barrel storage area consists of a leveled gravel pad located on a saddle between the Upper Site and the adjacent peak to the east. This site was referred to as a barrel storage area in the 1994 assessment report. In 2004, this area was used as a helicopter landing pad. A large dumpsite is also located off the north end of this pad. Figure 5 shows the location of this site and Photos 11, 12, and 13 shows the site features. In 2004 there were approximately 110 barrels stored on top of the pad and approximately 250 additional barrels as well as a small amount of domestic waste were located between the pad and the dump site to the north. A large well defined black stain was also observed around the base of the barrels on the pad as well leading down gradient towards the dumpsite. This stain covered an area of approximately 510 m². Observations indicated that approximately 50 barrels at the southern end of the pad had been burned in place. A number of full to partially full barrels were also identified in this area, 13 were located on the pad and 6 were identified scattered north of the site. All of these barrels appeared to have been previously opened.

This pad area, which has approximate dimensions of 50 m x 50 m, was constructed by leveling the area and bridging over the voids in the boulders with smaller sized rock and gravel. There was approximately 0.15 m of sand material used as the surface material. Due to the sizes of the voids between the boulders, the bridging has subsided in some locations, leaving deep cavities in the pad surface. Black staining was also observed to be present in some of the voids located below the pad.

The majority of the materials observed in the dump were made of metal/steel or wood. Items that were identified included a large amount of barrels, domestic waste (tin cans,

dishes, pots, cloth), used vehicle and heavy equipment parts, various types of filters, and batteries. The dumpsite was situated on a 20° slope (determined from vertical survey data). It should be noted that the material at the toe end of the dumpsite mainly consisted of scattered metal (barrels) and wood debris on the ground surface and the footprint of dumped materials was estimated at approximately 600 m². Approximately 75 m beyond the toe end of the dump, the slope dramatically increased and became a cliff. A number of barrels were noticed at the bottom of this cliff.

A barrel dump (Barrel Dump #1) was also located approximately 100 m south of this site, this dump contained approximately 1000 empty barrels, due to the lack of surface staining at this site, no investigation activities were conducted in this area.

Soil Investigation

The investigation program at this site consisted of the collection of soil samples at six locations; one surface water sample was also collected down gradient of the dumpsite. Three of the sample locations were positioned around the perimeter of the main dump; one was located below a smaller dump area located off the NE corner of the pad and two samples were collected in the stained area on top of the pad.

Due to the small thinness of soil or fine-grained material in this area, the samples were typically recovered between the depths of 0 cm to 15 cm. The soil samples from the pad area were analyzed for hydrocarbons, PCBs and metals. Samples for PAHs were only collected at two locations. The summary of the analytical results is presented in Tables 6.1 to 6.4 in Appendix D.

The analytical results indicated that there was an exceedance above CCME criteria for the F3 and F4 hydrocarbon fractions in the area where the barrels had been burned (MS-1086) and an exceedance for F3 at the north edge of the pad (MS-1080). The PAH analysis indicated that there was an exceedance above CCME residential criteria for phenanthrene (6.54 ppm vs. 5 ppm).

Assuming that there is a layer of accessible fine grained material with a thickness of 15 cm and the impacted material is confined to the stained area, the volume of hydrocarbon impacted soils in this area is approximately 75 m³. However, due to the presence of large boulder sized rocks and the small amount of fine grained material within the stained area, remediation of all the impacted material is difficult to impracticable due to the difficulty in removing contaminants from around the rock material.

The soil samples collected from around the perimeter of the dumpsite were analyzed for hydrocarbons, metals and PCBs. Tables 6.1 to 6.4 in Appendix D present a summary of the analytical test results. The PCB analysis indicates that there were no PCB, metals or hydrocarbon exceedances in the soil samples collected down gradient of the dumpsite.

Groundwater Investigation

Below the dumpsite, water could be heard running through and under the porous substrate of boulders and cobbles. This stream was followed and found to surface further



Photo 11 Barrel storage area and dump, looking south



Photo 12 Staining at barrel storage area, looking northeast



Photo 13 Waste materials at dumpsite, looking north



Photo 14 Staining below Barrel Dump #2, looking south

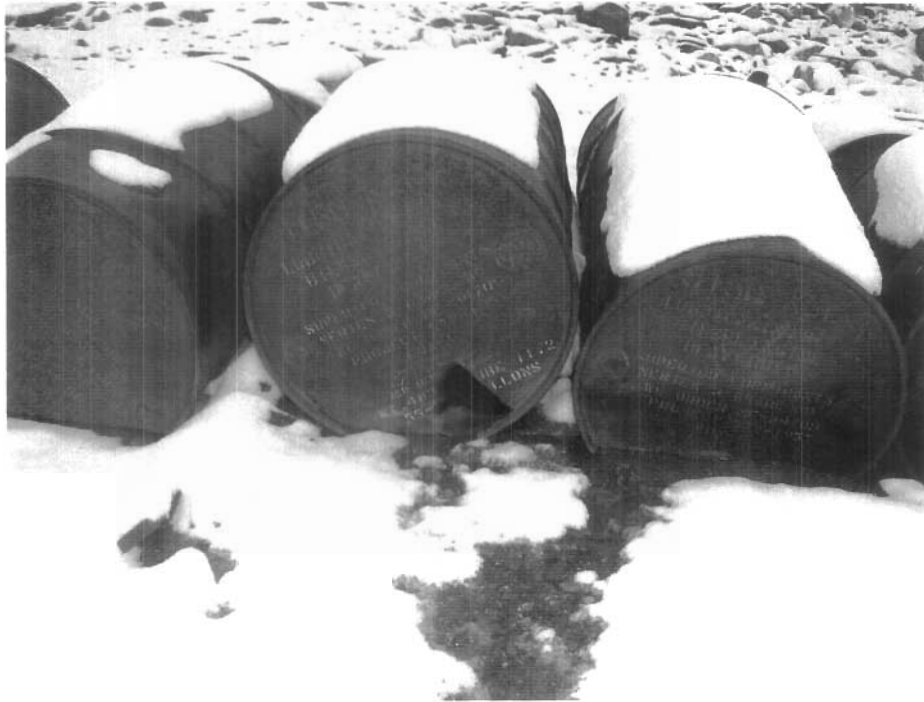


Photo 15 Split open lubricating oil barrel, Barrel Dump #2



Photo 16 Barrel Dump #4, looking west



Photo 17 Barrels and debris around Quonset Hut #1



Photo 18 Staining and debris at Barrel Dump #6



Photo 19 Barrel Dump #5 across from Quonset huts



Photo 20 Barrel Dump #7

down gradient of the dumpsite. One grab sample of the groundwater was collected (MS-1081) and was analyzed for metals (both dissolved and total), hydrocarbons PAHs and PCBs. The analytical results indicated that PAH and PCB compounds were below detection limits.

Tables 7.1-7.3 in Appendix D present a summary of the analytical results of the groundwater sample collected from this location. The results indicated that all the total metal parameters, except for aluminum, iron and cadmium were below CCME freshwater aquatic life criteria. All hydrocarbon parameters were also below CCME freshwater aquatic life criteria. The results also indicate that the PCB levels in all four samples collected around the dump materials were less than the laboratory detection limits. The metal concentrations determined in this sampling program were similar to the concentrations determined in the previous surface water sampling events at the FOX – C site.

The analysis of the dissolved metal concentrations indicated that all metal parameters were at or below the CCME freshwater aquatic life criteria.

4.5.3 Barrel Dump #2

Barrel Dump #2 consists of approximately 120 barrels, which were labeled as containing lubricating oil. These barrels are located in a storage area that is located off the main road. This storage area had been leveled and surfaced with a gravel/sand material. Large boulders and cobble sized material surrounded the site. Some of the barrels were partially full and evidence indicated that the barrels were split open while they were stockpiled at this location. Viewed from above, a large stain was visible on the down gradient side of the barrels and extended down the mountain for a considerable distance. Aerial photos showing the staining at this site are presented in Photo 14 and Photo 15 shows one of the split opened barrels.

Two additional barrel dumps were located south of this site (Barrel Dump#3 and #8), however due to the lack of surface staining around these dumps, a subsurface investigation was not completed at these sites.

The investigation that was completed at this site consisted of the collection of soil samples at a total of six locations. One soil sample was collected up gradient of the source (MS-1087) and two samples (MS-1088 and MS-1089) were installed to delineate the lateral extent of the impacted area. Sample locations MS-1090 and MS-1090B were both located down gradient of the source (40 and 90 m). Due to the lack of soil media in this area and the snow cover, the field identification of stained areas and the delineation of the impacted area was hampered. Figure 5.0 shows the samples locations.

Soil samples were typically recovered at depths ranging from the ground surface to a maximum depth of 10 cm and in areas where fine and coarse weathered material had accumulated (typically in seasonal drainage courses). The majority of the stained material was located around and below large sized rocks. Due to the size of the rock material that is located below the ruptured barrels, it is possible that a large percentage of the released oil has migrated vertically downwards until it reached bedrock material. The

released oil materials on the rocks continue to migrate down gradient during runoff events.

Table 8.1 in Appendix D presents a summary of the analytical data from this site. As indicated in analytical summary table, exceedances for the hydrocarbon fraction F3 and F4 were recorded adjacent to the barrels extending in an area approximately 90 m down gradient of the site. Determination of the down gradient extent of hydrocarbon contamination was not achieved.

Based on the area observed to be stained in the aerial photos the stained area may cover an area of approximately 1,600 m². Calculation of the volume of impacted material is difficult due to the lack of soil media within the contaminant plume, remediation of the impacted material is also difficult to impracticable due to the difficulty in removing contaminants from around the rock material. Based on observations, there is approximately 50 m³ of accessible granular material located around the base of the barrels. It is recommended that this material be removed since it continues to be a source for future down gradient contamination.

4.5.4 Barrel Dump #4

Barrel Dump #4 consists of approximately 200 empty barrels located on the south side of the remains of Quonset Hut #1. Waste debris is scattered around the hut as well as amongst the barrel piles (see Photos 16 and 17). In order to confirm that there was no residual hydrocarbon contamination within the confines of the barrel dump and immediately down gradient of the barrels, three grab samples were collected and analyzed for hydrocarbons. One sample from MS-1091 was also analyzed for PCBs. Tables 8.1 and 8.3 presents a summary of the analytical data from the three samples collected from barrel dump #4. The three samples (MS-1091, MS-1092, and MS-1093) were collected between the ground surface and a depth of 10 cm in an area where fine materials had accumulated. The analysis indicated that the BTEX concentrations were below detectable levels. The F1-F4 fractions were detectable however they were also below the applicable CCME residential/parkland remediation criteria. It should be noted that the F3 fraction in the sample collected from MS-1091 was close to the CCME generic guideline (726 ppm vs. 800 ppm). The PCB concentration in the sample collected from MS-1091 was below laboratory detection limits.

Based on results from this investigation and from the metal analysis completed in the previous investigation, no additional investigation is recommended at this location. At the time the barrels are removed, it is recommended that the area be re-inspected to confirm if there is any residual hydrocarbon impacted soils located below the barrels.

4.5.5 Barrel Dump #6

Barrel Dump #6 consists of approximately 175 empty barrels. Large amounts of waste material are also scattered around Quonset Buildings #2, #3 and #4. Barrel dump #5 is located across the access road from Quonset Building #2 (Photo 19). Based on the