MONTANA POLE AND TREATING PLANT NPL SITE

Final Feasibility Study - Revision 1
Volume I

Prepared for:

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Weathered Bedrock Deposits are described as an orangish-brown to whitish-gray grus; a friable medium to fine gravel sized, angular quartz and feldspar with abundant micas and a trace of hornblende in a slightly kaolinitic matrix.

Examination of field data gathered during the RI drilling program, as well as use of previous site data, suggests that the topography of the weathered bedrock surface varies significantly throughout the site (Figure 1-9). A local bedrock high is present in the southwestern portion of the site, near Greenwood Avenue, indicating intrusion by the Boulder Batholith. At soil boring location B-7, the weathered bedrock/bedrock contact was encountered at a depth of 11 feet below the ground surface, which corresponds to approximately 5,434 feet above msl. From this location, the bedrock surface appears to descend to the northeast at an average slope of 0.061 (unitless), until reaching the center half of the study area. The remaining bedrock surface on the northeast half of the site appears as a nearly horizontal plane with the lowest elevation at approximately 5,395 feet above msl.

1.6 HYDROGEOLOGY

This section summarizes the regional hydrogeology and site-specific hydrogeologic conditions discussed in the final RI report (ARCO, 1993).

1.6.1 Regional Hydrogeology

The City of Butte, as well as the surrounding land areas, lie within the Pacific Northwest Groundwater Region (Todd, 1983). Groundwater occurrence within the vicinity of Butte is generally associated with two water-bearing units: 1) the unconsolidated sediments associated with the Tertiary and Quaternary age valley fill deposits, and 2) the weathered and fractured bedrock deposits associated with the Boulder Batholith. According to published reports (Chen-Northern and CH2M Hill, 1990), the depth to water in the unconsolidated valley fill ranges from 2 to greater than 30 feet. Botz (1969) reported that well yields for the valley typically range from 3 gallons per minute (gpm) to over 30 gpm.

1.6.2 Site-Specific Hydrogeologic Conditions

Evaluation of hydrogeology for the MPTP site was developed primarily from installation of monitoring wells at varied depths across the site and from stratigraphic information obtained during the soil boring/well installation program. Water level measurements of monitoring wells provided data relative to the position of the potentiometric surface, water level fluctuations, and groundwater gradients across the site. Soil boring data were utilized to evaluate site hydrogeologic transmissive units and to characterize the lithology and geometry of the units.

The uppermost aquifer encountered at the site is composed of the Quaternary age alluvial valley fill sediments. Groundwater is present at the site under unconfined conditions, with depth to water measurements ranging from approximately 5 to 20 feet.

1.6.2.1 Hydraulic Properties. Groundwater elevation data collected during the RI from wells monitoring the alluvial aquifer system indicate that the direction of groundwater flow is generally towards the northwest. Monitoring wells penetrating the alluvial aquifer zone indicate a range in water levels from elevations of approximately 5,439 feet msl to 5,426 feet msl.

Contours of the potentiometric surface in the southeastern portion of the site show that the hydraulic gradient is approximately 0.003 ft/ft, while within the northwestern portion of the site it is approximately 0.007 ft/ft. The average hydraulic gradient across the entire site is approximately 0.005 ft/ft. These values are similar to those for the Lower Area One (LAO) (Chen-Northern and CH2M Hill, 1990).

In addition to the regional west to northwest groundwater flow direction, the presence of groundwater mounds in the vicinity of the southeast and south infiltration galleries alter the general flow patterns for the MPTP. To closely investigate the possibility of mounding, ARCO installed a number of monitoring wells in the vicinity of the southeastern infiltration gallery. Figure 1-11 presents a vertical cross section parallel to the overall site groundwater flow direction (southeast to northwest), through the wet well of the southeast infiltration gallery. The listed water level elevations are the average of hourly values measured over a four-day period including June 6, 1991. The input of water to shallow zones in the vicinity of the infiltration gallery is demonstrated by the water level elevation in the south wet well and in adjacent shallow observations wells. Similarly, the creation of significant downward gradients is indicated by the generally lower potentiometric elevations measured in observation wells completed in deeper strata.

While the mounding of groundwater associated with the southeast infiltration gallery is most conspicuous in the shallowest zones of the aquifer, comparison of water level elevations in wells GW25 and W16 indicates an "off-mound" gradient was created at a depth of 20 feet or more. Water input through the infiltration gallery would have moved downward and outward in response to prevailing horizontal and vertical gradients.

Three monitoring wells were screened totally within the lower, water-bearing, weathered bedrock zone. A detailed potentiometric surface map based on these three data points has been developed and is shown in Figure 1-12. The direction of groundwater flow in this deep water-bearing zone is to the north-northeast, similar to the shallow zone, and the gradient is approximately 0.004 ft/ft.

The results of vertical gradient measurement data collected as part of the November 1990 groundwater sampling event ranged from 0.007 ft/ft to 0.03 ft/ft. Groundwater elevation data from well nest M-7 and M-8 showed a downward vertical gradient of 0.002 ft/ft. Water level measurements at the well nest formed by wells GW-2 and GW-3, which monitor the base of the alluvial aquifer and the weathered bedrock, respectively, also showed a small downward, vertical hydraulic gradient.

An evaluation of vertical groundwater flow at the MPTP site in relation to the LAO Operable Unit was conducted using groundwater elevations for well nests BMW-1A/B, GS-17S/D, and GS-25/GS-25C. Groundwater elevation measurements were obtained from past reports. Each of these locations showed that wells within LAO were found to have a slight upward hydraulic gradient. Although these data were not collected at the same time as water levels at the MPTP site and were not collected from a single measurement episode, they do indicate that this is a regional groundwater discharge area. This evidence is supported by data gathered in the LAO investigation (Chen-Northern and CH2M Hill, 1990) which determined that Silver Bow Creek is a gaining stream within LAO.

In-situ rising and falling hydraulic conductivity tests (slug tests) were performed at 28 well locations across the site during the RI. Slug test data results provide information for the specific locations in which the tests are conducted. Slug test results do not provide information on the overall aquifer characteristics.

Horizontal hydraulic conductivities were determined for monitoring wells screened within the top of the alluvial aquifer, the base of the alluvial aquifer, and the weathered bedrock. Horizontal hydraulic conductivity for the site ranged from 3.8×10^{-5} cm/sec to 4.2×10^{-2} cm/sec. Average horizontal hydraulic conductivity values for the alluvial aquifer were calculated to be 5.7×10^{-3} cm/sec using the method of Bouwer and Rice (1976) for an unconfined aquifer condition. Because slug tests are subject to error due to factors such as screen blockage, entrained gas bubbles, and conduct seepage, the calculated conductivities are considered to be approximate. Slug test data results indicate that the central portion of the site exhibits higher hydraulic conductivities than surrounding areas of the site. The effective porosity is estimated to be 20 percent based upon an average total soil porosity of 32 percent. This value is typical for silt and sand (Driscoll, 1986).

1.6.2.2 **Groundwater Movement.** The hydraulic gradient across the site varies depending upon location and point in time. The average hydraulic gradient across the site is approximately 0.005 ft/ft, with average gradients of approximately 0.003 ft/ft and 0.007 ft/ft in the southern and northern halves of the site, respectively.

Using these data, the average interstitial groundwater velocity may be estimated. Using an average hydraulic conductivity of 12 feet/day and an average hydraulic gradient of 0.005 ft/ft, the average groundwater velocity across the site is estimated to be 0.3 ft/day (110 ft/year). The average groundwater velocity north of the interstate is estimated to be 0.42 ft/day (153 ft/year). The average groundwater velocity south of the interstate is estimated to be 0.18 ft/day (66 ft/year). Assuming a distance of 1,200 feet from the site of the plant process area to Silver Bow Creek, the corresponding groundwater flow travel time across the site is approximately 11 years. The actual rate of groundwater flow may be greater or less than these approximate ranges given the heterogeneity of the alluvial aquifer and assumptions implicit in this simplistic analysis.

1.7 VEGETATION

Vegetation in the Butte area has been characterized by Culwell (1977), ECON (1980), MERDI (1980), Montana Department of State Lands (1981), Hydrometrics (1983), and Keystone (1990). The bluebunch wheatgrass (Agropyron spicatum)/bluegrass (Poa spp.)/rubber rabbitbrush (Chrysothamnus nauseosus) plant community is most predominant and best describes the pre-disturbed vegetation for the Montana Pole and Treating Plant site. Other major plant species included in the community type are Idaho fescue (Festuca idahoensis), needle-and-thread (Stipa comata), prairie Junegrass (Koeleria cristata), western wheatgrass (Agropyron smithii), threadleaf sedge (Cares filifolia), and big sagebrush (Artemisia tridentata) (Veseth and Montagne 1980).

Vegetation along Silver Bow Creek and its tributary streams includes cottonwood (Populus deltoides), willow (Salix spp.), rushes (Juncus spp.) and cattails (Typha latifolia). Plant communities associated with Silver Bow Creek have been extensively affected by past urban and industrial activity. The major impact to the plant communities near the MPTP site has been industrial facility construction. Inspection of the floodplain boundary of the site indicates that an impact to plant communities may have been caused by deposition of metal-enriched materials covering the original alluvial soils. In areas with extensive deposition, vegetative cover is sparse with only intermittent areas supporting communities of inland salt grass (Distichlis stricta), scorpion plant (Phacelia hastata), and willows. Where the metal-enriched materials have eroded away (exposing original alluvial soil), willows, tufted hairgrass (Deschampsia caespitosa), and bentgrass (Agrostis spp.) have recolonized the substrate (Hydrometrics, 1983).

Additional disturbances to vegetation resulted from activities associated with the construction of the railroad and treatment plant facility buildings located on the site. A storage yard, previously used for stockpiling treated and untreated timbers, is an associated disturbance. Traffic and mechanical activities in the facility and storage yard areas eliminated the original vegetation and hindered natural regrowth. Surface soils within the plant area were unvegetated during most of the site's operations, exposing the soils to wind and water erosion.

1.8 LAND USE

The predominant land use in the vicinity of the site is heavy industry; however, residential neighborhoods are present immediately east of the site and approximately 1,000 feet west of the site. One residence, a single occupancy office building, and an auto repair shop are also present on the site. Mining-related wastes are found to the west and north of the Montana Pole site within the LAO. The former Butte Reduction Works is located directly north. The Montana Power Company's storage areas are located to the north and east of the site. A POTW is northwest of the site. A partially reclaimed gravel pit and a blasting and explosive powder company (LaVelle Powder) are located to the south of the site. An equipment maintenance company (Roberts Equipment) is located east of the site and a former oil refinery (Russel Oil Refinery) is located to the south of the site. A cemetery lies directly southeast of the site.

The MPTP is the only known industry associated with historical land use at the site. Land at the MPTP site is currently zoned M-1 and M-2 industrial. M-1 zoning allows for a caretaker residence for a business on the site. The existing home is a legal nonconforming use.

2.0 CONTAMINANT ASSESSMENT

A description of the nature and extent of the contamination at the MPTP site is presented in Section 2.1. The fate and transport of contamination, state and federal requirements, and a summary of the baseline risk assessment are discussed in Sections 2.2, 2.3, and 2.4, respectively.

2.1 NATURE AND EXTENT OF CONTAMINATION

This section of the report summarizes the nature and extent of contamination at the MPTP site as presented in the final RI report (ARCO, 1993). The USEPA has been performing removal action at the site since this data was collected. Therefore, the data presented in this section does not reflect current or future conditions at the site.

The discussions in this section are organized by media sampled at the site. These media include:

- Surface soils
- Subsurface soils
- Removed soils
- Groundwater
- Surface water and sediments
- Process equipment
- Miscellaneous oils and sampling sludges

Potential sources of contamination are spillage around the plant site (especially by the mixing tank), drippings from the treated wood, leaking pipelines used to transfer products, the drainage ditch that received process wastewater from the plant, the catchment area below the retorts (concrete sumps were not used), the water discharged from clarifying tanks, the mixing vat, or areas where condensate pooled during discharge (ARCO, 1993). Groundwater, soil, and surface water sampling locations are shown in Figures 2-1 and 2-2.

2.1.1 Surface Soils

Surface soils include those soils between a depth of 0 to 6 inches up to 0 to 2 feet bgs. The ranges and average concentrations of contaminants detected in the surface soils are presented in Table 2-1. Figure 2-3 outlines the areas with pentachlorophenol (PCP) concentrations greater than 15,000 μg/kg and total petroleum hydrocarbon (TPH) concentrations greater than 100 mg/kg. The volume of surface soils at PCP concentrations greater than 15 mg/kg is approximately 30,000 cubic yards.

2.1.1.1 Surface Water Drainage Soil Samples. Analyses of five soil samples (SL101B through SL105B) for PCP and TPH collected along the main ditch running from south to north were used to characterize the surface soils in the surface water drainage areas on the site. Concentrations of PCP along the length of the ditch ranged from 8,300 to 54,900 μg/kg. The highest concentration of PCP measured (54,900 μg/kg) was from a sample (SL101B) taken immediately north of the former retort building. TPH was only detected in the soil sample collected from the northwestern area at a concentration of 286 mg/kg.

2.1.1.2 Backhoe Test Pit Soils. Analysis of soil samples from 15 backhoe test pits within and around the area of the previous emergency soil removal activities for PCP and TPH were used to characterize the vertical extent of contamination. Only 11 of the pits had visible contamination and were sampled. For the surface soil samples collected from the test pits, PCP concentrations ranged from 3,100 to 743,000 μg/kg with the lowest concentrations found along the perimeter of the site. The surface soils (0 to 3 feet) analyzed for TPH indicated the presence of fuel oils #4 and #6. TPH concentrations ranged from 198 to 39,600 mg/kg.

2.1.1.3 Stained and Opportunistic Soil Samples. Seventeen surface soil samples were collected from areas displaying visual evidence of contamination. These samples had detected PCP concentrations ranging from 141 to 1,510,000 μg/kg. Of the TPH constituents, fuel oil #4 was found in nine of the 17 samples. The maximum concentration of TPH (71,500 mg/kg) was found at a location approximately 150 feet northeast of the former pole plant.

2.1.1.4 Surface Grids. Surface soil samples were collected about every 10 feet over the eastern and western treated wood storage yards in the southern portion of the site. These samples were analyzed for PCP and TPH. With the exception of four sampling locations, PCP concentrations within the western treated wood storage yard were below 1,000 μg/kg. The highest PCP concentration detected was 144,000 μg/kg in the soil sample collected northwest of the pole barns. This high concentration of PCP appears to be an isolated incident because soil samples collected around that sample had PCP concentrations less than 1,000 μg/kg. Concentrations of PCP in surface soil samples collected along Greenwood Avenue ranged from 1,190 to 22,400 μg/kg. Concentrations of PCP in three soil samples collected along the southern side of Greenwood Avenue (off site) ranged from below detection limits (less than 11 μg/kg) to 36.3 μg/kg.

PCP concentrations in most of the 28 surface soil samples collected throughout the eastern treated wood storage yard were less than 1,000 μg/kg. This indicates contamination resulting from dripping wood rather than distinct source areas. Surface soil samples collected from three areas had PCP concentrations greater than 1,000 μg/kg: the former wood treating process area; just south of the former pole plant; and approximately 800 feet east of the former pole plant along the Chicago, Milwaukee, St. Paul, and Pacific Railroad. The highest concentrations are within the former wood treating operations area where PCP concentrations ranged from 163 to 30,700 μg/kg.

One surface soil grid sample collected from the western treated wood storage yard had a TPH concentration of 1,370 mg/kg. This sample was characterized as fuel oil #6.

2.1.1.5 Near Surface Soil Borings. Surface soil samples (0- to 2-foot interval) were collected from soil borings. These surface soil samples were analyzed for PCP, PAHs, TPH, benzene, toluene, ethylbenzene, and xylene (BTEX), metals, and dioxins/furans. PCP concentrations in the near surface soil borings were found to exceed 10,000 μg/kg in the former process area and along the historic drainage ditch. The maximum PCP and TPH concentrations measured were 1,160,000 μg/kg and 55,600 μg/kg, respectively. The samples were taken in the northern portion of the site along the historic drainage ditch. Elevated TPH concentrations (greater than 10 mg/kg) in near surface soil borings were found in the former process area and north of interstates I 15/90. The maximum TPH concentration (9,130 mg/kg) was found within the former process area. The maximum BTEX concentration (2,400 μg/kg) was also measured in the former process area. Inorganic chemicals were detected in all of the surface soil samples. Arsenic concentrations ranged from 3,620 to 356,000 μg/kg. Cadmium concentrations ranged from 214 to 3,310 μg/kg. Chromium concentrations ranged from 4,640 to 15,000 μg/kg. Copper concentrations ranged from 23,800 to 1,140,000 μg/kg. Lead concentrations ranged from 6,620 to 264,000 μg/kg. Zinc concentrations ranged from 42,200 to 1,720,000 μg/kg. Near surface soil boring results indicate elevated concentrations of the contaminants of concern in the former process area and along the historic drainage ditch.

2.1.2 Subsurface Soils

Thirty-five subsurface soil samples were collected and analyzed for PCP, polycyclic aromatic hydrocarbons (PAHs), TPH, BTEX, and metals. Table 2-2 summarizes the range and average concentrations of PCP, TPH, PAH, and BTEX detected in the soil samples.

A total of 12 surface and subsurface soil samples were collected and analyzed for dioxins/furans. Total 2,3,7,8 - TCDD equivalent concentrations ranged from below detection limit to 16 ppb.

Metals were detected in subsurface soil samples throughout the site. The maximum arsenic concentration (220,000 μg/kg) was taken just south of Silver Bow Creek. The maximum cadmium concentration (3,270 μg/kg) was measured within the historic drainage ditch at the 18- to 28-foot interval (west of the pole barns). Elevated concentrations of chromium (22,700 μg/kg) and zinc (1,720,000 μg/kg) were detected. The maximum lead concentration (1,280,000 μg/kg) was measured in a sample collected just west of the historic drainage ditch. Concentrations of metals at the site, above naturally occurring background levels, are considered to be related to historic mining operations in the vicinity of the site rather than MPTP related activities. Figures 2-4 through 2-7 show the location and concentration of contaminants. The nature and extent of subsurface soil contamination is discussed for each of the four areas that make up the site: the former wood treatment process area, the eastern treated-wood storage yard, the western treated-wood storage yard, and the northern area.

2.1.2.1 **Former Wood Treatment Process Area.** Six subsurface soil borings and seven backhoe test pits were completed within the former process area of the site. The highest concentration of PCP in the former process area collected from either test pits or borings was 743,000 μg/kg in test pit SL212C. LNAPLs were observed during the subsurface investigation in the former process area. Similar trends were noted for total PAH and TPH. BTEX concentrations remained fairly constant with depth and ranged from 8,390 μg/kg at 6 to 8 feet to 1,862 μg/kg at a depth of 41 to 43 feet. Subsurface soil contamination concentrations in the former wood treatment process area is consistently greater than in any other area on the MPTP site.

2.1.2.2 **Eastern Treated-Wood Storage Yard.** A total of 10 subsurface soil borings were completed in the eastern treated-wood storage yard. PCP and PAHs were detected in only the surficial soil samples collected from this area. Petroleum hydrocarbons were not detected in any of the soil samples collected. BTEX was detected in samples collected from two soil borings which were located in close proximity to the former process area and near the southeast infiltration gallery. No obvious hot spots, represented by elevated concentrations of contaminants, were observed in the subsurface soils in the eastern treated-wood storage yard.

2.1.2.3 **Western Treated-Wood Storage Yard.** A total of 11 subsurface borings were completed in the western treated-wood storage yard. As was observed in the eastern treated-wood storage yard, PCP was detected in only the surficial soils located within the western area, with the exception of two locations in which concentrations ranged from less than 35 to 389 μg/kg. A subsurface soil sample collected within an area where a light oil component had been consistently measured in nearby monitoring well W-8 was found to have a detected PCP concentration of 2,290 μg/kg. This elevated concentration is believed to be indicative of the presence of a free oil layer at the water table surface. PCP concentrations measured in samples collected from the water table and above the weathered bedrock surface were all below detection limits.

TPH concentrations in the subsurface soil samples collected throughout the western treated-wood storage yard were all below detection limits. PAH concentrations ranged from below detection limits to 4,904 μg/kg at the subsurface boring location near monitoring well W-8. BTEX constituents were detected in four subsurface boring locations in the western treated-wood storage yard with concentrations ranging from 0.36 μg/kg to 742 μg/kg. Concentrations throughout the western treated-wood storage yard are fairly constant with the exception of elevated concentrations measured in the hot spot surrounding monitoring well W-8.

2.1.2.4 Northern Area. Elevated contaminant concentrations exist in subsurface soil samples taken along the historical drainage ditch which runs through the site in the northern area. A total of nine subsurface borings were completed in the northern area. Three of the sampling locations (A-2, A-4, and A-14) were located within the historical drainage ditch which ran through the site. PCP concentrations detected in the drainage ditch samples ranged from 976 to 96,000 μg/kg at 6 to 8 feet bgs, and below detection to 174 μg/kg at the top of the weathered bedrock (30 to 42 feet bgs). The highest PCP concentration detected in subsurface soil borings in the northern area is 300,000 μg/kg which was measured at a depth of about 8 feet bgs approximately 400 feet west of the north oil/water separator. The PCP concentrations detected are from those samples not removed from the drainage ditch during the EPA removal action. TPH concentrations were detected in six of the borings in the northern area ranging from 71.6 mg/kg to 55,600 mg/kg. PAH concentrations in each of the eight subsurface borings ranged from 3.5 μg/kg to 364,500 μg/kg at a depth of 2 to 6 feet bgs from a sampling location approximately 20 feet west of the north oil/water separator and within the historical drainage ditch. BTEX concentrations ranged from below the detection limit of 2 to 1,390 μg/kg. BTEX is present throughout the surface and subsurface soils and at the base of the alluvial deposits.

2.1.3 Removed Soils

As part of the 1985 USEPA emergency response actions, approximately 10,000 cubic yards (yd^3) of soil were removed, bagged, and stored in the five pole barns. Keystone characterized these soils by analyzing one bag of soil from each barn. Table 2-3 summarizes contaminant concentrations.

The soil samples were analyzed for PCP, TPH, PAHs, VOCs, BTEX, metals, and dioxins and furans. Results indicate that aromatic VOCs are not present in the bagged soils (detection limits vary from 2.1 to 7.0 μg/kg) except for chlorobenzene, which was detected at a concentration of 2.2 μg/kg. PCP concentrations in the bagged soils ranged from 116,000 μg/kg in the Building 2 sample to 1,450,000 μg/kg in the Building 5 sample. Bagged soils used in the treatability studies were found to contain PCP concentrations of approximately 18,000,000 μg/kg (Keystone, 1991a). PAH concentrations within the bagged soils ranged from 16,600 μg/kg in the Building 2 sample to 441,600 μg/kg in the Building 5 sample. Fuel oil #4 was the only TPH detected in the removed soil samples. TPH concentrations ranged from below detection to 23,600 mg/kg in the Building 3 sample. Total 2,3,7,8-TCDD equivalent concentrations measured in the removed soil samples ranged from 2.12 to 9.45 μg/kg.

Metals analyses were performed on one soil sample collected from Building 3 and a composite sample from all five pole barns. Toxicity Characteristics Leachate Procedure (TCLP) for extracted metals were less than the USEPA established TCLP regulatory limits of 5 mg/l for arsenic, 100 mg/l for barium, and 1 mg/l for cadmium. Total metals concentrations detected were 183 mg/kg for copper, 0.644 to 0.742 mg/kg for cadmium, and 194 mg/kg for zinc.

2.1.4 Groundwater Quality

Elevated contaminant concentrations have been detected in groundwater samples collected throughout the MPTP site. The estimated areal extent of groundwater contamination is 2,680,000 square feet. A total of 52 on-site monitoring wells, 16 off-site monitoring wells located within the LAO Operable Unit, and two off-site residential or irrigation supply wells (Mount Moriah Cemetery and Bontempo) were sampled to determine the extent of groundwater contamination. The groundwater samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), TPH, PAHs, dioxins/furans, metals, total organic carbon (TOC), and total dissolved solids (TDS). The average and range of concentrations of contaminants detected in the groundwater samples are listed in Table 2-4. Figures 2-8 through 2-15 indicate the locations of the elevated concentrations. To facilitate the description of the nature and extent of groundwater contamination, the site is split at I-15/90 into the northern and southern areas. A discussion of metals concentrations is included because of the relationship of the MPTP site with the LAO Operable Unit. A discussion of the LNAPL, which was detected in some of the groundwater samples, is presented at the end of this section because of its continuing affect on groundwater quality.

2.1.4.1 Volatile Organic Compounds. BTEX constituents (benzene, toluene, ethylbenzene, and xylenes) were analyzed during sampling rounds 1, 2, and 3. Approximate boundaries of the total BTEX concentrations greater than 5 μg/l are indicated on Figure 2-8. Analytical data are shown on Figure 2-9.

BTEX was detected in the majority of the groundwater samples collected from the shallow monitoring wells, and in each of the deeper wells which were located either at the base of the alluvial deposits or within the weathered bedrock. In general, those wells containing a LNAPL layer contained the highest concentration of BTEX. For example, well W-8 located immediately northwest and downgradient of the former process area, displayed the greatest total VOC concentration in groundwater: 1,300 μg/l. BTEX concentrations decreased with depth, as illustrated in the well nest located in the former process area, which measured 122 μg/l at 19 feet and below detection limits of 6.0 μg/l at 40.5 feet and 69.5 feet. BTEX was detected in only one well located off-site at a concentration of 0.39 μg/l approximately 1,400 feet northwest of the MPTP site.

2.1.4.4 **Total Petroleum Hydrocarbon.** A hydrocarbon scan was used to determine if one or more hydrocarbon fractions exist in the groundwater. Results for the MPTP site indicate fuel oil #4 is the dominant hydrocarbon. The approximate extent of the TPH plume and hydrocarbon scan results are shown on Figure 2-14.

A maximum TPH concentration of 5,080 mg/l was detected in a groundwater sample collected in the southern area from a well in which floating product had been observed. TPH concentrations in samples collected from three wells downgradient of this well, ranged from less than 0.1 mg/l at a depth of 69.5 feet to 37.1 mg/l at a depth of 19 feet, suggesting TPH migration within the horizontal plane. Samples collected from the other monitoring wells in the south had TPH concentrations ranging from below detection limits to 911 mg/l.

In the northern area, the maximum TPH concentration of 4,250 mg/l was detected in a groundwater sample collected from a shallow well located along the historic drainage ditch. TPH concentrations throughout the rest of the northern area ranged from below the 0.2 mg/l detection limit (0.2 mg/l) to 639 mg/l (well W-4).

The maximum TPH concentration detected in LAO groundwater wells was 3.09 mg/l in offsite well GW-NE-2. Concentrations in additional off-site wells ranged from below detection limits to 0.359 mg/l (well GW-NE-1).

2.1.4.5 **Dioxins/Furans.** Groundwater samples were collected for dioxin/furan analysis from wells W-2 and W-11. Total 2,3,7,8-TCDD equivalent concentrations detected in the groundwater sample from W-2 was 0.013 μg/l and 0.053 μg/l from well W-11.

2.1.4.6 **Metals.** The presence of inorganics in groundwater is either naturally occurring or related to historic mining operations in the vicinity. The analytical results for dissolved metals are shown in Figure 2-15. Generally, wells located near Silver Bow Creek contain trace elements such as arsenic, cadmium, chromium, copper, lead, and zinc, which are likely the result of mining-related wastes. Arsenic concentrations detected in the shallow groundwater samples ranged from below 0.010 mg/l (majority of site wells) to 1.57 mg/l. The maximum concentration was detected in the groundwater sample collected approximately 1,500 feet northwest of the site. Cadmium was detected in two on-site wells in the northern area at concentrations of 0.0084 and 0.029 mg/l. Cadmium concentrations detected in off-site wells located northwest of the site ranged from 0.00599 to 0.232 mg/l. Using the target analyte list (TAL) testing method, chromium was not detected in on-site groundwater wells. Copper concentrations in the shallow groundwater ranged from below 0.025 mg/l to 34.6 mg/l. Generally, copper was detected only in the monitoring wells within the northern area. Off-site measurements ranged from below 0.025 mg/l to 21.9 mg/l northwest of the MPTP site. Lead was not present in any on-site monitoring wells using detection limits of 0.003 and 0.005 mg/l. However, subsequent analysis below the detection limit of 0.002 mg/l indicated the presence of lead at or slightly above the detection limit in three on-site wells: one in the former process area, another just north of I-15/90, and one along Silver Bow Creek. Zinc concentrations within the alluvial aquifer system were fairly consistent throughout the site ranging from below 0.020 mg/l to 11.6 mg/l. Off-site zinc concentrations ranged from below 0.020 mg/l to 75.2 mg/l. Elevated metals concentrations in groundwater were likely the result of mining operations in the area and not activities conducted at the MPTP site.

2.1.4.7 Total Organic Carbon and Total Dissolved Solids. Total dissolved solids concentrations ranged from 325 to 1,500 mg/l in groundwater samples collected from well 8. Total organic carbon concentrations ranged from 1.71 to 76.1 mg/l in groundwater samples collected in the northern area.

2.1.4.8 Light Non-Aqueous Phase Liquid. During the groundwater sampling program, water levels were measured at several monitoring well locations with an oil/water interface probe to determine the presence of distinct phases of hydrocarbon fluid. Light, non-aqueous phase liquid (LNAPL) was evident in eight of the 39 site monitoring wells measured. In all of the wells where non-aqueous phase liquids were detected, only a light oil (floating) phase was observed. A dense non-aqueous phase liquid (DNAPL) has not been measured historically, and highest concentrations (0.0252 and 0.0303 mg/l, respectively) measured at the seep location. Zinc concentrations ranged from 0.262 to 1.12 mg/l at the farthest downstream location with concentrations increasing approximately two-fold throughout the site. Copper concentrations ranged from 0.0936 to 0.220 mg/l at the seep location. As discussed earlier, Silver Bow Creek has been impacted by historic mining and mineral processing activities in the area. Elevated metals concentrations are not a result of wood-treating operations.

TPH concentrations measured in the surface water samples collected in the seep area indicated the presence of fuel oil #6 at a concentration of 0.593 mg/l and fuel oil #4 at a concentration of 2.17 mg/l.

2.1.5.2 Sediments. PCP, PAH, and TPH concentrations detected in sediment samples are shown in Figure 2-19. PCP concentration in the background sample is below detection limits (<274 μg/kg). The PCP concentration detected in the seep sample is 673 μg/kg. PCP concentrations of 1,820 μg/kg and 333 μg/kg, were detected directly downstream of the seep and at the farthest downstream location, respectively. Fuel oil #4 was present in the sediments at the farthest downstream location at a concentration of 161 μg/kg.

Detected PAH concentrations in the sediment samples are highest immediately downstream of the seep location. The maximum concentration of 4,958.3 μg/kg was detected in a sediment sample (SD002) collected adjacent to an asphalt production and storage area located off-site.

Detected metals concentrations in the sediment samples are shown on Figure 2-20. Arsenic concentrations in the creek sediment samples ranged from 31 mg/kg at the farthest downstream sampling location to 842 mg/kg at the seep location. Copper and lead followed similar trends with the highest concentration at the seep and incrementally lower towards the downstream sampling location. Copper concentrations ranged from 656 mg/kg downstream of the source seep to 5,210 mg/kg at the seep. Lead concentrations ranged from 362 mg/kg immediately downstream of the seep to 714 mg/kg at the seep. Cadmium, chromium, and zinc displayed the same trend. Cadmium concentrations ranged from 4.44 mg/kg downstream of the seep to 21.9

mg/kg at the seep. Chromium concentrations ranged from 5.55 to 18.7 mg/kg and zinc concentrations ranged from 1,360 to 6,220 mg/kg.

2.1.6 Plant Process Equipment

Former plant process equipment and debris are stored on the premises at the MPTP site. During the RI, selected pieces of equipment were steam cleaned and then wiped over a 100 cm^2 area, These wipe samples were analyzed for PCP, PAHs, and dioxins/furans. Analytical results for the phenolics indicated that PCP was the most prevalent contaminant, ranging from 3.09 μg/wipe for a large pipe to 317 μg/wipe for a steel tank. PAH concentrations ranged from 16.46 μg/wipe for a nickel tank to 20.76 μg/wipe for a steel tank. Total 2,3,7,8-TCDD equivalent concentrations for a large pipe ranged from 4×10^{-5} to 0.00719 μg/wipe. HNu readings, which assess the presence of any VOCs, were at or very near background.

2.1.7 Miscellaneous Oils and Sludges

The following miscellaneous oils and sludges are stored on site: oil skimmed from groundwater recovery systems; waste oil; sludges from tanks, both treatment vats, and retorts; sludges from the KPEG treatability tests; and treated oil/sludge. The approximate volumes of each are presented in Table 2-7. The samples collected from the different oils and sludges were analyzed for VOCs, PCP, and PAH. Select samples were analyzed for total metals, TCLP metals, TCLP semi-volatiles, TCLP pesticides/herbicides, and dioxins. The range of chemical concentrations for each media are presented in Table 2-8.

High concentrations of BTEX, PCP, PAH, and lead were detected in the separator oils. Pesticides and congeners of dioxins and furans were also detected but at relatively low concentrations. Barium was detected in the separator oil TCLP extract but at concentrations less than the regulatory limits for hazardous waste designations established by the USEPA (40 CFR 261). Only one herbicide (2,4-TP) and two SVOCs (2,4,6-trichlorophenol and pentachlorophenol) were detected above their respective detection limits.

High concentrations of PAH, lead, and low concentrations of BTEX were detected in KPEG-treated oils. Cogeners of dioxins and furans were all below detection limits. Concentrations of metals, herbicides, and SVOCs in the TCLP extract were all below detection limits, except for barium, detected at 251 μg/l in the TCLP extract of KPEG-treated oil sample.

High concentrations of BTEX and PAH were detected in KPEG reagent sludge samples. A total metals analysis indicated a detected cadmium concentration of 14 mg/kg in the KPEG reagent sludge. Concentrations of metals, herbicides, and SVOCs in the TCLP extract were below detection limits.

Miscellaneous sludge samples had high detected concentrations of PCP and cogeners of dioxins and furans; and low detected concentrations of PAH and BTEX. Barium was detected in the miscellaneous sludge TCLP extract but at concentrations less than the regulatory limits for hazardous waste designations. Concentrations of herbicides and SVOCs in the TCLP extract were below detection limits.

The miscellaneous liquid samples had high detected concentrations of PCP, PAH, BTEX, cogeners of dioxins and furans, and zinc. Concentrations of metals, herbicides, and SVOCs in the TCLP extract were below detection limits.

Miscellaneous liquid mixed with sludge samples had high detected concentrations of PCP, PAH, BTEX, and low concentrations of cogeners of dioxins and furans. Concentrations of metals, herbicides, and SVOCs in the TCLP extract were below detection limits.

2.1.8 Summary of Nature and Extent of Contamination

Seven different media were sampled during the RI for the MPTP site. These media include: soils (surface, subsurface, and removed), groundwater, surface water, sediments, process equipment, miscellaneous oils, and miscellaneous sludges. The samples were typically analyzed for PCP, PAHs, TPH, VOCs, dioxins/furans, and metals. The removed soils and miscellaneous oils and sludges were also analyzed using the TCLP method for metals and organics.

Elevated levels of PCP, PAHs, TPH, and dioxins were detected in the surface and subsurface soil samples collected from the plant process area and the historical drainage ditch. The maximum concentrations of PCP, TPH, and dioxins detected in the surface soil samples were 1,510,000 μg/kg, 71,500 mg/kg, and 8.18 μg/kg, respectively. The maximum concentrations of PCP, PAH, TPH, and dioxins detected in the subsurface soil samples were 1,160,000 μg/kg, 2,304,320 μg/kg, 55,600 mg/kg, and 11.36 μg/kg, respectively. Elevated levels of PCP and PAH were generally found to depths of 8 feet in the northern portion of the site and to depths greater than 15 feet in the southern portion of the site. PCP, PAH, and TPH were detected in surface soil samples collected from the former eastern and western wood storage yards at relatively low concentrations. PCP, PAH, and TPH were not detected in subsurface soil samples collected in the wood storage yards. The maximum concentrations of PCP, PAH, TPH, and dioxins detected in the bagged soils were similar to the concentrations detected in the surface and subsurface soils.

PCP in the groundwater is fairly widespread throughout the site (Figure 2-10). The TPH plume is less widespread than the PCP plume and is generally located beneath the plant process area and the historical drainage ditch. LNAPL was detected in eight of the 39 wells sampled. The maximum LNAPL thickness (2.2 feet) was measured in well W-8 which is located north of the pole barns.

PCP, PAH, and TPH were detected in the surface water and sediment samples collected near the seeps. The maximum concentration of PCP detected in the surface water samples (591 μg/l) was from the sample collected near the farthest seep. The maximum concentration of PCP detected in the sediment samples (1,820 μg/kg) was from the sample collected immediately downstream of the farthest seep.

Minimal wipe sampling was performed on the process equipment. The maximum concentrations of PCP, PAH, and 2,3,7,8-TCDD detected on the wipe samples (100 cm^2) were 317 μg/wipe, 10.76 μg/wipe, and 7.19 ng/wipe.

Approximately 26,000 gallons of oils and sludges are stored on site including oil recovered from

Approximately 26,000 gallons of oils and sludges are stored on site including oil recovered from the oil/water separator, oils treated by the KPEG process, reagent sludge from the KPEG processing operation, and miscellaneous oils and sludges presumably collected from various tanks used in the wood preserving operations. Elevated concentrations of PAHs, and VOCs were detected in all the oil and sludge samples. Elevated concentrations of PCP were detected in all but the KPEG treated oils and reagent sludge samples (Table 2-8). Low levels of 2,3,7,8-TCDD were detected in all but the KPEG treated oils and reagent sludge samples.

2.2 CONTAMINANT FATE AND TRANSPORT

This section summarizes the environmental fate and transport of the primary compounds of concern (PCP, PAHs, dioxins, and furans) at the MPTP site. Metals (i.e., arsenic, cadmium, chromium, copper, lead, and zinc) detected in soil and groundwater at the site are believed to be related to naturally occurring or from off-site sources and not due to any activities at the site. Therefore, the fate and transport of metals is not included in this discussion.

The conceptual model of contaminant fate and transport, developed in the final RI report, provides an overview of the site and describes the relationship between source areas, migration pathways, and potential receptors (ARCO, 1993). In summary, PCP, PAHs, dioxins, and furans at the MPTP site have entered the environment from several source areas by spillage, leaks, or infiltration and have migrated via various transport pathways (e.g., advective flow with the groundwater). Section 2.2.1 summarizes the major source areas at the MPTP site. Section 2.2.2 presents the primary migration pathways for contamination to migrate into and through the subsurface. A detailed discussion of the chemical and biological processes and an estimate of the rates of migration of different contaminants in the subsurface are presented in the final RI report (ARCO, 1993) and are not repeated here.

2.2.1 Major Sources of Contamination from Historical MPTP Operations

Based on historical information about former MPTP operations and data gathered during the RI, the major sources of contamination from historic MPTP operations are discussed below and include:

- Plant process area;
- Wastewater discharge ditch including the former waste sedimentation pond; and
- LNAPL plume.

2.2.1.1 **Plant Process Area.** Two retorts and two butt treatment vats were located within the plant process area, and spillage of product from these facilities during MPTP operations has been reported (see Section 1.2). Surface and subsurface soil samples from the plant process area indicate the presence of high concentrations of PCP and PAH compounds (Sections 2.1.1 and 2.1.2). Some of the soils in this area are saturated with wood-treating chemicals and carrier oils. In addition, PCP levels greater than 10,000 μg/l have been detected in groundwater beneath this area of the site, and an LNAPL layer is present on the water table.

2.2.1.2 **Wastewater Discharge Ditch Area.** Wastewater from the wood-treating process was discharged into on-site sedimentation pond(s) and an on-site drainage ditch. PCP mixed with petroleum (PCP/oil) was used to treat timber during the time these discharges occurred. A sedimentation pond is visible on the USEPA Environmental Monitoring Systems Laboratory Las Vegas (EMSL) aerial photograph, August 1983, as located on Figure 1-3. Evidence of the sedimentation pond no longer exists and may have been obscured by the 1985 USEPA removal actions (see Section 1.0) or other previous site activities.

The drainage ditch flow northward through the site toward Silver Bow Creek Soil was excavated from portions of the ditch area to a depth of up to 6 feet as part of USEPA's 1985 actions. Sampling conducted during the RI (Section 2.1) indicates that soils and groundwater beneath the drainage ditch are heavily contaminated throughout its length. Depth to groundwater varies along the length of the drainage ditch. Groundwater is at about 20 feet bgs near Greenwood

Appropriate cleanup levels for all site contaminants of concern will be addressed in the site Record of Decision (ROD).

The risk-based PRAGs developed by DHES and presented in this section are based on a lifetime excess cancer risk of $1x10^{-6}$. Preliminary remediation goals for carcinogens are set at 10^{-6} excess cancer risk as a point of departure, but may be revised to a different risk level within the acceptable risk range based on the consideration of appropriate site-specific factors. State and federal regulatory agencies have the flexibility to specify cleanup levels that are based on an excess cancer risk between 10^{-4} and 10^{-6}.

3.2.1 Preliminary Remedial Action Goals

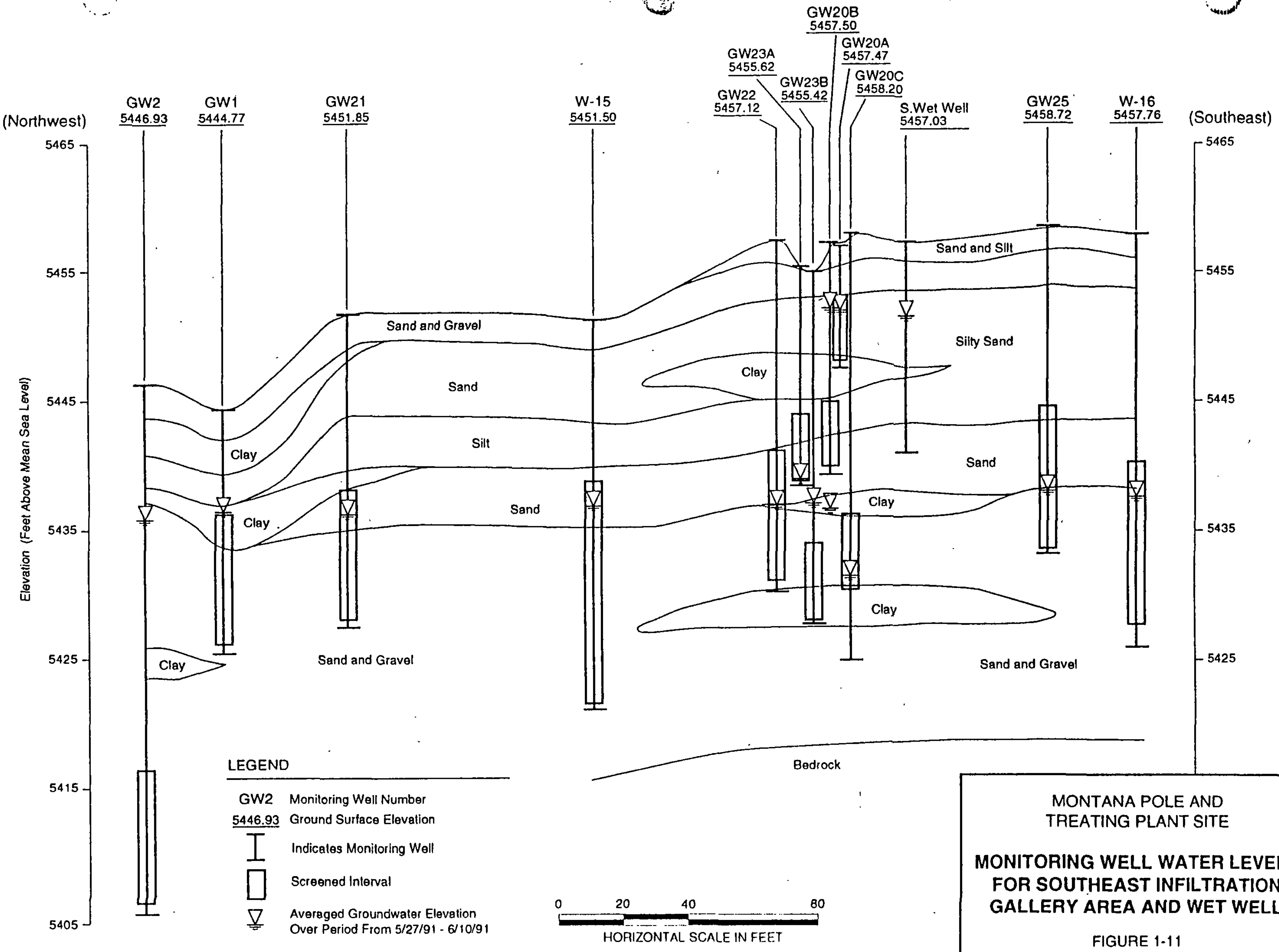
PRAGs for site soils and sediments are presented in Table 3-1 for three potential land use scenarios: residential land use, industrial or commercial land use, and recreational or trespasser land use. The PRAGs were calculated by linearly adjusting the concentrations identified in the Baseline Risk Assessment report (CDM, 1993) for each land use scenario to correspond to an excess cancer risk of $1x10^{-6}$ except for dioxins. The PRAG for dioxins correspond to an excess cancer risk of $1x10^{-4}$. For PCP, the dermal contact exposure scenario was used because it results in the highest risk of all the exposure scenarios. The PRAGs for dioxins/furans, carcinogenic PAHs, and arsenic were calculated using ingestion of contaminated soil as the exposure scenario. Carcinogenic PAHs are based on benzo(a)pyrene (BAP) equivalents using the toxicity equivalency factors (TEFs) as described in the Baseline Risk Assessment report (CDM, 1993). In 1988, the USEPA recommended a general approach for the disposition of PCP and PCB waste and contaminated soil. The recommended levels of dioxin in soils were 1 ppb TCDD equivalents for residential areas and 20 ppb TCCD equivalents for industrial or nonresidential sites (U.S. Congress, 1991). These values recommended by USEPA are more than two orders-of-magnitude less stringent than the risk-based PRAGs developed by DHES. The contaminant concentrations corresponding to 10^{-4}, 10^{-5}, and 10^{-6} risk are presented in Table 3-2. As stated above, although the PRAGs are based on a 10^{-6} risk, the regulatory agencies have the flexibility to specify cleanup levels that are based on an excess cancer risk between 10^{-4} and 10^{-6}.

PRAGs for site groundwater are presented in Table 3-3 and include both regulatory criteria (i.e., MCLs) and risk-based levels. The risk-based levels for groundwater were calculated similarly to the soil calculations above and correspond to an excess cancer risk of 1×10^{-6} based on data for the residential ingestion exposure pathway as presented in the Baseline Risk Assessment report (CDM, 1993).

PRAGs for site groundwater treated under certain remediation alternatives are based on the disposal option. If the groundwater is recharged into a clean portion of the aquifer, the concentrations of contaminants in the discharged water must meet regulatory criteria (i.e., MCLs). If the groundwater is recharged into a contaminated portion of the aquifer, the contaminant concentrations in the recharged water must meet nondegradation standards (i.e., be equal to or less than the average contaminant concentrations in the aquifer in the vicinity of the recharge system). However, to achieve long-term remedial action objectives, recharged groundwater concentrations should be significantly less than those existing in the aquifer. If the groundwater is discharged into Silver Bow Creek, the concentrations of contaminants must meet the regulatory criteria for a new discharge to surface water. PRAGs for surface water and discharge to surface water are presented in Table 3-4 and include health-based regulatory criteria and aquatic criteria. These PRAGs are based upon the Montana Water Quality Act I-Classification for Silver Bow Creek, the goal of which is to restore the creek to swimmable, fishable, and drinkable waters. MCLs and aquatic standards are discussed in Section 2.3.

Equipment and debris that are contaminated with a prohibited listed waste must meet the treatment standards for the listed waste. However, treatment standards for FO32 and FO34 wastes have not been promulgated by USEPA. Therefore, equipment and debris can either be disposed in a RCRA Subtitle C landfill, or, in a municipal landfill if the equipment and debris is adequately decontaminated.

The oil and sludge wastes stored on site are considered RCRA FO32 and FO34 listed wastes. There are no promulgated treatment standards for the FO32 and FO34 classification.

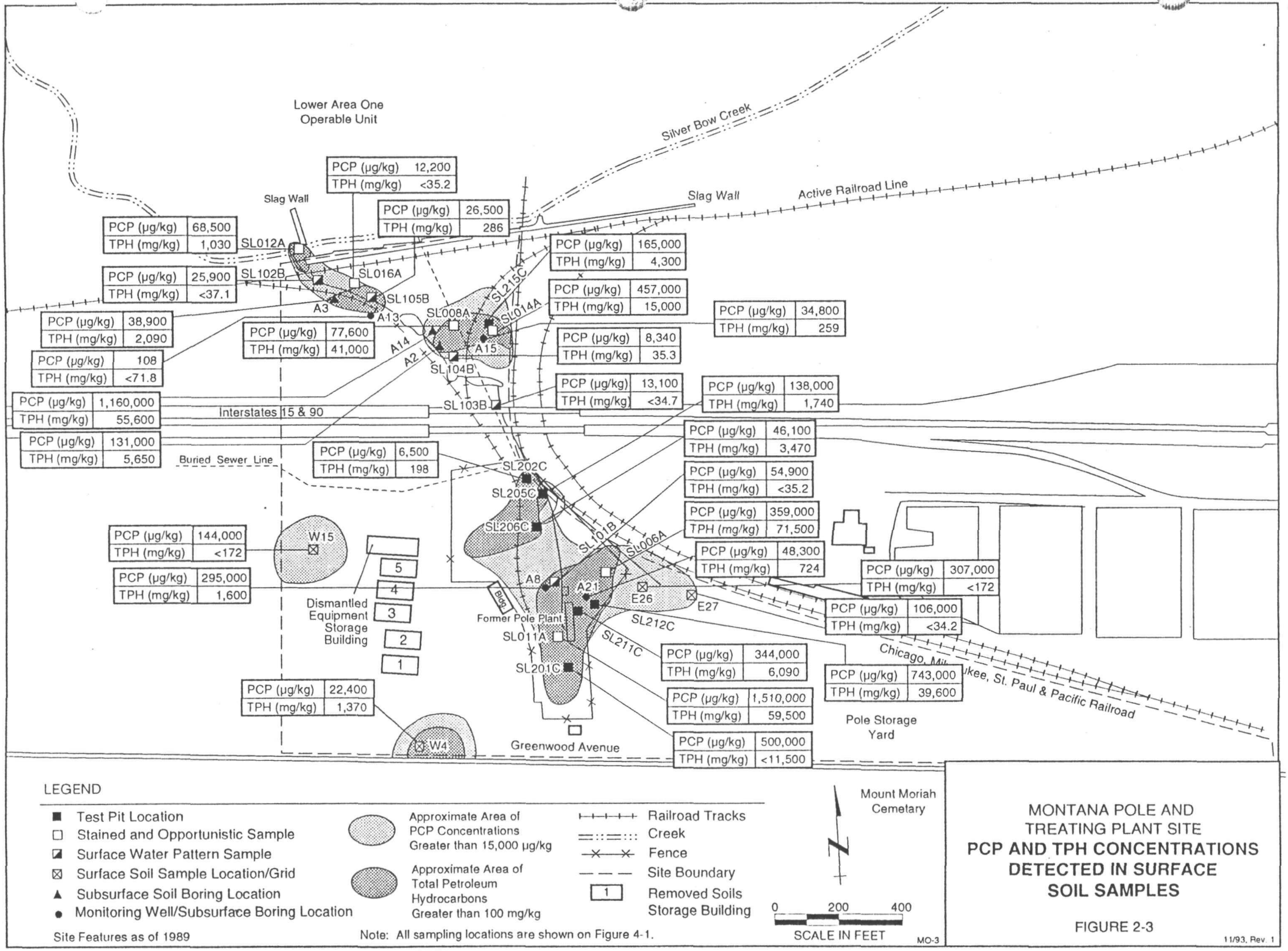


MONTANA POLE AND
TREATING PLANT SITE

MONITORING WELL WATER LEVELS FOR SOUTHEAST INFILTRATION GALLERY AREA AND WET WELL

FIGURE 1-11

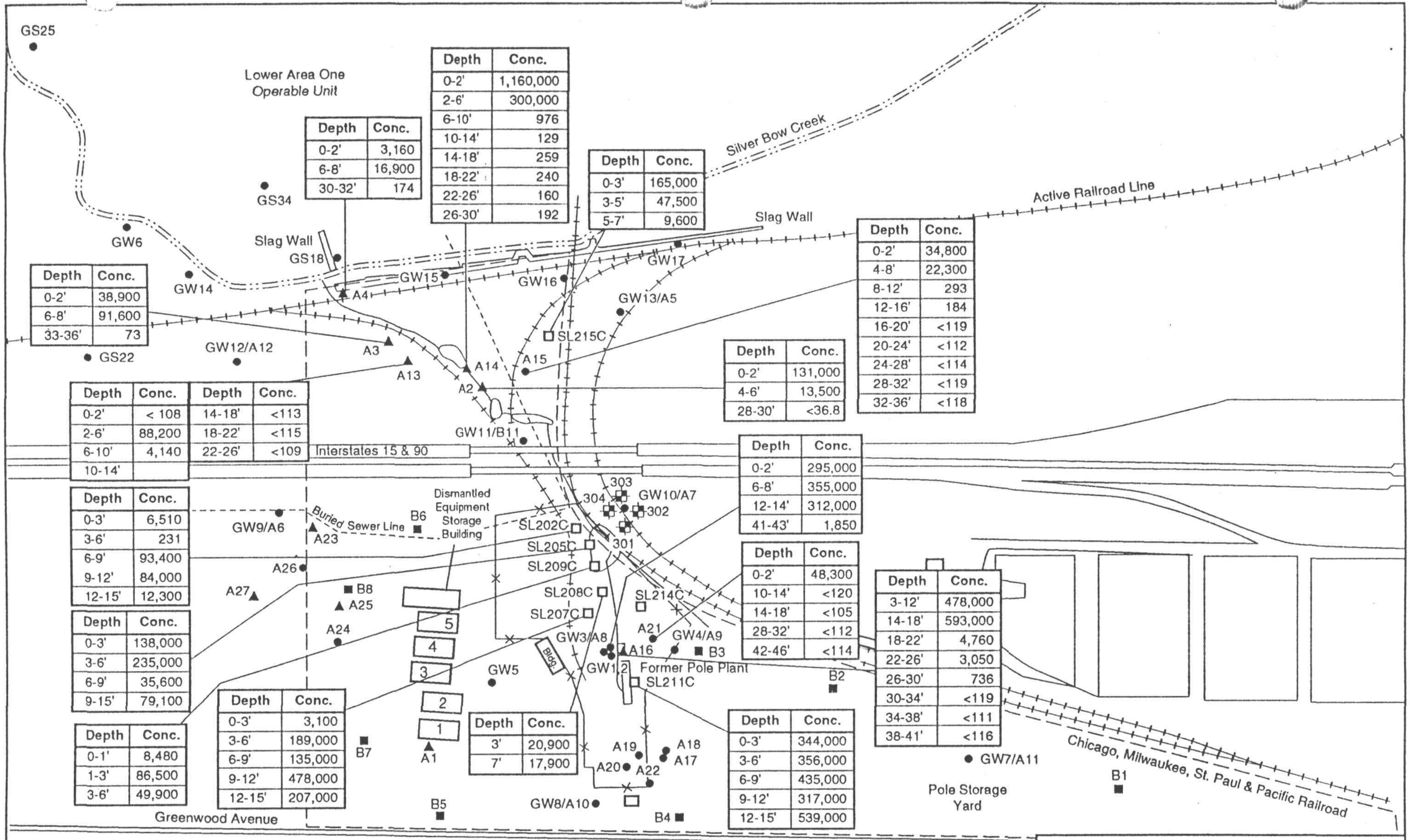
11/93, Rev. 1



MONTANA POLE AND
TREATING PLANT SITE

PCP AND TPH CONCENTRATIONS DETECTED IN SURFACE SOIL SAMPLES

FIGURE 2-3



Depth	Conc.
0-2'	1,160,000
2-6'	300,000
6-10'	976
10-14'	129
14-18'	259
18-22'	240
22-26'	160
26-30'	192

Depth	Conc.
0-2'	3,160
6-8'	16,900
30-32'	174

Depth	Conc.
0-3'	165,000
3-5'	47,500
5-7'	9,600

Depth	Conc.
0-2'	34,800
4-8'	22,300
8-12'	293
12-16'	184
16-20'	<119
20-24'	<112
24-28'	<114
28-32'	<119
32-36'	<118

Depth	Conc.
0-2'	38,900
6-8'	91,600
33-36'	73

Depth	Conc.
0-2'	131,000
4-6'	13,500
28-30'	<36.8

Depth	Conc.
0-2'	< 108
2-6'	88,200
6-10'	4,140
10-14'	
14-18'	<113
18-22'	<115
22-26'	<109

Depth	Conc.
0-2'	295,000
6-8'	355,000
12-14'	312,000
41-43'	1,850

Depth	Conc.
0-3'	6,510
3-6'	231
6-9'	93,400
9-12'	84,000
12-15'	12,300

Depth	Conc.
0-2'	48,300
10-14'	<120
14-18'	<105
28-32'	<112
42-46'	<114

Depth	Conc.
3-12'	478,000
14-18'	593,000
18-22'	4,760
22-26'	3,050
26-30'	736
30-34'	<119
34-38'	<111
38-41'	<116

Depth	Conc.
0-3'	138,000
3-6'	235,000
6-9'	35,600
9-15'	79,100

Depth	Conc.
0-1'	8,480
1-3'	86,500
3-6'	49,900

Depth	Conc.
0-3'	3,100
3-6'	189,000
6-9'	135,000
9-12'	478,000
12-15'	207,000

Depth	Conc.
3'	20,900
7'	17,900

Depth	Conc.
0-3'	344,000
3-6'	356,000
6-9'	435,000
9-12'	317,000
12-15'	539,000

LEGEND

- ▲ Subsurface Soil Boring Location
- ■ Subsurface Boring Based on 20% Surface Borings
- ● Monitoring Well/Subsurface Boring Location
- □ Test Pit Samples
- ✚ Supplemental Surface Soil Location

Conc. = Concentration in µg/kg

Site Features as of 1989

- ┼┼┼┼┼ Railroad Tracks
- ═::═::: Creek
- ─×─×─ Fence
- ─ ─ ─ Site Boundary

Note: 0-2' measurements are also included in Figure 4-3.
All sampling locations are shown on Figure 4-1.

0 200 400
SCALE IN FEET

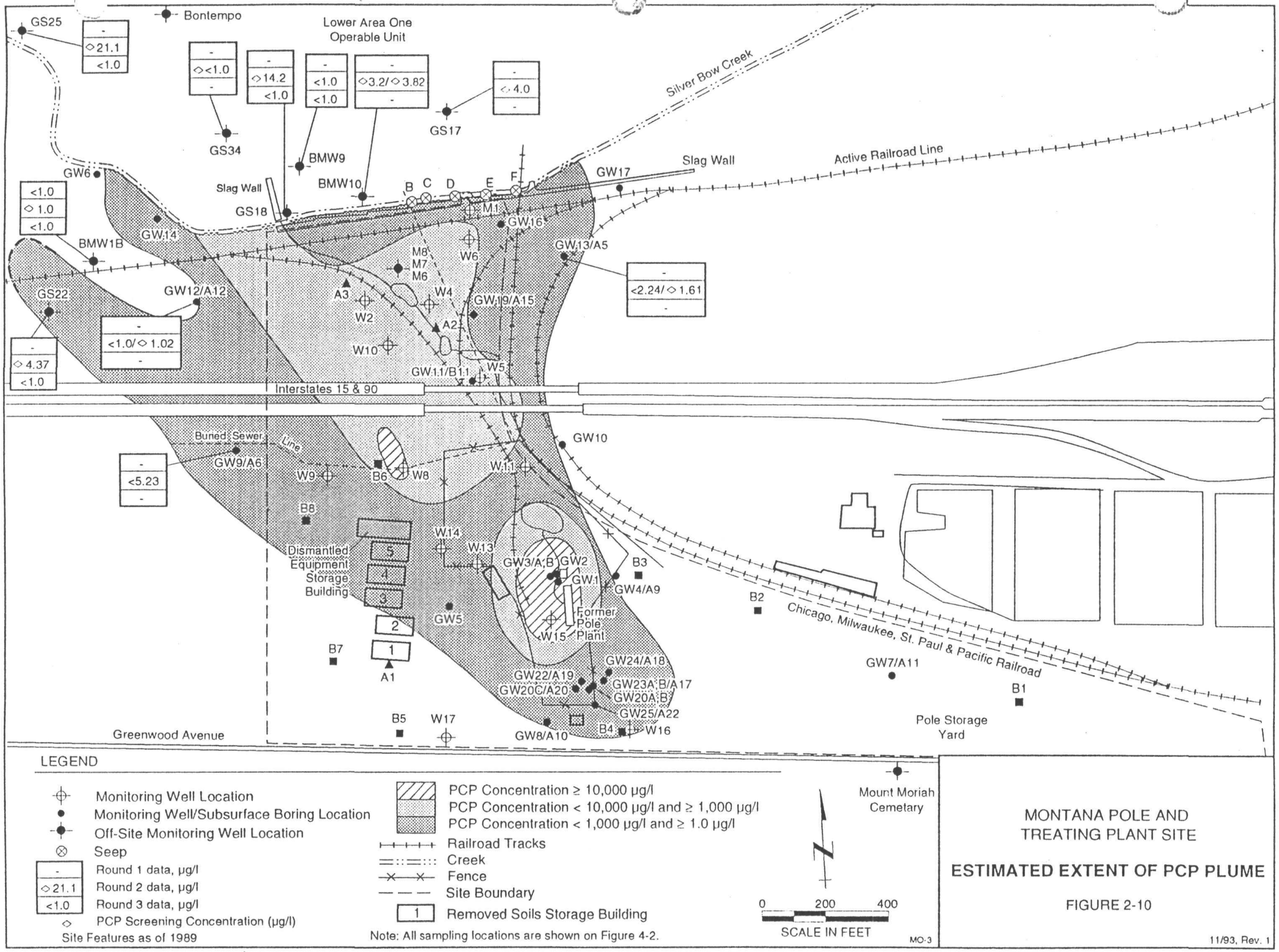
MO-3

MONTANA POLE AND
TREATING PLANT SITE

PCP CONCENTRATIONS DETECTED IN SUBSURFACE SOIL SAMPLES

FIGURE 2-4

11/93, Rev. 1

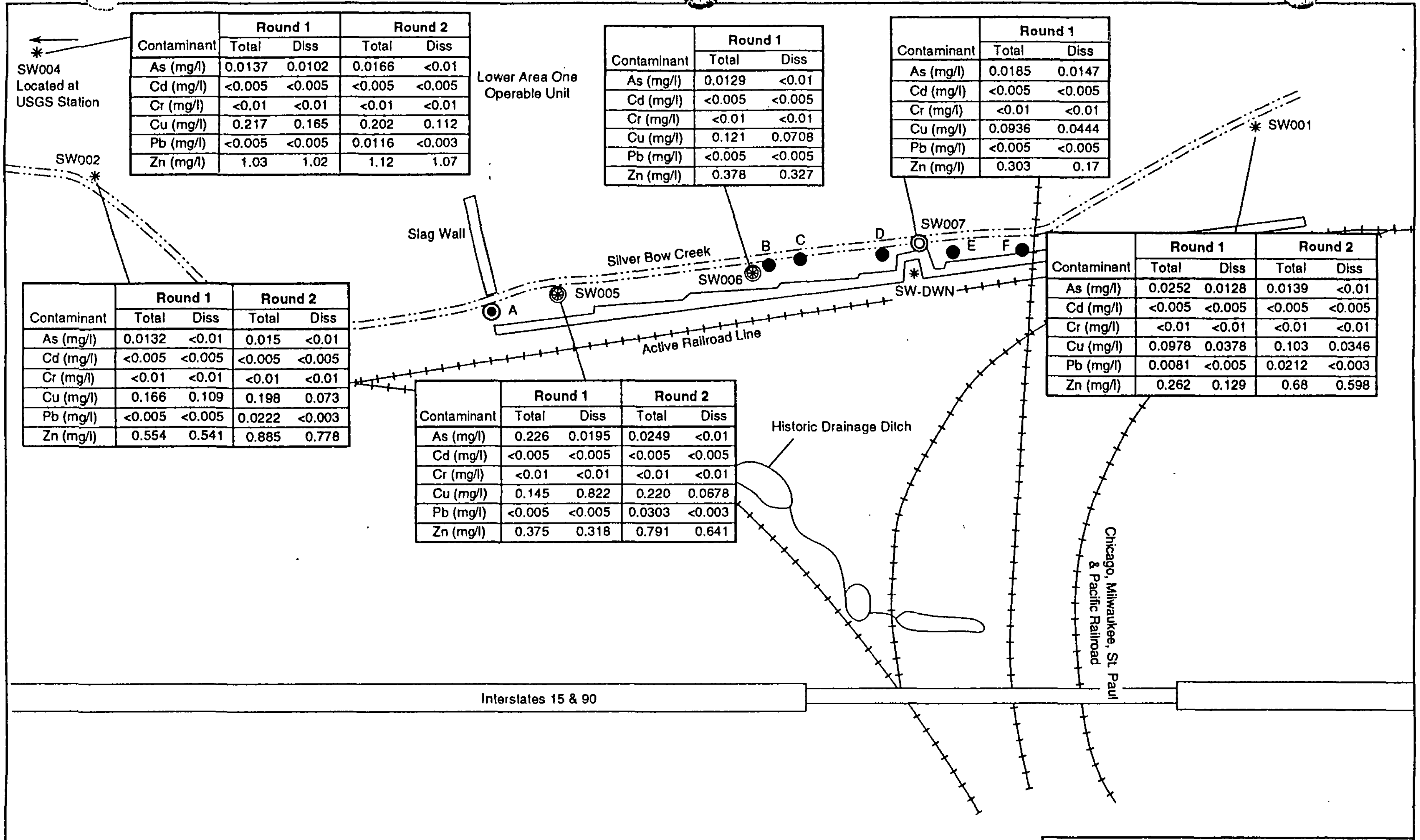


MONTANA POLE AND
TREATING PLANT SITE

ESTIMATED EXTENT OF PCP PLUME

FIGURE 2-10

11/93, Rev. 1



Contaminant	Round 1		Round 2	
	Total	Diss	Total	Diss
As (mg/l)	0.0137	0.0102	0.0166	<0.01
Cd (mg/l)	<0.005	<0.005	<0.005	<0.005
Cr (mg/l)	<0.01	<0.01	<0.01	<0.01
Cu (mg/l)	0.217	0.165	0.202	0.112
Pb (mg/l)	<0.005	<0.005	0.0116	<0.003
Zn (mg/l)	1.03	1.02	1.12	1.07

Contaminant	Round 1	
	Total	Diss
As (mg/l)	0.0129	<0.01
Cd (mg/l)	<0.005	<0.005
Cr (mg/l)	<0.01	<0.01
Cu (mg/l)	0.121	0.0708
Pb (mg/l)	<0.005	<0.005
Zn (mg/l)	0.378	0.327

Contaminant	Round 1	
	Total	Diss
As (mg/l)	0.0185	0.0147
Cd (mg/l)	<0.005	<0.005
Cr (mg/l)	<0.01	<0.01
Cu (mg/l)	0.0936	0.0444
Pb (mg/l)	<0.005	<0.005
Zn (mg/l)	0.303	0.17

Contaminant	Round 1		Round 2	
	Total	Diss	Total	Diss
As (mg/l)	0.0132	<0.01	0.015	<0.01
Cd (mg/l)	<0.005	<0.005	<0.005	<0.005
Cr (mg/l)	<0.01	<0.01	<0.01	<0.01
Cu (mg/l)	0.166	0.109	0.198	0.073
Pb (mg/l)	<0.005	<0.005	0.0222	<0.003
Zn (mg/l)	0.554	0.541	0.885	0.778

Contaminant	Round 1		Round 2	
	Total	Diss	Total	Diss
As (mg/l)	0.0252	0.0128	0.0139	<0.01
Cd (mg/l)	<0.005	<0.005	<0.005	<0.005
Cr (mg/l)	<0.01	<0.01	<0.01	<0.01
Cu (mg/l)	0.0978	0.0378	0.103	0.0346
Pb (mg/l)	0.0081	<0.005	0.0212	<0.003
Zn (mg/l)	0.262	0.129	0.68	0.598

Contaminant	Round 1		Round 2	
	Total	Diss	Total	Diss
As (mg/l)	0.226	0.0195	0.0249	<0.01
Cd (mg/l)	<0.005	<0.005	<0.005	<0.005
Cr (mg/l)	<0.01	<0.01	<0.01	<0.01
Cu (mg/l)	0.145	0.822	0.220	0.0678
Pb (mg/l)	<0.005	<0.005	0.0303	<0.003
Zn (mg/l)	0.375	0.318	0.791	0.641

LEGEND

- ● Itinerant Seasonal Seep
- ◎ Major Seep
- ✳ Surface water sampling locations for the 1990 RI
- +-+-+-+ Railroad Tracks
- =::=::: Creek

Site Features as of 1989

Note:
Seep observations from June through December 1990.
All sampling locations are shown on Figure 2-2.
Diss = Dissolved.

N

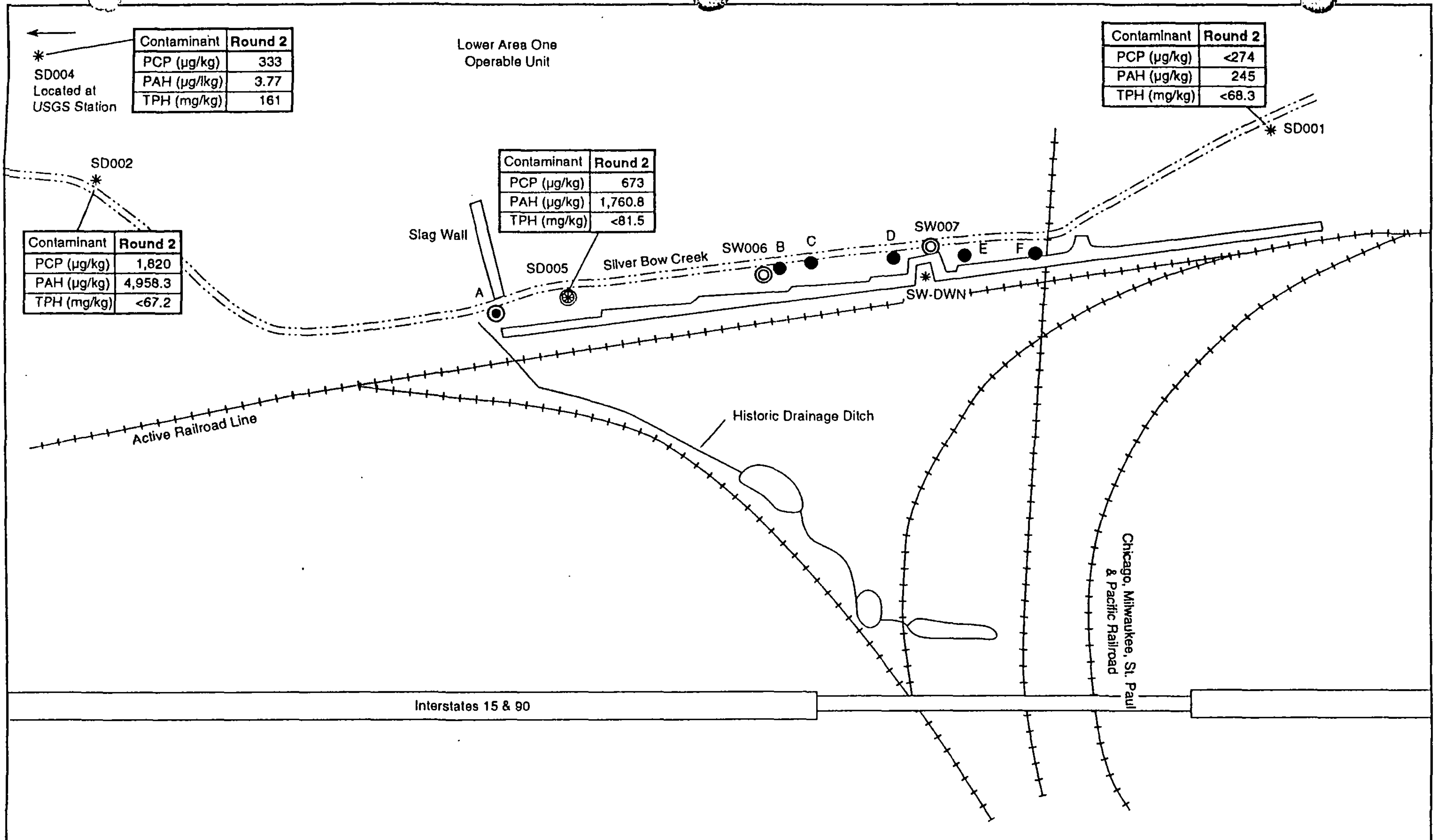
0 60 120 180
SCALE IN FEET

MO-3

MONTANA POLE AND
TREATING PLANT SITE
METALS CONCENTRATIONS DETECTED IN SURFACE WATER SAMPLES

FIGURE 2-18

11/93, Rev. 1



Contaminant	Round 2
PCP (µg/kg)	333
PAH (µg/lkg)	3.77
TPH (mg/kg)	161

Contaminant	Round 2
PCP (µg/kg)	<274
PAH (µg/kg)	245
TPH (mg/kg)	<68.3

Contaminant	Round 2
PCP (µg/kg)	673
PAH (µg/kg)	1,760.8
TPH (mg/kg)	<81.5

Contaminant	Round 2
PCP (µg/kg)	1,820
PAH (µg/kg)	4,958.3
TPH (mg/kg)	<67.2

LEGEND

● Itinerant Seasonal Seep

◎ Major Seep

✳ Surface water sampling locations for the 1990 RI

+-+-+-+-+-+ Railroad Tracks

=::=::= Creek

Note:
Seep observations from June through December 1990.
Creek sediments sampled during second round only.
All sampling locations are shown on Figure 4-2.

Site Features as of 1989

0 60 120 180
SCALE IN FEET

MO-3

MONTANA POLE AND
TREATING PLANT SITE

**PCP, PAH AND TPH
CONCENTRATIONS DETECTED IN
CREEK SEDIMENTS**

FIGURE 2-19

11/93, Rev 1

TABLE 2-1

CONCENTRATION OF CONTAMINANTS IN SURFACE SOIL SAMPLES

Contaminant	Range in Concentration	Average[a] Concentration	Number of Samples
PCP (μg/kg)	5[b] - 1,510,000	102,000	89
TPH (mg/kg)	16.5[b] - 71,500	4,513	89
2,3,7,8-TCDD equivalent (μg/kg)	4.6E-07 - 8.18		12

Reference: Keystone, 1992e

[a] Concentrations were calculated using an arithmetic mean. These average concentrations are likely higher than the geometric mean.

[b] Minimum concentration is represented by one-half the detection limit.

TABLE 2-2

CONCENTRATION OF CONTAMINANTS IN SUBSURFACE SOIL SAMPLES

Contaminant	Range in Concentration	Average Concentration	Number of Samples
PCP (μg/kg)	0.0381 - 1,160,000	26,835	150
TPH (mg/kg)	0.07 - 55,600	1,612	133
PAH (μg/kg)	0 - 2,304,320	37,874	128
BTEX (μg/kg)	0.36 - 7,440	254	93
2,3,7,8-TCDD equivalent (μg/kg)	0 - 16		7

Reference: Keystone, 1992e

TABLE 2-3

CONCENTRATION OF CONTAMINANTS IN REMOVED SOILS

Contaminant	Range in Concentration
PCP (μg/kg)	116,000 - 1,450,000
PAH (μg/kg)	16,600 - 441,600
TPH (mg/kg)	ND - 23,600
VOC (μg/kg)	ND
Chlorobenzene (μg/kg)	ND - 2.2
2,3,7,8-TCDD equivalent (μg/kg)	2.12 - 9.77
Metals Total	
As	ND
Cu (mg/kg)	ND - 183
Cd (mg/kg)	0.644 - 0.742
Pb	ND
Zn (mg/kg)	ND - 194
TCLP Extract for Metals	
As (μg/l)	112 - 118
Ba (μg/l)	1,080 - 1,560
Cd (μg/l)	11.7 - 12.5

Reference: Keystone, 1992e

TABLE 2-4

CONCENTRATION OF CONTAMINANTS IN GROUNDWATER SAMPLES

Contaminant	Range in Concentration	Average[a] Concentration	Number of Samples
PCP (μg/l)	0.5[d] - 880,000[a]	3,830[b]	87
TPH (mg/l)	.01[d] - 5,080	210	87
PAH (μg/l)	.02 - 3,668,691	51,770	88
BTEX (μg/l)	.39 - 1,300	40	74
As (μg/l)[c]	.2[d] - 1,570	40	84
Cd (μg/l)[c]	2.5[d] - 232	20	74
Cu (μg/l)[c]	12.5[d] - 34,600	1,470	77
Zn (μg/l)[c]	10[d] - 75,200	5,340	76
2,3,7,8-TCDD equivalent (μg/l)	0.001 - 0.0537		5

Reference: Keystone, 1992e

[a] Average concentrations were calculated using an arithmetic mean. These average concentrations are likely higher than the geometric mean.

[b] Average concentration does not include maximum PCP concentration measured in groundwater samples because it is not representative of the dissolved concentrations.

[c] Metal concentrations represent dissolved metals.

[d] Minimum concentration is represented by one-half the detection limit.

TABLE 2-5

CONCENTRATION OF CONTAMINANTS IN SURFACE WATER

Contaminant	Range in Concentration	Average Concentration	Number of Samples
PCP ($\mu g/l$)	0.5[a] - 591	75	12
TPH (mg/l)	.05[a] - 2.17	0.11	12
PAH ($\mu g/l$)	0.3 - 49.53	9	12
As (mg/l)	0.0129 - 0.0252	0.018	10
Cd (mg/l)	0.0025[a] - 0.0025	0.0025	10
Cr (mg/l)	0.0050[a] - 0.0050	0.005	10
Cu (mg/l)	0.0936 - 0.220	0.156	10
Pb (mg/l)	0.0025[a] - 0.0303	0.011	10
Zn (mg/l)	0.262 - 1.120	0.614	11

Reference: Keystone, 1992e

[a] Minimum concentration is represented by one-half the detection limit.

TABLE 2-6

CONCENTRATION OF CONTAMINANTS IN CREEK SEDIMENTS SAMPLES

Contaminant	Range in Concentration	Average Concentration	Number of Samples
PCP (μg/kg)	137[a] - 1,820	741	4
PAH (μg/kg)	3.77 - 4,958.3	1,742	4
TPH (mg/kg)	33.6[a] - 161	65	4
As (mg/kg)	31 - 842	321.85	4
Cd (mg/kg)	4.44 - 21.9	10.603	4
Cr (mg/kg)	5.55 - 18.7	13.113	4
Cu (mg/kg)	656 - 5,210	2,691.5	4
Pb (mg/kg)	362 - 714	541.25	4
Zn (mg/kg)	1,360 - 6,220	3,045	4
2,3,7,8-TCDD equivalent (μg/kg)	0.00303 - 0.019		2

Reference: Keystone, 1992e

[a] Minimum concentration is represented by one-half the detection limit.

TABLE 2-8

CONCENTRATIONS OF CONTAMINANTS IN MISCELLANEOUS OILS AND SLUDGES
(Page 1 of 2)

						Misc. Liquid with Sludge	
Chemical	Separator Oil Recovered (mg/l)	KPEG Treated Oils (mg/l)	KPEG Reagent Sludge (mg/kg)	Misc. Sludge (mg/kg)	Misc. Liquid (mg/l)	Oil Phase (mg/l)	Sludge Phase (mg/kg)
PCP	1.9 - 2.7	BDL	BDL	7,500	BDL - 160	8.8 - 11	6,500 - 17,000
PAHs	5.7 - 5.9	1.2 - 6.7	2,046 - 14,180	2,350	246.8 - 748	2.8 - 6.2	3,520 - 13,380
VOCs	57.0 - 304.0	34.3 - 43.5	60,000 - 253,000	27,000	42.1 - 321.8	105.2 - 390	BDL - 86
TCL and TCLP Pesticides							
Aldrin	0.001 - 0.0013[a]	0.0034 - 0.0094[a]	BDL	BDL	BDL	0.002 - 0.024[a]	29
4,4-DDT	0.0024 - 0.0031[a]	BDL	BDL	BDL	BDL	BDL	BDL
Heptachlor	0.3	0.027	NA	NA	NA	NA	NA
Heptachlor epoxy	0.3	0.002	NA	NA	NA	NA	NA
Methoxychlor	NA	0.007	NA	NA	NA	NA	NA
TCLP Herbicide 2,4-TP	0.0098 - 6.5	NA	NA	NA	NA	0.00015	NA
2,3,7,8-TCDD (equiv.)	0.002 - 0.004	0.00	NA	0.195 - 0.206	0.0003 - 0.280	0 - 0.00311	NA
TCLP Metals							
Arsenic	BDL	BDL	NS	BDL	NS	BDL	BDL
Barium	<0.2	BDL	NS	310	NS	BDL	BDL
Cadmium	BDL	BDL	NS	BDL	NS	BDL	BDL
Chromium	BDL	BDL	NS	11.5	NS	1.63	BDL
Lead	BDL	BDL	NS	BDL	NS	BDL	BDL
Mercury	BDL	BDL	NS	BDL	NS	BDL	BDL
Silver	BDL	BDL	NS	BDL	NS	BDL	BDL

TABLE 2-8

CONCENTRATIONS OF CONTAMINANTS IN MISCELLANEOUS OILS AND SLUDGES

(Page 2 of 2)

						Misc. Liquid with Sludge	
Chemical	Separator Oil Recovered (mg/l)	KPEG Treated Oils (mg/l)	KPEG Reagent Sludge (mg/kg)	Misc. Sludge (mg/kg)	Misc. Liquid (mg/l)	Oil Phase (mg/l)	Sludge Phase (mg/kg)
TCLP Semivolatile Organic Compounds							
2,4,6-trichlorophenol	0.497 - 128	BDL	NS	0.964	NS	BDL	BDL
Pentachlorophenol	BDL - 4.92	BDL	NS	14.3	NS	BDL	BDL
Non-TCLP Metals[a]							
Cadmium	BDL	0.014	NS	NA	NS	BDL	BDL
Chromium	- - - - - - - - - - - - - - - - - Ranged from BDL (6 to 10 mg/kg) - 720 - - - - - - - - - - - - - - - - -						
Copper	BDL	BDL	NS	290	NS	NA	NA
Lead	1.2	1.2	NS	NA	NS	BDL	NA
Zinc	NA	NA	NS	NA	250	NA	NA
Corrosivity	corrosive	corrosive	NS	non-corrosive	NS	non-corrosive	non-corrosive

[a] Reported as mg/kg in draft RI (Keystone, 1992e)

BDL	below detection limit	PCP	pentachlorophenol
PAH	polycyclic aromatic compounds	NA	Information not available
VOC	volatile organic compounds	NS	Not Sampled

TABLE 3-5

VOLUME ESTIMATES OF CONTAMINATED SOILS AT THE MONTANA POLE AND TREATING PLANT SITE

Soils	Volume, yd^3
1. Bagged Soils[a]	10,000
2. Near Creek Soils[b]	6,000
3. Soils excavated for groundwater extraction system	7,000
4. Contaminated Surface soils[c]	10,000
5. Contaminated Surface and Subsurface soils[d]	82,000
6. Accessible LNAPL "smear zone" soils[e]	93,000
7. Soils overlying accessible LNAPL "smear zone" soils[f]	
Northern portion of site	28,000
Southern portion of site	66,000
8. Inaccessible contaminated soils[g]	41,000

[a] Soils previously excavated and stored on-site.

[b] Near-creek soils are those soils north of the Gundwall constructed during the latest USEPA removal action at MPTP site and covers an area of about 750 feet long by 50 feet wide.

[c] Areas marked on Figure 3-1 from surface to 3 feet below ground surface.

[d] Areas marked on Figure 3-2 where contamination is continuous from 3 feet below ground surface to 4 feet below groundwater surface.

[e] Areas marked on Figure 3-3 where contaminated soils are associated with the LNAPL plume. Volume includes soils from 2 feet above groundwater surface to 4 feet below groundwater surface. Volume excludes the area accounted by surface/subsurface soils in #3 above and soils beneath the highway.

[f] Areas of uncontaminated soils which overlie accessible LNAPL "smear zone" soils shown on Figure 3-3.

[g] Inaccessible soils beneath the interstate highway include approximately 37,000 yd^3 associated with the LNAPL "smear zone" as shown on Figure 3-3 and approximately 4,000 yd^3 of surface and subsurface soils shown in Figure 3-2.