Data Summary Report for Process Areas Soils Characterization

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SECTION 1.0
INTRODUCTION

The Atlantic Richfield Company ("ARC") conducted site characterization activities in the Process Areas of the Yerington Mine Site in accordance with the Process Areas Work Plan submitted May 5, 2004 to the U.S. Environmental Protection Agency ("EPA"), the U.S. Bureau of Land Management ("BLM") and the Nevada Division of Environmental Protection ("NDEP"). This Data Summary Report ("DSR") for Process Areas Soil Characterization has been prepared in compliance with the Unilateral Administrative Order for Initial Response Activities (UAO 0-2005-2011) issued by EPA to ARC under Section 106 of the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"). Field investigations of soil and groundwater conditions in the Process Areas were performed by Brown and Caldwell from September 2004 through April 2005.

The purpose of the site characterization program is to investigate the occurrence, three-dimensional extent and magnitude of constituents of concern ("COCs") in Process Areas soils and underlying groundwater that may have resulted from past operations at the Yerington Mine Site. This DSR presents sampling methods and analytical results of soil samples collected from November 2004 through April 2005 as part of the agency-approved Process Areas Work Plan (Brown and Caldwell, 2004). A separate DSR has been prepared for Process Areas groundwater investigations.

1.1 Site Location and Background

The Yerington Mine Site is located approximately one mile west of the town of Yerington in Lyon County, Nevada (Figure 1-1). The Yerington Mine Site consists of an inactive open pit copper mine, waste rock piles, leached ore tailings piles, evaporation ponds, and ore processing facilities including tanks, buildings, underground utilities and remnant foundations (Figures 1-2 and 1-3). The Process Areas, which cover an area approximately 5,000 feet long and 2,000 feet wide or about 230 acres, includes only the central processing facilities.

The Anaconda Mining Company began mining operations in the early 1950s. From 1953 to 1965, operations at the site consisted of mining and processing copper oxide ores. The copper oxide ores were processed using a Vat Leach extraction process. The Vat Leach process involved crushing of oxide copper ore to a uniform ½ inch size. The crushed ore was loaded into one of a row of eight large concrete leach vats within which a weak sulfuric acid solution produced a pregnant leach solution. The leach solution was conveyed to nearby precipitation cells where copper was precipitated onto scrap iron and de-tinned cans. The barren solution then passed to iron launders where excess iron was removed, then re-acidified before returning to the Leach Vats. Tailings were deposited as solids in the Oxide Tailings Area and copper concentrates were sent off site for smelting.

In 1965, the mill and concentrator were modified to allow processing of both oxide and sulfide ores. The sulfide ore process circuit involved fine crushing and copper sulfide recovery by chemical flotation, in which lime was added to the process solution to maintain a basic pH. Sulfide tailings were conveyed as slurry to the Sulfide Tailings Area. A copper concentrate was produced from the sulfide ore, and was also shipped off site for smelting. Historic records also indicate that dump leaching of the W-3 Waste Rock dump began in 1965, where sulfuric acid was applied to the W-3 Waste Rock dump to increase copper production (Anaconda, 1965). The ore material from the Yerington Mine contained naturally occurring radioactive minerals. Processing of that ore produced technologically enhanced naturally occurring radioactive materials ("TENORM") in which the radioactive minerals were concentrated above natural levels in tailings and process solutions.

In 1989, Arimetco International initiated leaching operations at the mine site, with little disturbance in the Process Areas. Arimetco constructed new processing components including solvent extraction and electro-winning plants located across the road from the Process Areas. Facilities such as the electro-winning circuit and heap leach pads operated by Arimetco were not evaluated during this phase of site characterization.

1.2 Overall Status and Land Use

Mining and ore beneficiation operations at the mine site have ceased and, with the exception of fluid management associated with Arimetco heap leach process components, the Process Areas shown in Figure 1-3 are no longer active. Electrical, gas, and water services to all buildings within the Process Areas have been disconnected, except for the Administration Building and the Equipment Garage. All heavy mining equipment and haul trucks have been removed from the mine site.

Land ownership is a combination of BLM and private property owned by Arimetco and managed by bankruptcy probate. The land status of the approximate 230-acre Process Areas is also shown in Figure 1-2.

1.3 Previous Investigations

The following reports provide background information associated with soil and Process Areas conditions at the Yerington Mine Site.

- **Ecology & Environment, Inc., Superfund Technical Assessment and Response Team (START), "Expanded Site Inspection, Anaconda Copper Company, Yerington Mine", December 2000.** This inspection was completed at the request of EPA following CERCLA/Superfund protocol. The purpose was to evaluate the site to determine if enough potential hazards existed to warrant additional investigations under CERCLA. The conclusion was that further assessment was needed.
- **Ecology & Environment, Inc., Superfund Technical Assessment and Response Team (START), "Anaconda, Yerington Mine Site Emergency Response Assessment Final Report", June 2001.** This report summarizes the results of the 2000 inspection of the Mine Site along with additional samples collected off-site in 2001 at the Yerington Paiute Indian Colony and other residential locations.
- **Phillips Services Corporation, "Yerington Nevada Electrowinning Fluids and Drum Removal Project Summary", July 30, 2003.** This report is a detailed account of activities at the site to remove remaining process chemicals and drums left by Arimetco.
- **BLM Carson City Field Office, "BLM Health and Safety Plan, Process Area, Yerington Mine, Yerington, Nevada", August 2004.** For preparation of their Health and Safety Plan, the BLM completed some initial soil sampling and radiation monitoring in the Process Areas, completed by subcontractor Walker and Associates. The results of the radiological study are included in Appendix E of the Health and Safety Plan.

- **Foxfire Scientific, "Yerington Mine Site Fugitive Dust Radiological Dose Assessment", September 2004.** This was a report commissioned by NDEP to evaluate radiological hazards to onsite workers as well as off-site, down-wind residential communities originating from the tailings areas and evaporation ponds fugitive dusts.
- **Bureau of Land Management, Technical Resources Group, "Review of Yerington Mine Characterization Activities", December, 2004.** This report was completed by the BLM in order to summarize recent radiation characterization activities completed within the previous 6 months on the mine site by BLM, Brown and Caldwell, and Foxfire personnel and specifically during a site visit on December 9, 2004.

1.4 Physical Setting

The Yerington Mine Site and Process Areas are located on the west side of Mason Valley, a structural basin surrounded by uplifted mountain ranges. Mason Valley is bordered by the Singatse Range to the west, the Desert Mountains to the north, and the Wassuk Range to the east. The Yerington Mine Site is located on the flank of the Singatse Range on an east facing alluvial fan. The mountain blocks are primarily composed of granitic, metamorphic and volcanic rocks with minor amounts of semi-consolidated to unconsolidated alluvial fan deposits. The Singatse Range has been subject to metals mineralization, as evidenced by the large copper porphyry ore deposit at the Yerington Mine and other similar ore deposits found nearby. Proffett and Dilles (1984) published a geologic map of the Yerington District that describes these features. Natural topography in the area has been altered by mining and milling operations.

SECTION 2.0
SOIL CHARACTERIZATION ACTIVITIES

The soil characterization activities conducted by ARC in the Process Areas at the Yerington Mine Site included: 1) collection of surface and subsurface samples by sonic core drilling and surface grab sampling; 2) excavation and sampling of underground utility pipelines; 3) excavation and sampling of oil stained soils; and 4) the submittal of all soil samples for chemical analysis. All field work was performed in accordance with the agency-approved Process Areas Work Plan (May 5, 2004), the Quality Assurance Project Plan (QAPP; Brown and Caldwell, 2003), and subsequent written correspondence between ARC, the EPA and the BLM. Field work was also performed in accordance with the Site Health and Safety Plan (SHSP), which has been revised as of May 2005 to reflect known occurrences of radioactive materials at the site. Descriptions of all field activities are provided in this section of the DSR, and copies of field notebooks are found in Appendix A and photos of sample locations in Appendix B. Laboratory analytical results from borehole and excavation samples are presented in Section 3.0, and in Appendices C and D.

Most sample locations were selected to target specific processing components such as buildings, tanks, pumps and ditches. The specific locations were selected in order to evaluate areas most likely to be affected by process-related activities (e.g., solution conveyances, drains, sumps or piping). ARC believes this biased sampling program served to evaluate “worst-case” conditions in the Process Areas because: 1) significant historical and physical information was available for each component; and 2) the objective of the investigation was to screen the Process Areas for the presence or absence of contamination at levels of concern to human health and the environment.

2.1 Surface and Subsurface Sampling

A total of 1,143 samples were collected from 253 locations in the Process Areas from borehole and surface grab samples. All samples were analyzed for the full suite of analytes, as required by the QAPP including metals, acid-base potential (ABP), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), pesticides, herbicides and PCBs. Pursuant to the Process Areas Work Plan, samples collected around process tanks and piping were analyzed for radionuclides and samples associated with support buildings (e.g., administration building and maintenance shops) were not sampled for radionuclides. Photos of all sample locations were taken, either at the time of drilling or subsequent to that, and are included as Appendix B.

Figure 2-1 shows the locations of borehole and surface samples completed during this sampling event. Two hundred thirty (230) of these locations were sampled to depths of 10 to 25 feet below ground surface (bgs) at 5-foot intervals with the use of a roto-sonic core drilling rig, owned and operated by Water Development Corporation (WDC). The sonic core rig advances a 4-inch diameter core barrel into the soil through vibration and rotation in a way that allows the cored material to remain in place as the core barrel advances around it, with little disturbance or mixing of the soil. No drilling fluid or air was used in the drilling, which minimized potential contamination or stripping of volatile organics from samples. Samples were retrieved at the surface by vibrating the core barrel, allowing the soil to loosen from the barrel and collecting it in a disposable plastic sleeve.

Typically, a 1-foot interval of soil was collected from the target depth and distributed to sample containers, unless a duplicate sample was required, in which case a 2-foot interval was collected to ensure enough sample volume to fill all containers. Duplicate samples were always collected from the near surface sample based on the assumption that potential soil contamination would likely be highest at the surface.

Samples were collected at depth intervals of 0.5 to 2.5 feet, 4 to 5 feet, and 9 to 10 feet bgs. Sample locations that required sampling to greater depths also included sample intervals from 14 to 15 feet, 19 to 20 feet, and 24 to 25 feet bgs. Several angle boreholes were drilled to sample the soil beneath tanks and ponds. The goal was to terminate the bottom of the borehole at a point that was underneath the perimeter footprint of the tank. Because of the dimension of the tanks and constraints of the drilling equipment, it was not possible to drill to a reasonable depth beneath the center of the tanks. Angle boreholes were drilled on a 45 degree angle perpendicular to the side wall of the tank or pond. Samples from the angle boreholes were collected at the target depths of 1, 5, 10, 15, 20 and 25 feet bgs which required additional drilling footage (i.e., to reach the target depth of 5 feet bgs required drilling 7.5 feet at a 45 degree angle).

Collected samples were placed into the appropriate number of lab-supplied containers (glass jars, VOA vials and plastic bags) for the specific analytical method to be performed by the individual analytical laboratories. Soil samples were evenly distributed from each sample interval into the appropriate container. All samples were labeled with sample ID number, date, time and sampler's initials as the samples were collected. As defined in the QAPP, sample preservation required that all samples be placed in a chilled cooler until transported back to the field office, where they were transferred to a secure refrigerator. Chain of custody procedures were followed when custody of the samples was transferred from one person to another. Completed chains of custody are included with the original laboratory reports in Appendix D.

Samples analyzed for VOCs by Sequoia Labs were collected in four preserved vials that required the samples to either be analyzed or frozen within 48 hours. Once frozen, the sample hold time was extended to 14 days. Because of this requirement, all VOC samples, and typically other samples going to the same lab, were packaged for shipment within 24 hours of collection and sent to the lab for overnight delivery. The samples were sent unfrozen but chilled on regular ice. The exception to this was for samples collected on Friday and Saturday during weekends, which were frozen onsite and shipped to the lab on dry ice to keep them frozen during transport. Samples shipped to Energy Labs for ABP and radionuclides had longer hold times and no preservation requirement, so they were typically shipped within 2 to 4 days of collection in ambient temperature coolers.

Decontamination procedures, as required by the QAPP, were followed for all reusable sampling equipment including the drill core barrel, backhoe bucket, scoops, picks and shovels. Decontamination of reusable equipment consisted of washing the tool with Alconox soap and water, followed by a double rinse with distilled water. All decon water was collected and disposed on-site in a lined waste pond. Whenever possible, disposable sampling equipment was used and discarded between each sample collected. Disposable equipment included gloves, scoops and plastic liners.

2.1.1 Designation of Areas

To facilitate the management and evaluation of the analytical data from the soil samples collected in the Process Areas (i.e., because of the large number of samples collected and analyses performed), this DSR sub-divides the Process Areas into twelve smaller areas. The designation of these smaller areas is based on similar historical operations and contiguous process components. With the exception of Area 12, sample locations within an area are contiguous. These smaller areas, defined in Figure 2-2, are described in more detail below:

Area 1 – Administration and Maintenance Areas. This area includes the Administration Office (A), Change House (D), School House (E), Assay Lab (F), Large Warehouse (G), Small Warehouse (H), Quonset Hut (Q), Grease Shop #1 and 2 (J, V), Filling Station #1, 2 and 3 (U, W, X), and Concrete Pad (Z).

Area 2 – Truck Shop and Crushers. Includes the Truck Shop (K), Equipment Garage (L), Truck Wash/Paint Shop (M), Equipment Wash (C), Carpenter Shop (N), Lead Shop (O), Fire Engine Storage (I), Emergency Shed (R), Sheet Metal Shop (S), Primary Crusher (CC), Secondary Crusher (OO), and Stacker (NN).

Area 3 – Vat Leach Tanks. Includes the eight Vat Leach Tanks (P) and the Sulfide Ore Stockpile area (YY) at the northwest end of the Vat Leach Tanks.

Area 4 – Solution Tanks. Includes the three Solution Tanks (DD) and the associated Solution Tanks Electrical Building (FF) and basements.

Area 5 – Precipitation Plant. Includes the iron launder and precipitation tanks and associated basements and piping in the Precipitation Plant (EE).

Area 6 – Sulfide Plant. Includes the remaining concrete foundations and thickener tanks associated with the Sulfide Plant (HH) and the Sulfide Plant Foremen’s Office (GG).

Area 7 – Calcine Ditch. Includes approximately 2400 feet of the large ditch area at the northwest end of the Process Areas known as the Calcine Ditch (WW).

Area 8 – North Solution Ditch. Includes 1000 feet of a Solution Ditch (FFF) of unknown origin or purpose located between the Precipitation Plant and the Sulfide Plant.

Area 9 – East Solution Ditch. Includes 1200 feet of a Solution Ditch (EEE) located northeast of the Precipitation Plant at the base of the VLT pile.

Area 10 – North Low Area. Includes the north half of a topographically low area (HHH) on the northeast side of the Process Areas. It also includes an earthen Surge Pond (KK) and Concrete Ramps (II).

Area 11 – South Low Area. This area includes the southern half of the topographically low area (HHH) in addition to the Upper Truck Sludge Pond (BBB), Lower Truck Sludge Pond (CCC), and Ditch Between Upper and Lower Truck Sludge Ponds (DDD).

Area 12 – Peripheral Process Components. Includes the Core Building (AA), Acid Tanks (PP), Arimetco Crusher (QQ), Arimetco Stacker (RR), Old Crusher (UU), Tailings Pump House (VV), Surface Pumps Foundation (ZZ), and Concrete Pump House (AAA).

Area 1 – Administrative and Maintenance Support Buildings

Administration Building (A)

The Administration Building is an L-shaped building of frame construction with a concrete floor, composite siding, with a floor area of approximately 9,285 square feet. The building contains offices, storage rooms, restrooms, and a garage. The only service entrance is a single overhead garage door on the northwest side of the building. In the parking lot approximately 50 feet from the northeast side of the Administration Building, a refilling station pump island with two pumps was removed in 1998. An underground utility locating service was not able to locate evidence of a buried tank at this location, so it is assumed that the tank was removed at the time the pumps were removed. On sample location was drilled in front of the garage door area.

Change House (D)

This building has a floor area of approximately 4,400 square foot, metal siding, and concrete floor. The building was used as a dressing room and showers and is currently empty. A small former laboratory is present at the north corner of the building. The nature of work conducted within the lab is unknown, and no chemicals are present. No discoloration of ground surface was observed. Two sample locations were drilled, one by the southwest man door, and a second near a drain pipe exiting the western corner of the building.

School House (E)

The School House is situated directly north of the Change House. The building dimensions are approximately 25 feet by 50 feet (1,250 square feet), and the construction is metal siding and roof with concrete floor. The building, as the name implies, was used as a school for on-site training of employees. There is no reason to believe that any contaminants of concern were ever stored or used within the School House. Two sample locations were drilled, one located between the School House and the Change House, and a second in front of the roll-up service door on the southwest side of the building.

Assay Laboratory (F)

The Assay Laboratory building is approximately 200 feet long by 70 feet wide (13,800 square feet) and is constructed of metal walls and roof, with a concrete floor. The building contains a loading dock along the southwest, northeast, and northwest sides of the building, and a basement at the southeast end of the building that is below approximately one third of the first floor area. The center section of the building was used as a warehouse and shop area while the south end of the building was used as a laboratory. The assay laboratory represents a potential source of COCs (e.g., acids and solvents) that may have been stored here. Since the building was also used as a shop, the potential exists for leaking equipment and storage of oils and lubricants. Five sample locations were drilled around all sides of the building, targeting specifically docks, loading ramps, and exterior piping.

Large Warehouse (G)

The warehouse building is approximately 150 feet long by 33 feet wide (4,950 square feet), constructed of metal walls and roof, and a concrete floor. The building contains fittings, supplies, miscellaneous scrap steel, debris, and some tools. The exact nature of items that were stored in the warehouse over time is unknown. The potential COCs are those associated with ancillary equipment storage and maintenance (e.g., large equipment and containers of lubricant, oil and solvents). Three locations were sampled around the Large Warehouse, one at each end in front of the large service doors, and one located in front of a small collection bin near the south corner that appeared to contain glassy slag material.

Small Warehouse (H)

The small warehouse is approximately 35 feet by 40 feet (1,400 square feet), constructed of metal walls and roof with a concrete floor. There are used transformers and oil-filled switches being stored in the Small Warehouse, and most of the transformers have been tagged as containing PCBs. The exact nature of items that were stored in the warehouse over time is unknown. The potential contaminants of concern are those associated with the transformers and ancillary equipment storage and maintenance, including large equipment, lubricant oil and solvents. Two sample locations were drilled. One was located on the south side where heavy equipment or trucks likely parked, and the second location was in front of the northwestern service door.

Grease Shop #1 (J)

This small storage building is approximately 20 feet by 20 feet (400 square feet) with metal walls and roof, and a concrete floor. The building was used for shop and storage activities, including, as the name implies, grease and lubricants. The building is presently empty. Stored lubricants and oils represent a potential source of PCBs. One sample was collected in front of the northwestern door.

Quonset Hut (Q)

A quonset-style building and fenced-in storage yard are present north-east of the Administration Building. The building is approximately 100 feet long and 25 feet wide (2,500 square feet), and is constructed of wood. There is no floor in the building. The building and storage yard contain old scrap electrical supplies such as wire, switches, lights, and control equipment. The yard was formerly used to store transformers, and at least one old transformer is still present in the storage yard. The apparent use of this building was to store electrical equipment, which could have included transformers. Leaking transformers represent a potential source of oil and PCBs. Four locations were drilled in the Quonset Hut area including one in front of the north east door, one on both the northern and southern sides where equipment had been stored, and one near a large mobile electrical structure approximately 50 feet north of the Quonset Hut building.

Filling Stations (U, W, X)

One petroleum filling station (U) consists of two, currently active, above-ground storage tanks that are not housed in a building. The active filling station consists of one 10,000-gallon tank in secondary containment consisting of an earthen berm and plastic liner, and a second tank of 1,000-gallon capacity with no secondary containment. A former petroleum filling station (W) has fuel pumps located in a shed and two two-inch underground lines protruding from the ground outside the southeast end of the building. A third former gasoline filling station (X) is plastic-lined with pipes protruding from the ground and fuel pumps located in the station shed, a possible indication of the presence of underground petroleum storage tanks. These fueling stations represent a potential source for impact from diesel fuel and gasoline. Two samples were collected near the currently active filling station (U), one just off the concrete apron where vehicles park to fill up, and one directly in front of the filling and discharge line for the diesel tanks, which does not have a concrete drip apron. One sample each was collected near each of the remnants of the older filling stations that have been removed.

Grease Shop #2 (V)

This small storage building is approximately 15 feet by 18 feet (270 square feet) with metal walls and roof, and a concrete floor. The building was used for shop and storage activities, including, as the name implies, grease and lubricants. The small building contains dry scrap and debris. Stored lubricants and oils represent a potential source of PCBs. One location was drilled in front of the small door on the south side of the structure.

<u>Area 2 – Truck Shop, Crusher and Miscellaneous</u>

Equipment Wash Building (C)

This relatively small building, with a floor area of approximately 300 square feet, is constructed of concrete with a concrete floor. The northeast end of the building contains pipelines that were connected to former "cleaning solution" tanks. A concrete sump sits along the outside northeast wall of the building. It appears that small portable equipment was washed inside the building. A sign mounted on the northeast wall indicates that "cleaning solution" tanks were positioned along that interior wall at one time. Cleaning solutions represent a potential source of VOCs or

SVOCs, and the stained ground surface could indicate oil staining. Two locations next to this small shed were drilled, one off the northeast end just off the concrete wash pad adjacent to the small sump, the other was drilled through the concrete in front of the doors to the shed.

Fire Engine Storage (I)

The Fire Engine Storage building is approximately 60 feet by 35 feet (2,100 square feet), and is constructed of metal walls and roof with a concrete floor. The building was originally used to house fire-fighting equipment, fire trucks, and an ambulance. Six large used transformers are currently being stored in the Fire Engine Storage building, and some of these transformers are labeled as containing PCBs. The potential COCs are those associated with the transformers, truck storage and maintenance operations. Two sample locations were drilled. One location was near the southeast corner in front of the door (drilled through concrete), and the other was in an outdoor storage area off the northwest end of the building just off the edge of the concrete.

Truck Shop (K)

The Truck Shop is the largest ancillary building in the Process Areas, and was used for large equipment servicing and transformer storage. Potential COCs include oils, gasoline, solvents and PCBs. The building is approximately 350 feet long, 100 feet wide over one half of its length, and 75 feet wide over the other half (35,000 square feet). The walls and roof are metal, and the floor is concrete. The south half of the building was used as a machine shop. There are overhead service doors along the northeast side of the building, which provided access to the large equipment repair shop. There were two grease pits at the northern end of the machine shop, near the center of the building, each measuring 4 feet wide by 30 feet long. One of these pits still exists, but has been cleaned of any liquids. At the northwest end of the Truck Shop, three oil tanks of approximately 3,000-gallons capacity are inside a concrete secondary containment located outside the building. Electrical transformers were re-conditioned inside the Truck Shop in the 1980s by a company named Unison. Several areas are present on the concrete floor where former floor drains have apparently been filled in with cement.

Nine boreholes were drilled around the exterior perimeter of the Truck Shop. Borehole K1 was located as close as possible to a sump area in the concrete apron on the northeast (front) side of the truck shop. The apron collected rain and runoff, and directed it to the sump. Locations K2 through K4 were drilled in front of large service doors adjacent to the concrete. K5 was located in front of a service door on the northwest end of the building, near the oil tanks. K6 through K9 were located on the backside of the building targeting doors, piping, and secondary containments.

Equipment Garage (L)

The Equipment Garage is located to the northeast of the Truck Shop, and is approximately 150 feet long by 65 feet wide (9,750 square feet). The building is constructed of metal walls and roof and concrete floor. There are six large overhead service doors along the southwest side of the building, and another overhead door at the southeast corner. The Equipment Garage was used for vehicle and/or equipment servicing and storage, and represents a potential source for oils, gasoline, solvents and PCBs. Four locations were drilled around the Equipment Garage. One location was located on the back side of the building in front of an active electrical transformer with visible oil staining nearby. Two sample locations were located in front of service doors on the east corner and the southwest side. The fourth sample location was located next to a small storm drain sump located at the south end of the concrete apron in the front of the building.

Truck Wash and Paint Shop (M)

This building is located north of the Equipment Garage. It is approximately 45 feet by 45 feet (2,025 square feet), and is constructed of metal walls and roof and concrete floor. The building has two large overhead doors on opposing sides of the building where vehicles and equipment entered and exited. Outside the building, on the southwest side, is a large concrete wash pad that drains to a nearby sump and discharges to an unlined pit. The building and pad were used to wash and paint equipment. The stained ground surface may indicate leaking oil, and old paint represents a potential source of lead. Three samples were collected in this area; one in front of the back (northeast) roll-up door; one drilled through the concrete pad in front of the main service door on the southwest side; and one located off the north corner near a storage shed.

Carpenter Shop (N)

This building, located northwest of the Truck Shop, is approximately 70 feet by 40 feet (2,800 square feet) and is constructed of metal walls and roof and a concrete floor. Because no historical information exists that the building was ever used for activities other than carpentry work, no reason exists to believe that any potential COCs were ever used or stored in the shop. One location was sampled directly in front of the main service door on the south end of the building.

Lead Shop (O)

This building, located north of the Carpenter Shop, is approximately 20 feet by 40 feet (800 square feet), and is constructed of metal walls and roof, and a concrete floor. The building was used as a lead shop, where it is likely that lead pipes were worked and perhaps lead pipe joints constructed. Three sample locations were investigated around the Lead Shop, one by each of the south, east, and north corners of the building.

Emergency Shed (R)

This building, approximately 50 feet long by 16 feet wide (800 square feet), is constructed of metal walls and roof, with a concrete floor. The nature of past activities conducted inside the building is unknown, although the name suggests that "emergency" supplies were stored inside (e.g., gasoline or diesel for generators). It is not likely that emergency supplies included acids, solvents or other chemicals. Two locations were drilled, one in front of the roll-up service door on the southeast end and a second near a pipe that protrudes out of the ground near the north corner (a possible indication of an underground tank).

Sheet Metal Shop (S)

This building, located near the southwest corner of the Truck Shop (K), is approximately 60 feet long by 35 feet wide (2,100 square feet). It is constructed of metal walls and roof, and a concrete floor. No historical information exists to indicate that the building was used for any purpose other than as a sheet metal shop. Potential COCs include diesel fuel. Two locations were drilled near service doors along the northeast side off the edge of the concrete.

Primary Crusher (CC)

The Primary Crusher was used to crush the ore to a five-inch product before being sent on to the Secondary Crusher. The crushed ore was conveyed to a storage bin by overhead conveyor belt, which initially started below ground and emerged next to the stockpile and crusher. All that remains of the Primary Crusher is the concrete foundation and walls. The area of the foundations is approximately 100 feet by 130 feet (13,000 square feet). Historical records indicate that ore crushing was the only activity at this component, and there is no reason to believe that any potential COCs other than metals in the ore and lubricants (i.e., oil for machinery parts) were ever stored or used in this area. Because underground concrete structures limited sample locations, two locations were investigated (one along the southeast side of the main crushing unit and one on the northwest side.

Secondary Crusher (OO)

The Secondary Crusher was used to further reduce crushed ore, received from the Primary Crusher, to a nominal 0.5-inch diameter. The crusher cones along the north side of the building have been completely removed, but the concrete foundations remain. An underground concrete conveyor exists underneath the Secondary Crusher cone foundations, between the crusher and the ore stockpile. The potential contaminants of concern are metals associated with crushed ore.

Four locations were drilled around the secondary crusher area, including two along the borders of the concrete foundations where the crushers discharged to an underground conveyor. A third location near the southwest corner of the building that may have housed electrical support for the crusher (adjacent to possible outdoor transformers) was also investigated. The fourth location that was investigated is adjacent to an active pump containment used in the re-circulation of leach pad solutions from the Arimetco heap leach circuit.

Stacker Area (NN)

This conveyance area between ore crushers has had all components removed, and has been re-graded. The potential contaminants of concern are associated with crushed ore, namely metals.

Two locations on opposite ends of the service building that provided support and storage for the stacker and crusher area were investigated.

Area 3 – Leach Vats

Leach Vats (P)

Eight leach vats were used for sulfuric acid leaching of the crushed copper ore. Each vat measures 120 feet by 135 feet by 20 feet deep, and were constructed with (average) 18-inch concrete walls and concrete floors (wall thickness is reported to range from one foot thick at the top to three foot thick at the bottom). The interiors of the vats were lined with asphalt mastic (30 percent asphalt and 70 percent sand, reinforced with two layers of thick wire mesh) to protect the concrete from deterioration by the sulfuric acid. The vats were used to percolate acid leach solution through the crushed ore and, subsequently, the application of rinse solution. Each vat was capable of processing 12,000 tons of crushed ore. The potential COCs of concern are the acid solution that was contained within the vats. Additionally, the vats were serviced by a permanent overhead rolling crane, which represents a potential source of leaking oil.

Eight angle boreholes were drilled, one under each tank. Each angle hole was drilled to a total depth of 25 feet bgs at a 45 degree angle. Because of obstructions at the base of the tank, the drill rig was not able to set up any closer than 14 to 20 feet from the tank wall. This allowed at least the bottom two samples to be collected from under the foot print of the tank. An additional six samples were collected at the gaps or corners between tanks to target potential releases from piping between the tanks. One deep sample was taken at the southeast end of the row of tanks. Boreholes were drilled only on the northeast side of the tanks because an embankment and overhead crane track on the southwest side prevented access.

Sulfide Ore Stockpile Area and Underground Conveyors (YY)

This area was used to stockpile sulfide ore supplied to the Sulfide Plant for processing through the flotation and concentration process. Two underground conveyors enclosed in a concrete tunnel travels under the main roadway to connect the sulfide ore stockpile to the Sulfide Plant (HH). The contaminants of concern in this area are metals associated with the conveyed ore.

Two locations were drilled in this area, both of which required drilling through remnants of crushed ore before encountering native soil. Samples were not collected until soil was encountered.

Area 4 – Solution Tanks

Solution Tanks (DD)

Three Solution Tanks were used for short term storage of pregnant acid leach solution from the Leach Vats (P) awaiting precipitation in the Precipitation Plant (EE). The tanks are constructed of concrete floors and concrete walls and are approximately 90 feet wide and 18 feet deep. The tops of the tanks are at ground level with wall and floor thickness at minimally 12 to 18 inches. Acid pitting and erosion of the inside surfaces of the tanks is visible, possibly causing wall thickness to be reduced to less than 12 inches in areas. The length of all three tanks is approximately 360 feet (tank lengths vary from 90 to 140 feet in length). The southernmost Solution Tank was most recently used to store chemicals or petroleum products in approximately 280 55-gallon drums and soils in nine plastic 250-gallon containers. Several of the drums had been damaged, and some were labeled as containing PCBs. All of these drums have since been characterized and removed as of July 2003 (Phillips Services Corporation, 2003). The potential COCs in this area include acid, metals, radionuclides and the materials stored in the 55-gallon drums.

Eight surface grab samples were collected from each corner of the tanks and two deep boreholes were drilled on either end of the tank group. Three boreholes were drilled through the concrete floors of the tanks, one in the center of each end tank and a third near the inside wall of the southeastern tank, targeting the middle tank which was not accessible to the drill rig.

Solution Tanks, Electrical Building and Basement (FF)

This area is comprised of the electrical building that serviced the pumps for the solution tanks and precipitation plant, and an associated basement foundation of an unknown building, possibly the pump house. The area is approximately 60 feet wide by 200 feet long (12,000 square feet). There are switchgear present in the electrical building and, although there is no apparent oil staining, the potential for the past use of transformers in this building exists. The nature of operations in the building where the open basement foundation remains is uncertain. The potential COCs used in this area include acid solutions, metals, radionuclides and transformer oil. Four locations were drilled in this area, two near the electrical building and two near the open basement area which likely housed pumps and piping.

Area 5 – Precipitation Plant

Precipitation Plant (EE)

The Precipitation Plant consists of fifteen parallel concrete launders filled with light gauge scrap iron that were used to precipitate copper from the sulfuric acid leach solution pumped out of the Leach Vats. The copper in solution replaced the iron in the scrap material creating a copper cement product that was removed from the launders and transported to the railway at Wabuska for shipment to the smelter in Anaconda, Montana for final processing. The waste product was a ferrous sulfate solution that was sent to evaporation ponds.

Historical information indicates that several pumps, sumps and associated piping were constructed to convey solutions along the outside perimeter of the launders. Each launder measures 10 feet by 58 feet by five feet deep, with a 1.25 percent slope to facilitate flow from one launder to the next. The entire plant is approximately 600 feet long. There were previously several 55-gallon drums stored in one of the launders at the southeast end of the plant; all of which were removed in 2003 (Phillips Services Corporation, 2003). The contaminants of concern used in this area include acid, metals, radionuclides and the materials stored in the 55-gallon drums.

Access to the northeast side of the plant was obstructed by a partially buried concrete trench which extends approximately 20 feet from the base of the tanks. Beyond the trench is a concrete and asphalt apron that was used to store scrap iron. Five surface samples and two vertical boreholes were drilled on the northeast side of the tanks, just off the concrete pad approximately 30 to 40 feet from the tanks. Five additional surface samples were collected and five angle boreholes were drilled on the southwest side of the tanks. A concrete footing and rail for the overhead crane required the drill to be positioned at least 18 to 30 feet from the base of the tank resulting in a sample depth of 20 to 30 feet below ground surface under the foot print of the tank.

Area 6 – Sulfide Plant

Sulfide Plant Office (GG)

This L-shaped concrete building is located northwest of the Solution Tanks, and is approximately 50 feet by 25 feet along one wing, and 25 feet by 25 feet at the other (1,875 square feet). The office is empty with the exception of archived core samples. The office was apparently used for ancillary administrative purposes related to sulfide plant (HH) operations. One location was drilled near the front access door to this building.

Sulfide Plant (HH)

All buildings in the Sulfide Plant area have been removed, and only concrete structures remain. These concrete structures cover an area approximately 800 feet by 400 feet (320,000 square feet) and consist of foundations, slabs, columns, trenches, ramps and thickeners. Some of the structures, such as slabs and ramps, appear to be at and above surface grade, and some of the structures such as trenches and thickeners are partially buried. All of the circular-shaped thickeners have been filled with alluvial material. Sulfide ore was processed in the plant by first crushing the ore and then feeding it through a rough flotation circuit consisting of four concrete rows containing 24 separate cells. The resulting rough concentrate was routed to a 75-foot diameter thickener, then to a fine-grinding mill. From this mill, the concentrate was fed to a scavenger flotation circuit of similar construction to the first, then on to two 50-foot diameter thickeners. The final concentrate was dried in two six-foot diameter vacuum filters. The potential contaminants of concern used in this Sulfide Plant area are metals associated with the sulfide ore.

Five sample locations were drilled through the concrete floor of what remains of the Sulfide Plant building targeting areas near sumps and trenches where possible. Sample locations were restricted by drill accessibility. Sample location PA-HH1 encountered thick steel plate under the concrete and was abandoned without sampling. Six sample locations targeted all large and small storage, processing, and thickener tanks associated with the Sulfide Plant. The five largest tanks were sampled by drilling an angle borehole underneath the tank as it was not possible to set up on and drill through the tank base because of accessibility and other physical constraints. One additional location was added to the work plan to sample the soil in the low area just north of the largest thickener. The soil showed surface discoloration indicating the potential for copper and acid solution collection in the area.

Area 7 – Calcine Ditch

Former Calcine Ditch (WW)

In the former Acid Plant, dusts from gas produced in the manufacture of sulfuric acid were removed by wet scrubbers, mist precipitators and cyclones. The resulting wet slurry was directed to four calcine launders (i.e., concrete troughs covered with steel plates), from which the slurry was sent along with calcines (i.e., burned ore) from the Acid Plant reactors to the evaporation ponds north of the Process Areas. The conveyance along the calcine ditch used spent solution from the precipitation launders as a conveyance medium. The potential COCs in this area include sulfuric acid and metals associated with the conveyed calcines, and the collected stack dust. It is possible that other waste solutions were also transported in this ditch during past operations. The length of the ditch is approximately 3,200 feet. The 1,200–foot portion of the ditch closest to the source (the former Acid Plant) is buried under a heap leach pad and, therefore, was not sampled.

Nine boreholes were drilled along a 2,500 foot section of the Calcine Ditch with a total of 40 samples collected (boreholes were drilled to 20 foot depths). The locations were spaced approximately 200 feet apart and targeted the estimated bottom of the old ditch. A ditch is still in place in this location and marks the boundary between the Process Areas and vat leach tailings (VLT), but the location of the original Calcine Ditch has been obscured or partially filled in by movement of the VLT material.

Area 8 – North Solution Ditch

North Solution Ditch (FFF)

The North Solution Ditch was identified by examination of old photos taken of the Process Areas in 1961 and 1964. Surface expression of the ditch still remains and starts at approximately the northwest end of the Solution Tanks (DD), running for a distance of about 1,000 feet northeast where it disappears under the sulfide tailings adjacent to the Process Areas. The ditch is unlined, and it is uncertain whether solutions flowed freely in the ditch or were contained in piping that is no longer in place. The nature of the past use of this ditch is uncertain though, because of its placement, it may have carried waste solutions or runoff from the Solution Tanks to the sulfide tailings ponds. Potential COCs include acid, metals and radionuclides. Eighteen boreholes were drilled and 104 samples were collected.

Area 9 – East Solution Ditch

East Solution Ditch (EEE)

The East Solution Ditch runs northwest from the Lower Truck Sludge Pond (CCC) along the margin of the sulfide tailings. The ditch can be traced for approximately 1,500 feet up to the point where it disappears under the main haul road. The ditch is unlined and was likely used to convey surface drainage from the Truck Wash Pad, Upper and Lower Truck Sludge Ponds, and other localized surface runoff. Hydrocarbon residue is visible along the sides of the ditch and potential COCs include gasoline, diesel and motor oil residues. Twenty-one boreholes were drilled and 125 samples were collected.

Area 10 – North Low Area

North Low Area (HHH 1-16)

This is an area located northeast of the Precipitation Plant (EE) at a lower elevation than the general ground surface in the Process Areas. The low area has been used for general equipment and materials storage and exhibits apparent runoff accumulation from the surrounding topography. The potential contaminants of concerns are those associated with the Precipitation Plant and possible runoff from areas of oil or solvent stained ground surface. Sixteen boreholes were drilled in this area over an evenly spaced grid pattern of approximately 150 by 150 feet to a depth of 25 feet bgs.

Concrete Ramps (II)

There are two sloped concrete ramps east of the Sulfide Plant that are approximately 25 feet wide by 50 feet long. The exact nature of their past use is uncertain, but it is possible that these ramps were used to store or load trucks with copper cement from the Precipitation Plant that was transported to the Wabuska rail spur and ultimately to the Anaconda Smelter for final processing. The potential COCs in this area include metals associated with the copper cement. One borehole location was drilled at the front entrance to one of the ramps while the other was drilled next to the back, or deep end, where blue-green water was observed standing in the ramp.

Surge Pond (KK)

The Surge Pond is approximately 150 by 150 feet with a maximum depth of about 5 feet. It is located approximately 200 feet northeast of the Precipitation Plant. The Surge Pond was unlined,or had a clay liner, and was used for temporary storage of spent process solutions from the Precipitation Plant. Potential COCs in the Surge Pond include acids, metals and radionuclides. Three boreholes were drilled in the bottom of the Surge Pond.

<u>Area 11 – South Low Area</u>

South Low Area (HHH 17-38)

This is the continuation of the low area situated between the Process Areas and the VLT pile. The area also includes some of the intermediate elevations areas around the Precipitation Plant and the tire pile. General use of the area includes miscellaneous material storage (such as discarded heavy equipment tires), general vehicle roadways, and conveyance of process solutions through above ground pipelines. The area also includes an 1,800-gallon used oil tank situated inside an old haul truck bed which serves as secondary containment. Potential COCs include metals and hydrocarbons. A continuation of the 150 by 150 foot grid sample plan was completed with the used oil tank targeted by four closely spaced boreholes, one at each corner.

Upper Truck Sludge Pond (BBB)

This pond or pit area is located just north of the Equipment and Truck Wash areas (C and M) and appears to have been a collection point for wash water from the Wash Pad and possibly other drains from the Truck Shop Building (K). The pit is approximately 10 feet wide and 40 feet long, with an 8-inch diameter drain pipe that drains into this area. The soil in this area exhibits hydrocarbon contamination, and was not able to support the weight of any heavy equipment. Sampling was accomplished by drilling three angle boreholes underneath the pit area to a depth of 20 feet bgs.

Lower Truck Sludge Pond (CCC)

A second pond area exists in the South Low Area that received additional drainage from the Upper Truck Sludge Pond. This pond appears to have had a synthetic liner installed at one time that might have contained solutions and solids from further migration. The solids in the pond exhibited hydrocarbon contamination. The material was not firm enough to support the weight of the drill rig, so samples were collected by drilling two angle boreholes underneath the pond and two vertical holes adjacent to the pond.

Ditch between Upper and Lower Truck Sludge Ponds (DDD)

A possible ditch, or drainage pathway, between the Upper and Lower Truck Sludge Ponds was identified and sampled. Potential COCs include hydrocarbons (gasoline, diesel, and motor oil). Three vertical holes were drilled along the alignment between the sludge ponds.

<u>Area 12 – Peripheral Process Components</u>

Core Building (AA)

The Core Building is located southwest of the Process Area and contains several hundred boxes of core samples on shelves. The building is constructed of sheet metal on framework without a floor (i.e., a dirt floor). The building was constructed a relatively long distance (approximately 0.25 miles) from the edge of the existing Process Areas. No information exists as to activities other than core storage or logging in this building. Two locations were drilled, one near each large service door at opposite ends of the building.

Acid Tanks (PP)

The Acid Tanks area is located approximately one mile northwest of the main Process Areas on top of a VLT waste pile. The contents of the tanks were likely a dilute (one percent) sulfuric acid solution used on the nearby Arimetco leach pad. The tanks include a 50,000-gallon, two 5,000-gallon and a 10,000-gallon metal sulfuric acid tanks. Three of the four tanks are situated within secondary containments. Some yellow staining of soil is visible, suggesting possible spillage of sulfuric acid. The contents of all the acid tanks have been drained, but the tanks have not been cleaned out. The volume of residual acid sludge in the tanks is unknown. The potential COC in this area is sulfuric acid. Sample collection from this area was not feasible with the core drill rig, so the work plan was modified to allow collection of samples at just the surface and five feet below surface by excavation with a backhoe. Four locations were excavated and sampled.

Arimetco Crusher/Hopper (QQ)

The Arimetco Crusher/Hopper was located approximately one mile northwest of the main Process Areas, on the north side of the Oxide Ore waste rock area. The components have been removed and the area has been re-graded. The potential COCs in this area include sulfuric acid and metals associated with the crushed ore. Two locations were drilled in this area.

Arimetco Stacker Area (RR)

A lined stockpile existed on the area where the former Stacker was located, approximately one mile northwest of the main Process Areas. Acid-treated crushed ore was placed on the stockpile area. After the Crusher Plant was removed, the stockpile area was excavated and placed on the VLT Leach Pad. The contaminants of concern in the area are sulfuric acid and metals associated with the crushed ore. Two locations were drilled in the Stacker Area.

Old Crusher Site (UU)

A concrete foundation of an old crusher unit exists approximately 2,100 feet southeast of the Administration Building (A) on the south side of the Weed Heights Road north of the Yerington Pit. The foundation has no structures or equipment attached. Next to the foundation is an area where a former acid tank may have been located. The ground surface around the former tank area is discolored yellow. The potential COCs in this area include sulfuric acid and metals associated with crushed ore. Two locations were drilled, one near the foundation of the crusher unit and one near the yellow stained area.

Tailings Pump Houses (VV)

Two buildings containing large pumps and associated piping are located east of the Evaporation Ponds. The easternmost building was named the Tailings Pump House and contains two large pumps with approximate 16-inch diameter piping entering straight into the ground and underground out to the south. The other building consists of large pumps on a raised concrete deck, associated piping and a concrete holding tank with level gauge. Operation of the Tailings Pump Houses most likely involved pumping of fluidized, spent processed ore from the Process Areas to the sulfide tailings. Potential COCs in this area include sulfuric acid and metals associated with tailings, and lubricant oil from the pumps. Two boreholes were drilled and one surface grab sample was collected; one borehole was located next to each pump house building.

Surface Pumps Foundation (ZZ)

An above-ground concrete foundation exists just east of the middle Evaporation Pond in a low area near the northeast boundary of the mine site. The structure is a concrete holding tank approximately four feet deep with a grated inlet on the north side at ground surface, and openings in the top that suggest the presence of large pumps. The structure appears to have collected surface water or fluids from the surrounding topographic low area. The contaminants of concern near this structure are sulfuric acid and metals associated with surface runoff over tailings. One location was drilled next to the overflow grating on the north side of the concrete structure.

Concrete Pump Tank (AAA)

A large abandoned above-ground concrete tank is present at the southern end of the Unlined Evaporation Pond. The tank is approximately 12 feet high and appears to have had pumps attached to an integral concrete platform above the tank. A manhole with an apparent former valve ahead of the tank is present approximately 60 feet to the south of the tank. Potential COCs in the area of the tank include acidic solutions and calcines (the latter if the piping represents a continuation of the Calcine Ditch). One location was drilled next to the smaller box with the manhole based on the assumption that this was likely a valve controlling the flow of the pipe and would have been a more likely source of leakage.

2.2 Utility Pipeline Sampling

Underground piping in the Process Areas may have carried solutions with potential COCs such as metals, solvents and fuels. Because of the age of the facility, it is possible that pipelines have been broken or connections have leaked. The purpose of utility pipeline sampling was to locate as many underground lines as possible and sample each line at several points. Targeted sample points included pipe terminus into sumps or manholes, intermediate joints, and locations where the pipe makes a turn. A total of 60 soil samples were collected to evaluate potential releases from underground utility pipelines. All utility samples were analyzed for the full suite of analytes, including radionuclides. Sample and utility locations are shown in Figure 2-3.

Historical maps of the Process Areas provided locations of originally installed sewer lines, drain lines and water and gas lines. Because the facility has undergone changes over the years, the accuracy of the map was questionable (e.g., utility pipelines may no longer exist and the maps may not include all pipelines in the Process Areas). Initially, a private utility locating service was engaged to try to locate, by surface survey, as many pipelines as possible. It was soon apparent that a majority of the lines were constructed of non-conducting materials that were not picked up by the survey equipment. A field determination was made that the most feasible method for locating the pipes was to use a backhoe to excavate areas where pipelines were shown on the historical maps or areas where manholes could be opened and pipes observed.

A backhoe was used to excavate down to suspected pipe locations, ranging in depth from 1 foot to 12 feet bgs. When a pipe was located, the excavation would continue along the pipe until a connecting joint was located, at which point a sample was collected from 6 to 12 inches directly beneath the bottom of the piping at the closest pipe junction or connection. In locations where two or more pipes occurred in the same corridor, samples were collected under each pipe separately at each pipe's joint or connection. Depth, description and photos at each sample location were recorded and details are included in Appendices A and B.

2.3 Electrical Stations and Transformer Sampling

Several electrical sub-stations were operated at the mine site and many transformers exist on-site, either inoperative or still in use. The transformers, mounted on poles or on concrete pads within fenced-in areas, may have leaked oil. The potential COCs include oil and PCBs. Surface grab samples were collected from underlying and adjacent soils associated with five transformer sites in the Process Areas (Figure 2-4). The samples were analyzed for the full suite of analytes except radionuclides. No visible oil staining was observed around any of the transformers that were sampled.

2.4 Stained Soil Excavation and Sampling

During the field investigation, two areas were identified for excavation based on visual observation of surface oil staining and samples were collected at two additional areas that were not excavated (Figure 2-4). At each of the excavated locations, a preliminary sample was collected of the stained soil. Subsequently, confirmation samples were collected of the bottom and side walls of the excavated area following removal of visible contaminated soil. The excavations were limited in size to less than 10 by 10 feet by 3 feet deep, in accordance with the Process Areas Work Plan. Other oil-contaminated areas were observed, such as the Upper and Lower Truck Sludge Pits. However, the excavation and removal of these larger areas was beyond the scope of the site characterization activities presented in the Process Areas Work Plan.

At the time of the excavation, the soils were monitored with a real time *Organic Vapor Photo-Ionization Detector (PID)* to assist in determination of the extent of oil seepage as well as monitor for employee health and safety. The PID readings were very low throughout the excavation and final determination of extent was done visually rather than based on equipment readings.

2.5 Underground Storage Tanks

An initial survey was completed to determine the presence of possible underground storage tanks (USTs) remaining on the property. Areas around former fueling stations were investigated in a preliminary fashion to determine if any fuel or liquid is still remaining in those tanks (see Figure 2-5). Follow-up characterization activities would be presented in a separate UST Work Plan.

2.6 Modifications to Work Plan – Sample Location Changes

Minor changes in borehole locations were made during the field investigation period based on drill rig accessibility and identification of preferred target areas. These minor changes did not affect the data quality objectives (DQOs) presented in the Process Areas Work Plan. Modifications to planned sample locations are summarized below.

Upon review of the Draft Work Plan, the BLM requested some modifications or additions to the plan including additional sample locations at the Upper and Lower Truck Sludge Ponds and Ditch (BBB, CCC, and DDD), the North Solution Ditch (FFF) and East Solution Ditch (EEE), and grid samples taken in the Low Area (HHH).

A third Solution Ditch was identified at the north end of the Process Areas, north of the Sulfide Plant, by the BLM through examination of old aerial photos. Ground surface examination by Brown and Caldwell and BLM personnel could not locate any remaining surface expression of this ditch. An elevated causeway that was used for surface piping of process waste solutions to the VLT pile on the northeast side of the Process Areas occurs along the same alignment as this ditch. It is possible that the causeway was mistaken for a ditch in the photos or that it was built on top of a once existing ditch. In either case, the decision was made that it was not possible to sample the suggested ditch at this time and that, during potential future investigations, angle drilling underneath the causeway may be performed to evaluate possible leakage from the piping.

Three drill locations were planned around the Motor Cargo Building (TT), an ancillary support building located southwest of the Process Areas off the mine property on private property.

Because the building is currently in use and electrical and possibly other utilities are active around the building, a utility locating survey would be required before drilling or other ground disturbance could be completed.

A request was made by the EPA to modify the Work Plan to include drilling inside the Truck Shop (K) at locations where it appeared that floor drains had been filled with concrete and plugged. The drill that was used for the main area investigation was not suited for working inside a building, where the drill mast would potentially be too close to overhead obstructions, therefore a decision was made to not complete this work for safety reasons.

Several other proposed sample locations (LL, MM, and JJ), as written in the original Work Plan, were dropped as the new grid sample locations in the Low Area (HHH) duplicated these original locations.

2.7 Surveying

All borehole locations were surveyed for X, Y, and Z coordinates using a Trimball GeoXT handheld GPS unit with an accuracy of one meter or less. The GPS unit has an integrated receiver that uses WAAS (Wide Area Augmentation System) correction messages to improve GPS accuracy. All survey coordinates were entered into the sample database and were used to develop all GIS map data for surface and subsurface representations of sample results.

SECTION 3.0
SUMMARY OF ANALYTICAL RESULTS

Process Areas soils were evaluated by laboratory analyses of borehole, excavation and grab samples collected from the approximately 250 locations shown in Figures 2-1 through 2-5. Samples were analyzed for potential COCs including metals, radionuclides, acid-base potential, VOCs, SVOCs, TPH, pesticides, herbicides, and PCBs. The analyses were completed by Sequoia Analytical Laboratories (Morgan Hill, CA; Petaluma, CA; and Beaverton, OR), Energy Laboratories (Casper, WY), and NEL Laboratories (Las Vegas, NV). Summary tables of all analytical data results are provided in hard copy and electronic formats in Appendix C, and original laboratory data reports are provided electronically in Appendix D.

3.1 Preliminary Soil Screening Criteria

EPA Region IX preliminary remediation goals (PRGs) for an industrial outdoor worker (“industrial”), requested by EPA as preliminary soil screening criteria, are presented in this section of the DSR. In addition to the industrial PRGs, Process Areas soil data should be compared to background soil chemistry to properly evaluate the site. However, no background soil samples have yet been collected at, and around, the Yerington Mine Site. Given that the industrial PRGs were developed using risk-based calculations for potential populations exposed to the site by various exposure pathways (e.g., inhalation of dust, ingestion or absorption), the industrial PRGs listed below: 1) are generic and not based on site-specific information regarding exposure pathways associated with Process Areas soils; and 2) should not be used to arrive at site management decisions without soil background chemical data.

Tables 3-1a through 3-1i provide a comprehensive list of the preliminary screening criteria requested by EPA for use in screening the analytical results. In lieu of EPA-developed PRGs for TPH, Nevada State corrective action levels, as defined by Nevada Administrative Code 445A.2272, are provided in Table 3-1f as screening criteria for potential hydrocarbon-impacted portions of the Process Areas.

Table 3-1a. Preliminary Screening Criteria for Metals

Analyte	Unit	Industrial PRG
Aluminum	mg/kg	920,000
Antimony	mg/kg	410
Arsenic	mg/kg	260
Barium	mg/kg	67,000
Beryllium	mg/kg	1,900
Boron	mg/kg	200,000
Cadmium	mg/kg	450
Calcium	mg/kg	NA
Chromium, Total	mg/kg	2,500
Cobalt	mg/kg	13,000
Copper	mg/kg	41,000
Iron	mg/kg	310,000
Lead	mg/kg	NA
Magnesium	mg/kg	NA
Manganese	mg/kg	19,000
Mercury	mg/kg	310
Molybdenum	mg/kg	5,100
Nickel	mg/kg	20,000
Potassium	mg/kg	NA
Selenium	mg/kg	5,100
Silver	mg/kg	5,100
Sodium	mg/kg	NA
Thallium	mg/kg	67
Vanadium	mg/kg	1,000
Zinc	mg/kg	310,000

Table 3-1b. Preliminary Screening Criteria for Radionuclides

Analyte	Unit	Industrial PRG
Thorium-232	mg/kg	174
Uranium	mg/kg	200
Radium-226	pCi/G	3.7
Radium-228	pCi/G	8.4

Table 3-1c. Preliminary Screening Criteria for Acid-Base Potential

Analyte	Unit	Industrial PRG
Acid Potential	T/KT	NA
Acid/Base Potential	T/KT	NA
Neutralization Potential	T/KT	NA

Table 3-1d. Preliminary Screening Criteria for Volatile Organic Compounds

Analyte	Unit	Industrial PRG
1,1,1,2-Tetrachloroethane	ug/kg	2,000,000
1,1,1-Trichloroethane	ug/kg	6,900,000
1,1,2,2-Tetrachloroethane	ug/kg	4,000,000
1,1,2-Trichloroethane	ug/kg	130,000
1,1-Dichloroethane	ug/kg	1,700,000
1,1-Dichloroethene	ug/kg	410,000
1,1-Dichloropropene	ug/kg	54,000
1,2,3-Trichlorobenzene	ug/kg	NA
1,2,3-Trichloropropane	ug/kg	79,000
1,2,4-Trichlorobenzene	ug/kg	220,000
1,2,4-Trimethylbenzene	ug/kg	170,000
1,2-Dibromo-3-Chloropropane	ug/kg	11,000
1,2-Dibromoethane (Ethylene Dibromide)	ug/kg	140,000
1,2-Dichlorobenzene	ug/kg	4,100,000
1,2-Dichloroethane	ug/kg	28,000
1,2-Dichloropropane	ug/kg	21,000
1,3,5-Trimethylbenzene (Mesitylene)	ug/kg	70,000
1,3-Dichlorobenzene	ug/kg	2,100,000
1,3-Dichloropropane	ug/kg	360,000
1,4-Dichlorobenzene	ug/kg	10,000,000
2,2-Dichloropropane	ug/kg	NA
2-Chlorotoluene	ug/kg	NA
4-Chlorotoluene	ug/kg	NA
Benzene	ug/kg	120,000
Bromobenzene	ug/kg	92,000
Bromochloromethane	ug/kg	NA
Bromodichloromethane	ug/kg	810,000
Bromoform	ug/kg	12,000,000
Bromomethane	ug/kg	13,000
Carbon Tetrachloride	ug/kg	7,300
Chlorobenzene	ug/kg	530,000
Chloroethane	ug/kg	18,000,000
Chloroform	ug/kg	190,000
Chloromethane	ug/kg	160,000
Cis-1,2-Dichloroethylene	ug/kg	150,000
Dibromochloromethane	ug/kg	1,500,000
Dibromomethane	ug/kg	NA
Dichlorodifluoromethane	ug/kg	310,000
Ethylbenzene	ug/kg	7,400,000
Hexachlorobutadiene	ug/kg	180,000
Isopropylbenzene (Cumene)	ug/kg	2,000,000
Methylene Chloride	ug/kg	9,300,000
Naphthalene	ug/kg	190,000
n-Butylbenzene	ug/kg	2,200,000
n-Propylbenzene	ug/kg	2,200,000
p-Cymene (p-Isopropyltoluene)	ug/kg	NA
sec-Butylbenzene	ug/kg	1,600,000

Styrene	ug/kg	18,000,000

Table 3-1d. Preliminary Screening Criteria for Volatile Organic Compounds - Continued

Analyte	Unit	Industrial PRG
t-Butylbenzene	ug/kg	2,000,000
Tetrachloroethylene(PCE)	ug/kg	130,000
Toluene	ug/kg	2,200,000
Trans-1,2-Dichloroethene	ug/kg	230,000
Trichloroethene (TCE)	ug/kg	110,000
Trichlorofluoromethane	ug/kg	1,300,000
Vinyl Chloride	ug/kg	140,000
Xylenes, Total	ug/kg	900,000

Table 3-1e. Preliminary Screening Criteria for Semi-Volatile Organic Compounds

Analyte	Unit	Industrial PRG
1,2,4-Trichlorobenzene	mg/kg	220
1,2-Dichlorobenzene	mg/kg	4,100
1,3-Dichlorobenzene	mg/kg	2,100
1,4-Dichlorobenzene	mg/kg	10,000
2,4,5-Trichlorophenol	mg/kg	62,000
2,4,6-Trichlorophenol	mg/kg	62
2,4-Dichlorophenol	mg/kg	1,800
2,4-Dimethylphenol	mg/kg	12,000
2,4-Dinitrophenol	mg/kg	1,200
2,4-Dinitrotoluene	mg/kg	1,200
2,6-Dinitrotoluene	mg/kg	620
2-Chloronaphthalene	mg/kg	23,000
2-Chlorophenol	mg/kg	240
2-Methylnaphthalene	mg/kg	NA
2-Methylphenol (o-Cresol)	mg/kg	31,000
2-Nitroaniline	mg/kg	1,800
2-Nitrophenol	mg/kg	43,000
3,3'-Dichlorobenzidine	mg/kg	NA
3-Nitroaniline	mg/kg	180
4,6-Dinitro-2-Methylphenol	mg/kg	NA
4-Bromophenyl Phenyl Ether	mg/kg	NA
4-Chloro-3-Methylphenol	mg/kg	NA
4-Chloroaniline	mg/kg	2,500
4-Chlorophenyl Phenyl Ether	mg/kg	NA
4-Methylphenol (p-Cresol)	mg/kg	3,100
4-Nitroaniline	mg/kg	1,800
4-Nitrophenol	mg/kg	NA
Acenaphthene	mg/kg	29,000
Acenaphthylene	mg/kg	NA
Anthracene	mg/kg	240,000
Benzo(a)Anthracene	mg/kg	NA
Benzo(a)Pyrene	mg/kg	NA

Benzo(b)Fluoranthene	mg/kg	NA

Table 3-1e. Preliminary Screening Criteria for Semi-Volatile Organic Compounds - Continued

Analyte	Unit	Industrial PRG
Benzo(g,h,i)Perylene	mg/kg	NA
Benzo(k)Fluoranthene	mg/kg	NA
Benzoic Acid	mg/kg	2,500,000
Benzyl Alcohol	mg/kg	180,000
Benzyl Butyl Phthalate	mg/kg	NA
Bis(2-Chloroethoxy) Methane	mg/kg	NA
Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	mg/kg	NA
Bis(2-Chloroisopropyl) Ether	mg/kg	4,000
Bis(2-Ethylhexyl) Phthalate	mg/kg	12,000
Carbazole	mg/kg	NA
Chrysene	mg/kg	NA
Dibenz(a,h)Anthracene	mg/kg	NA
Dibenzofuran	mg/kg	1,600
Diethyl Phthalate	mg/kg	490,000
Dimethyl Phthalate	mg/kg	6,200,000
Di-n-Butyl Phthalate	mg/kg	NA
Di-n-Octylphthalate	mg/kg	25,000
Fluoranthene	mg/kg	22,000
Fluorene	mg/kg	26,000
Hexachlorobenzene	mg/kg	490
Hexachlorobutadiene	mg/kg	180
Hexachlorocyclopentadiene	mg/kg	3,700
Hexachloroethane	mg/kg	620
Indeno(1,2,3-c,d)Pyrene	mg/kg	NA
Isophorone	mg/kg	120,000
Naphthalene	mg/kg	190
Nitrobenzene	mg/kg	100
n-Nitrosodi-n-Propylamine	mg/kg	NA
n-Nitrosodiphenylamine	mg/kg	12,000
Pentachlorophenol	mg/kg	12,000
Phenanthrene	mg/kg	NA
Phenol	mg/kg	180,000
Pyrene	mg/kg	29,000

Table 3-1f. Preliminary Screening Criteria for Total Petroleum Hydrocarbons

Analyte	Unit	Nevada Corrective Action Level
Gasoline C4-C12	mg/kg	100
Diesel Components	mg/kg	100
Motor Oils	mg/kg	100

Table 3-1g. Preliminary Screening Criteria for Pesticides

Analyte	Unit	Industrial PRG
Aldrin	ug/kg	18,000
Alpha BHC (Alpha Hexachlorocyclohexane)	ug/kg	400,000
Alpha Endosulfan	ug/kg	NA
Alpha-Chlordane	ug/kg	NA
Beta BHC (Beta Hexachlorocyclohexane)	ug/kg	160,000
Beta Endosulfan	ug/kg	NA
Chlordane	ug/kg	400,000
Delta BHC (Delta Hexachlorocyclohexane)	ug/kg	NA
DDD	ug/kg	NA
DDE	ug/kg	NA
DDT	ug/kg	430,000
Dieldrin	ug/kg	31,000
Endosulfan Sulfate	ug/kg	3,700,000
Endrin	ug/kg	180,000
Endrin Aldehyde	ug/kg	NA
Endrin Ketone	ug/kg	NA
Gamma BHC (Lindane)	ug/kg	240,000
Gamma-Chlordane	ug/kg	400,000
Heptachlor	ug/kg	310,000
Heptachlor Epoxide	ug/kg	8,000
Methoxychlor	ug/kg	3,100,000
Toxaphene	ug/kg	NA

Table 3-1h. Preliminary Screening Criteria for Herbicides

Analyte	Unit	Industrial PRG
2,4 DB	ug/kg	4,900,000
2,4,5-T (Trichlorophenoxyacetic Acid)	ug/kg	6,200,000
2,4-D (Dichlorophenoxyacetic Acid)	ug/kg	7,700,000
Dalapon	ug/kg	18,000,000
Dicamba	ug/kg	18,000,000
Dichloroprop	ug/kg	NA
Dinoseb	ug/kg	620,000
MCPA	ug/kg	310,000
MCPP	ug/kg	620,000
Silvex (2,4,5-Tp)	ug/kg	NA

Table 3-1i. Preliminary Screening Criteria for PCBs		
Analyte	**Unit**	**Industrial PRG**
PCB-1016 (Arochlor 1016)	ug/kg	37,000
PCB-1221 (Arochlor 1221)	ug/kg	37,000
PCB-1232 (Arochlor 1232)	ug/kg	37,000
PCB-1242 (Arochlor 1242)	ug/kg	37,000
PCB-1248 (Arochlor 1248)	ug/kg	37,000
PCB-1254 (Arochlor 1254)	ug/kg	37,000
PCB-1260 (Arochlor 1260)	ug/kg	37,000
PCB-1268 (Arochlor 1268)	ug/kg	37,000

3.2 Analytical Results

Analytical results from Process Areas soil sample locations with one or more samples that exceed the preliminary screening criteria presented above are discussed in this section of the DSR. Per EPA's request the tables that are included in the following text summarize analytical results that exceed preliminary screening criteria (results that exceed the criteria are shaded grey) for samples from the designated areas (Areas 1 through 12, described in Section 2.1) that comprise the Process Areas and ancillary operations areas. Field duplicate samples are listed with the designation "B" after the sample name. Complete data tables of all analytical results are included in Appendix C. In these tables, for comparison of analytical results to the preliminary screening criteria, the PRGs have been converted to the same units reported by the analytical laboratory. Figures showing sample locations that exceed the preliminary screening criteria for each of the designated areas within the Process Areas, and ancillary operations areas, are presented in the Figures Section of this DSR.

Statistical summary tables for all analytical results from each of the designated areas are included in Appendix C, in both hard copy and electronic formats. These tables include: 1) information on minimum, maximum and average concentrations found in the designated areas that comprise the Process Areas and ancillary operations areas; 2) number of samples analyzed and detected above laboratory detection limits; and 3) number and percent of samples that exceed industrial PRGs or TPH criteria.

<u>Area 1 – Administrative and Maintenance Support Buildings</u>

Of the 26 sample locations in Area 1, and 78 samples collected for analyses, six samples, or 8 percent of all samples collected in this area, had results that exceeded the Nevada criteria for diesel components. Two of the six samples were duplicates. Four samples (5 percent), two of which are duplicates, exceeded for motor oils (Table 3-2). The areas with TPH impacted soils were near the location of an old fueling station and in front of the garage attached to the administration building. Because the buildings and facilities in Area 1 were primarily operated as administrative, laboratory and maintenance support, which did not have direct contact with process solutions, radionuclide analyses were not performed.

Table 3-2. Area 1 Analytes that Exceed Preliminary Screening Criteria

Location Name	Sample Name	Diesel Components	Motor Oils
		mg/kg	mg/kg
PA-A1	PA-A1-1	34	250
	PA-A1-1B	46	310
PA-W1	PA-W1-1	19,000	3,000
	PA-W1-1B	15,000	2,100
	PA-W1-5	410	73
	PA-W1-10	870	93
PA-Z1	PA-Z1-1	220	70
	PA-Z1-1B	240	65
Preliminary Screening Criteria		**100**	**100**

<u>Area 2 – Truck Shop, Crusher and Miscellaneous</u>

A total of 36 locations in Area 2 were sampled, with 108 samples collected for analyses plus 18 duplicate samples. As presented in Table 3-3, nine samples (7 percent of all samples collected in this area, including duplicates) exceeded the Nevada criteria for diesel components, and 14 samples (11 percent) exceeded Nevada criteria for motor oils. No analytical results exceeded preliminary screening criteria for samples submitted for other inorganic or organic constituents. Radionuclides were not analyzed in this area because the presence of process solutions was not anticipated.

Table 3-3. Area 2 Analytes that Exceed Preliminary Screening Criteria

Location	Sample Name	Diesel Components mg/kg	Motor Oils mg/kg
PA-C1	PA-C1-5	290	200
PA-CC2	PA-CC2-1	37	560
	PA-CC2-1B	52	970
PA-I1	PA-I1-1	810	50
PA-K4	PA-K4-1	620	2,100
PA-K5	PA-K5-1	1,900	11,000
	PA-K5-1B	2,100	13,000
PA-K8	PA-K8-1	120	1,200
PA-L1	PA-L1-1	450	3,100
PA-L2	PA-L2-1	22	180
	PA-L2-1B	15	110
PA-M2	PA-M2-1	3,200	4,700
	PA-M2-1B	4,300	5,200
Preliminary Screening Criteria		**100**	**100**

Area 3 – Leach Vats

Angle and vertical boreholes at 17 locations were drilled around the Leach Vats with 57 samples collected from the boreholes (Figure 3-3) plus 7 duplicates. None of the samples collected from Area 3 yielded analytical results that exceed the preliminary screening criteria.

Area 4 - Solution Tanks

A total of 16 locations were sampled in and around the Solution Tanks, with a total of 46 samples plus 6 duplicates collected. As presented in Table 3-4, five samples (11% of total percentcollected) exceeded the industrial PRG for Radium-226, including three surface samples collected at the corners of the tanks and one shallow sample from PA-FF3 borehole (note that the borehole duplicate sample also exceeded the PRG). Soil samples from locations drilled through the bottoms of the tanks, to check potential leakage from the tanks, did not yield analytical results with concentrations for any constituent that exceed the preliminary screening criteria. Three samples (6 percent) exceeded Nevada criteria for diesel components and nine samples (17 percent) exceeded Nevada criteria for motor oils.

Table 3-4. Area 4 Analytes that Exceed Preliminary Screening Criteria

Location Name	Sample Name	Radium-226 pCi/g	Diesel Components mg/kg	Motor Oils mg/kg
PA-DD4	PA-DD4-1	2.2	3,100	490
PA-DD5	PA-DD5-1	18	12	160
PA-DD6	PA-DD6-1	1	6.4	110
PA-DD7	PA-DD7-1	3.9	54	440
PA-DD9	PA-DD9-1	0.8	7.7	170
PA-DD10	PA-DD10-1	4.3	110	1,000
PA-DD11	PA-DD11-1	2.7	11	140
PA-FF2	PA-FF2-1	1	2,300	9,200
PA-FF3	PA-FF3-1	13.7	12	110
	PA-FF3-1B	6.5	7.7	72
Preliminary Screening Criteria		**3.7**	**100**	**100**

<u>Area 5 – Precipitation Plant</u>

In the area of the Precipitation Plant and Iron Launders, 18 locations were sampled with a total of 60 samples collected by vertical boreholes, angle boreholes under the tanks, and surface grab samples (Figure 3-5). One surface sample (or 1.5 percent of all samples collected in this area) exceeded the industrial PRG for copper (PA-EE6 is located off the northwest corner of the Iron Launder tanks, adjacent to a deep basement area and some piping where solutions entered the tanks).

As presented in Table 3-4, two surface samples (3 percent of all samples collected in this area) yielded analytical results that exceeded the industrial PRG for Radium-226 (PA-EE7 and PA-EE17; note that the duplicate sample for PA-EE17 was less than the PRG). These samples were collected from areas that registered elevated gamma readings taken with a hand-held gamma meter. Four samples (6 percent) exceed the Nevada criteria for motor oils and one sample (1.5 percent) exceeded Nevada criteria for diesel components. In Area 5, only those samples collected near the surface, from 0.5 to 2.5 feet bgs, exceeded the preliminary screening criteria.

None of the samples collected beneath the iron launders indicate that the tanks leaked solutions into the underlying soils.

Table 3-5. Area 5 Analytes that Exceed Preliminary Screening Criteria

Location Name	Sample Name	Copper	Radium-226	Diesel Components	Motor Oils
		mg/kg	pCi/g	mg/kg	mg/kg
PA-EE2	PA-EE2-1	4,800	1	440	84
PA-EE6	PA-EE6-1	44,000	1.8	61	100
PA-EE7	PA-EE7-1	660	4	9.3	69
PA-EE8	PA-EE8-1	2,600	1.5	49	560
PA-EE9	PA-EE9-1	11,000	1.5	40	530
PA-EE17	PA-EE17-1	1,900	5	94	1000
	PA-EE17-1B	1,500	1.7	23	320
Preliminary Screening Criteria		**41,000**	**3.7**	**100**	**100**

Area 6 – Sulfide Plant

A total of 50 samples plus 6 duplicates were collected from 13 locations that were drilled in the Sulfide Plant area, which targeted concrete foundations and tanks (Figure 3-6). None of the samples yielded analytical results that exceeded any preliminary screening criteria.

Area 7 - Calcine Ditch

A total of 40 samples plus 5 duplicates were collected from 9 borehole locations along the Calcine Ditch. As presented in Table 3-5, one sample (or 2 percent of all samples collected in this area) from location PA-WW4 yielded analytical results that exceeded the industrial PRG for arsenic at a depth of 10 feet bgs (Table 3-6). Five samples (11 percent) yielded analytical results for Radium-226 that exceeded the industrial PRG (PA-WW3 at 5 and 10 feet bgs, PA-WW6 at 5 feet bgs and PA-WW7 at 5 feet bgs; the duplicate sample from PA-WW7-5 confirmed this result). Two samples (4 percent) yielded analytical results for Radium-228 that exceeded the industrial PRG (PA-WW2-10 and PA-WW8).

As presented in Table 3-6, three samples (7 percent) yielded analytical results that exceeded the Nevada criteria for TPH (motor oils).

Table 3-6. Area 7 Analytes that Exceed Preliminary Screening Criteria

Location Name	Sample Name	Arsenic mg/kg	Radium-226 pCi/g	Radium-228 pCi/g	Motor Oils mg/kg
PA-WW2	PA-WW2-10	7.1	3.4	20	13
PA-WW3	PA-WW3-5	12	4	1.2	100
	PA-WW3-5B	11	3.6	1	110
	PA-WW3-10	73	4.6	< 1	5.3
PA-WW4	PA-WW4-10	410	1.8	3.5	34
PA-WW6	PA-WW6-5	9	4.1	1.6	18
PA-WW7	PA-WW7-5	16	6	< 1	54
	PA-WW7-5B	15	6.3	< 1	74
PA-WW8	PA-WW8-20	15	1.5	8.8	< 2
PA-WW10	PA-WW10-5	7	3.1	1.1	160
Preliminary Screening Criteria		**260**	**3.7**	**8.4**	**100**

Area 8 - North Solution Ditch

Eighteen boreholes were drilled along this ditch consisting of six areas spaced approximately 200 feet apart with each area having a series of three boreholes; one in the center of the ditch and one 20 feet each side of it. A total of 104 samples and 9 duplicates were collected from these boreholes. As presented in Table 3-7, two drill locations (2 percent of all samples collected in this area) had samples collected from one foot bgs that exceeded the Nevada criteria for TPH (motor oils).

Table 3-7. Area 8 Analytes that Exceed Preliminary Screening Criteria

Location Name	Sample Name	Motor Oils mg/kg
PA-FFF3	PA-FFF3-1	120
PA-FFF9	PA-FFF9-1	240
Preliminary Screening Criteria		**100**

Area 9 – East Solution Ditch

The East Solution Ditch was sampled following the same pattern of drilling as performed for Area 8, with three boreholes spaced 200 feet apart along the visible length of the ditch, with one sample in the center and one 20 feet on both sides of center. Twenty one locations were drilled with a total of 125 samples and 9 duplicates collected. As presented in Table 3-7, three locations had shallow samples that exceeded the industrial PRG for Radium-226 (3 percent of all samples collected in this area) and four locations had samples that exceeded the industrial PRG for Radium-228 (4 percent of collected samples). Note that all three of the Radium-226 locations coincide with the three of the four Radium-228 locations. Thirteen samples (10 percent) in Area 9 yielded analytical results that exceeded Nevada criteria for diesel components and 21 samples (16 percent) exceeded Nevada criteria for motor oils.

Table 3-8. Area 9 Analytes that Exceed Preliminary Screening Criteria

Location Name	Sample Name	Radium-226	Radium-228	Diesel Components	Motor Oils
		pCi/g	pCi/g	mg/kg	mg/kg
PA-EEE1	PA-EEE1-1	1.6	2.1	120	720
	PA-EEE1-5	1.5	1.7	11	130
PA-EEE2	PA-EEE2-1	5.7	14.4	4,100	24,000
	PA-EEE2-1B	4.1	12.6	3,300	16,000
	PA-EEE2-5	1.8	3.8	370	1,600
PA-EEE8	PA-EEE8-1	2.1	5.2	83	540
	PA-EEE8-1B	2.1	5.7	400	3100
PA-EEE11	PA-EEE11-1	1.5	6.4	170	1,900
PA-EEE12	PA-EEE12-1	1.5	1.7	14	120
	PA-EEE12-1B	1.5	1.8	6	55
	PA-EEE12-10	1.7	1.7	800	8,100
PA-EEE13	PA-EEE13-1	5.1	9.3	1,100	7,300
PA-EEE14	PA-EEE14-1	2.4	16.9	1,700	13,000
	PA-EEE14-1B	2.9	14.2	1,800	14,000
PA-EEE15	PA-EEE15-1	2.6	3.5	97	1,600
PA-EEE17	PA-EEE17-1	4.9	24.4	61	550
	PA-EEE17-15	2.4	7.2	11	160
	PA-EEE18-1B	1.3	1.4	15	180
	PA-EEE18-15	1.4	< 1	32	300
PA-EEE20	PA-EEE20-1	1.2	< 1	250	2,000
	PA-EEE20-5	1.1	1.4	940	6,100
	PA-EEE20-10	1.3	1.3	3,100	17,000
Preliminary Screening Criteria		**3.7**	**8.4**	**100**	**100**

<u>Area 10 – North Low Area</u>

The Low Area along the northeast side of the Process Area was divided in half into North and South Low Areas for convenience. The North Low Area includes the general storage area

(HHH), the Surge Pond (KK), and the Concrete Ramps (II). Twenty two locations were drilled to depths of 10 to 25 feet with a total of 123 samples and 10 duplicates collected (Figure 3-10). As presented in Table 3-8, the only analyte that exceeded preliminary screening criteria for TPH was motor oil in the duplicate sample (<1 percent of all samples collected in this area) from the shallow sample from location PA-HHH1.

Table 3-9. Area 10 Analytes that Exceed Preliminary Screening Criteria

Location Name	Sample Name	Motor Oils mg/kg
PA-HHH1	PA-HHH1-1	32
	PA-HHH1-1B	120
Preliminary Screening Criteria		**100**

Area 11 – South Low Area

The South Low Area consists of the remainder of the Low Area grid sample locations (HHH), the Upper (BBB) and Lower (CCC) Truck Sludge Ponds, and the ditch connecting the two ponds (DDD). Thirty two locations were drilled with vertical and angle boreholes, with a total of 188 samples and 17 duplicates collected (Figure 3-11). As presented in Table 3-9, samples from two angle boreholes (1 percent of all samples collected) drilled under the Lower Truck Sludge Pond yielded analytical results that exceeded the industrial PRGs for two types of trimethylbenzene, a compound found in fuels (in PA-CCC2 the compounds were detected at depths of 10, 15, and 20 feet bgs; and at 25 feet bgs in CCC4). Eight sample locations from the South Low Area yielded analytical results that exceeded Nevada criteria for TPH (diesel components, gasoline and/or motor oils). Sixteen samples(8 percent) exceeded Nevada criteria for diesel components, 4 samples (2 percent) exceeded for gasoline, and 21 samples (10 percent) exceeded for motor oils.

Table 3-10. Area 11 Analytes that Exceed Preliminary Screening Criteria

Location Name	Sample Name	1,2,4-Trimethylbenzene ug/kg	1,3,5-Trimethylbenzene (Mesitylene) ug/kg	Diesel Components mg/kg	Gasoline C4-C12 mg/kg	Motor Oils mg/kg
PA-CCC2	PA-CCC2-5	< 5.2	< 5.3	4,000	13	22,000
	PA-CCC2-5B	< 5.7	< 5.8	3,800	9.5	21,000
	PA-CCC2-10	210,000	50,000	2,900	920	9,300
	PA-CCC2-15	110,000	25,000	950	680	3,300
	PA-CCC2-20	380,000	94,000	2,500	1,600	7,200
PA-CCC4	PA-CCC4-15	340	65	860	< 6.4	3,700
	PA-CCC4-25	76,000	34,000	2,200	1,900	6,600
PA-DDD3	PA-DDD3-1	< 0.058	< 0.064	58	< 2	620
	PA-DDD3-1B	< 0.056	< 0.061	27	< 1.8	320
PA-HHH19	PA-HHH19-1	< 0.055	< 0.061	61	< 0.96	390
	PA-HHH19-1B	< 0.055	< 0.061	46	1.2	290
	PA-HHH19-5	< 0.057	< 0.062	44	0.98	150
PA-HHH21	PA-HHH21-1	< 0.022	< 0.014	4,700	29	19,000
	PA-HHH21-1B	< 0.022	< 0.014	12,000	30	47,000
	PA-HHH21-5	< 0.012	< 1	12,000	18	27,000
PA-HHH23	PA-HHH23-1	< 0.05	< 0.055	1,400	< 1.8	4,900
	PA-HHH23-1B	< 0.051	< 0.056	1,400	< 3.9	4,500
PA-HHH25	PA-HHH25-1	< 0.056	< 0.061	5,000	< 0.77	21,000
	PA-HHH25-1B	< 0.054	< 0.059	1,600	< 2	6,500
PA-HHH27	PA-HHH27-1	< 0.057	< 0.063	130	< 1.2	660
	PA-HHH27-1B	< 0.054	< 0.059	200	< 0.89	1,000
Preliminary Screening Criteria		**170,000**	**70,000**	**100**	**100**	**100**

<u>Area 12 – Peripheral Process Components</u>

Nine areas, away from the main process area but associated by some processing or pumping activity, were included in the initial investigation. In those areas, 19 boreholes were drilled and 50 samples and 8 duplicates were collected (Figure 3-12). As presented in Table 3-10, one sample location (PA-W2) yielded analytical results that exceeded the industrial PRG for Radium-226 (4 percent of all samples analyzed for Radium-226 in this area). One sample (2 percent) yielded analytical results that exceeded Nevada criteria for TPH (motor oils).

Table 3-11. Area 12 Analytes that Exceed Preliminary Screening Criteria

Location Name	Sample Name	Radium-226 pCi/g	Motor Oils mg/kg
PA-VV1	PA-VV1-1	2.1	110
PA-VV2	PA-VV2-1	4.8	54
Preliminary Screening Criteria		**3.7**	**100**

Underground Utility Pipelines

A total of 60 locations were excavated that encountered underground, or in some cases surface, piping (Figure 3-13), and one sample was collected from each location. As presented in Table 3-11, one sample location PA-UT29 exceeded industrial screening levels for Thorium and Radium-226 (1.5 percent of all samples collected in this area). The sample from this location was a surface sample collected from a ditch where solutions temporarily exited a pipeline, flowed through an open ditch for 20 to 30 feet, then re-entered another pipe. Sediment had accumulated in the ditch and the area had elevated gamma radiation readings with the handheld gamma meter (no readings exceeded site safety levels). Also shown in Table 3-11, one sample (PA-UT23) exceeded industrial PRG levels for two types of Trimethylbenzene, a VOC commonly found in fuels. The location of this sample was at the end point of a buried fuel line where it surfaced at a filling station. This buried fuel line, which runs for a length of about 30 to 40 feet, has the potential for further deterioration. The soils at this sample location were stained and the odor of hydrocarbons could be detected. Eight samples (12%) of those collected exceeded the Nevada criteria for diesel components, 2 samples (3 percent) exceeded for gasoline, and 15 samples (23 percent) exceeded for motor oils.

Table 3-12. Utility Analytes that Exceed Preliminary Screening Criteria

Location/ Sample Name	Thorium-232 mg/kg	Radium-226 pCi/g	1,2,4-Trimethylbenzene ug/kg	1,3,5-Trimethylbenzene (Mesitylene) ug/kg	Diesel Components mg/kg	Gasoline C4-C12 mg/kg	Motor Oils mg/kg
PA-UT04	5.4	0.7	< 0.063	< 0.07	140	< 5.4	770
PA-UT05	5.4	1.7	< 0.063	< 0.069	4,100	< 5.3	16,000
PA-UT06	4.1	0.9	3.2	0.73	57	< 4.7	370
PA-UT07	4.7	1.5	< 0.062	0.56	340	< 4.8	1,500
PA-UT17	4.9	0.6	< 0.057	< 0.063	27	< 4.2	120
PA-UT23	6.3	0.4	320,000	110,000	7,900	7,400	550
PA-UT25	4.9	0.4	39,000	14,000	7,200	970	1,400
PA-UT29	235	4.6	0.25	< 0.084	200	< 5.3	490
PA-UT31	5.8	1	< 0.065	< 0.071	19	< 4.7	140
PA-UT36	8	1.7	0.56	0.17	8,300	< 4.9	60,000
PA-UT46	7.2	1.4	< 0.52	< 0.094	26	< 4.4	140
PA-UT48	41.6	0.7	< 0.31	< 0.068	13	< 4.2	130
PA-UT50	7.9	1.2	< 0.15	< 0.057	15	< 4	100
PA-UT53	6.8	1.4	< 0.061	< 0.067	25	< 3.4	230
PA-UT60	7.7	2.3	< 0.083	< 0.092	2,300	< 6.3	9,200
Preliminary Screening Criteria	**174**	**3.7**	**170,000**	**70,000**	**100**	**100**	**100**

Electrical Stations and Transformers

Five transformer locations were sampled in the course of this investigation. As presented in Table 3-12, three of the locations exceeded Nevada criteria for motor oils but none of the samples exceeded soil criteria for PCBs.

Table 3-13. Electrical Transformer Soils that Exceed Preliminary Screening Criteria

Location/Sample Name	Motor Oils mg/kg
PA-TR1	430
PA-TR3	120
PA-TR5	480
Preliminary Screening Criteria	**100**

Stained Soil Areas

Four areas were identified as having oil stained soil of which only two were determined to meet the excavation criteria defined in the Work Plan. Locations EX-01 and EX-04 were excavated and visibly contaminated soil was removed and stockpiled near the sample locations in order to determine the waste characteristics of the material soils for subsequent management (e.g., disposal on- or off-site). As presented in Table 3-13, all four locations yielded samples that exceeded the Nevada criteria for diesel and motor oils. A composite sample was collected from these stockpiles to complete the characterization profile. Excavated areas will be filled with clean soil.

Table 3-14. Stained Soil Analytes that Exceed Preliminary Screening Criteria

Location Name	Sample Name	Comment	Diesel Components mg/kg	Motor Oils mg/kg
PA-EX01	PA-EX01-A	Preliminary	7,800	15,000
	PA-EX01-1	S. side floor	430	1,700
	PA-EX01-2	N. side floor	77	250
	PA-EX01-3	Composite of excavated soil for waste characterization	1,600	4,700
PA-EX02	PA-EX02-A	Preliminary (not excavated)	9,400	23,000
PA-EX03	PA-EX03-A	Preliminary (not excavated)	16,000	33,000
PA-EX04	PA-EX04-1	SW side floor	1,400	7,400
	PA-EX04-2	NE side floor	34	300
	PA-EX04-3	Composite of excavated soil for waste characterization	1,900	8,200
Preliminary Screening Criteria			**100**	**100**

Underground Storage Tanks

No evaluation of underground storage tanks (USTs) was performed as part of the field investigations in the Process Areas. As envisioned in the Process Areas Work Plan, a separate Work Plan would subsequently be developed for USTs.

3.3 Modifications to Work Plan - Laboratory Analytical Changes

A change in contracted laboratories was made partway through the field investigation. NEL Laboratories was originally contracted to complete all of the pesticide, herbicide and PCB analyses. However, when the sample volume exceeded their laboratory capabilities, the decision was made to utilize Sequoia Analytical Labs to provide the analyses for these constituents for the remainder of the project. This change occurred early in the project so that most of the utility pipeline samples were completed by NEL and all of the borehole samples were completed by Sequoia.

One VOC analyte, MTBE, that was to be analyzed according to the QAPP, was not analyzed in any of the submitted samples due to laboratory oversight. Very few of the samples collected in the Process Areas had any detectable VOCs and MTBE was not likely to have been added to gasoline during the period that the facility was in operation. Therefore, MTBE is not expected as a contaminant of concern at this site and the missing data does not negatively impact the overall data quality.

VOC analyte dibromochloromethane was included in the lab analysis though it was not required by the QAPP.

Some of the reported sample results exceeded the contracted laboratory reporting limits. These changes in sample detection limits usually resulted from higher dilution factors in sample preparation or other sample handling issue.

The analytical method for Radium-226 and -228 was modified to use method 901.1 "Gamma emitting radionuclides" as opposed to the originally proposed wet digestion method 903.0 required by the QAPP. Method 901.1 is a dry gamma spectroscopy method that has higher precision for the low gamma levels found in the Process Areas and because it uses a larger volume of material it provides a more representative sample. EPA approved this change in method.

The QAPP initially required sterilized soil to be submitted to the labs as trip and field blanks to be analyzed for all project parameters. This was modified to require the use of deionized water as trip and field blanks for soil samples being submitted for VOC and TPH analysis and the blanks would be analyzed for the same compounds. The water was provided by the Sequoia Labs. One trip blank was included in each cooler that contained samples being analyzed for VOC/TPH and one field blank was submitted for every 20 samples collected in the field.

SECTION 4.0

QUALITY CONTROL SUMMARY

4.1 Data Quality Assurance Objectives and Quality Control Procedures

Quality assurance objectives are the broad goals for data collection and review. The following quality assurance objectives are described below: precision, accuracy, representativeness, completeness and comparability (PARCC).

> *Precision (P)* **-** Precision is defined as the degree of reproducibility of the measurements under a given set of conditions. Precision is documented on the basis of replicate/duplicate analyses: usually laboratory duplicate, laboratory control sample duplicates or matrix spike duplicates.
>
> *Accuracy (A)* **-** Accuracy is defined as the bias in a measurement system. Accuracy is documented on the basis of recovery of surrogates, laboratory control samples, and matrix spikes.
>
> *Representativeness (R)* **-** Representativeness is defined as the degree to which data represent a characteristic of a set of samples. The representativeness of the analytical data is a function of the procedures and carefulness used in procuring and processing the samples. The representativeness can be documented by the relative percent difference between separately procured, but otherwise identical sample aliquots.
>
> *Completeness (C)* **-** The completeness objective for an analysis is to provide sufficient data of the acceptable quality such that the goals of the analytical project can be achieved. The overall project completeness is expressed as the percentage of planned data that is usable for its intended purpose.
>
> *Comparability (C)* **-** The comparability objective is to provide analytical data for which the accuracy, precision, representativeness, completeness and detection limit are similar to these quality indicators for data generated by other laboratories for similar samples. The comparability objectives is documented by inter-laboratory studies carried out by regulator agencies or carried out for specific projects or contracts; and by comparison of periodically generated statements of accuracy, precision and detection limits with those of other laboratories.

These PARCC data quality objectives were evaluated during the data review process. The process of data review also included a completeness check to ensure that all data has been properly loaded into the database that will be used for report generation. Data that failed to meet the data quality assurance objectives for the project have been qualified as to usability and potential low or high bias during the review process. Data was reviewed against the project specific limits provided in the QAPP. Data review followed the basic guidance provided in the National Functional Guidelines for Data Review (http://www.epa.gov/superfund/programs/clp/guidance.htm) unless the QAPP or other project specific document specified otherwise.

Field Quality Control Samples

Quality control samples collected during the process area groundwater investigation included field blanks (equipment blanks, and trip blanks) and field duplicates.

> *Trip Blanks* - Trip blanks are used to evaluate representativeness by identifying any volatile organic compounds that may have been introduced to the environmental samples during shipment, handling, or storage on site and at the laboratory. Trip blanks are prepared in the laboratory by pouring deionized, distilled water into preserved volatile organic analysis (VOA) vials sample vials in the laboratory. The trip blanks are then shipped to the field, and then shipped back to the laboratory in each cooler containing samples for volatile organic analyses. Trip blanks are never opened in the field. Trip blanks were collected at a frequency of one per cooler that contained samples for volatiles or volatile TPH analysis. Trip blanks were analyzed for volatile organic compounds only (including volatile TPH).

> *Equipment Blanks* **-** Equipment blanks are used to evaluate representativeness by identifying any potential contamination from field procedures or insufficient decontamination. Equipment blanks were prepared in the field (after decontamination of sampling equipment was complete) by collecting the final rinse water. Equipment blanks were analyzed for all the parameters performed on the associated samples.

> *Field Duplicates* **-** Field duplicates are two samples collected at the same time from the same sample location, and which are submitted to one laboratory as separate samples (i.e., "blind" duplicates). Field duplicate samples can be used to assess the heterogeneity of compounds within the sample matrix and the consistency of the overall sampling effort, including collection, shipping, and analysis; the purpose of submitting them "blind" is to assess the consistency or precision of the laboratory's analytical system. Field duplicate samples were analyzed for the same parameters as the corresponding primary sample.

Data Review Procedures

As part of the presentation of analytical results, it is important to inform the data users of any results that failed to meet the Data Quality Objectives (DQOs) as established in the Work Plan and Quality Assurance Project Plan (QAPP). Laboratory data for this project was assessed through third-party validation and internal verification. Laboratory results that met all the DQOs have been accepted without qualification. Results associated with QC parameters that did not meet objectives have been qualified as estimated (J flagged) or rejected as unusable for any purpose (R flagged). Data qualified as estimated is considered usable for its intended purpose. However, the data user should be aware that the reported result may not be accurate or precise. Internal data verification was based on the same QA/QC parameters as data validation, except that raw data record reviews and recalculation of results from the raw data were not performed during verification. Verification was performed internally on the total amount of data produced. Validation was performed on approximately 10 percent of the data produced for this field effort. Data validation reports were reviewed by the project chemist and any additional data qualifiers were added to the results stored in the database before data were finalized. The components of data verification and data validation are presented in Table 4-1 to illustrate the differences between data verification and data validation.

During the evaluation of the data, qualifiers were assigned, if necessary. The valid data qualifiers that were added to the data when necessary are defined as follows:

- U - Analyte not detected at the detection limit concentration.
- J - Reported value is an estimated concentration.
- UJ - Analyte not detected at an estimated detection limit concentration.
- R - This data was rejected and was not used for any purposes.
- UR - The analyte was not detected. The detection limit is unreliable and may be representative of a false negative. This data was rejected and is not usable for any purpose.

Table 4-1. Data Verification/Validation Requirements

Review Item	Performed for Data Verification[1]	Performed for Data Validation[2]
Organic Analyses		
Case Narrative	X	X
Chain-of-Custody Documentation	X	X
Summary of Results	X	X
Holding Times	X	X
Method Blank Analysis Results	X	X
Field Blank Analysis Results	X	X
Surrogate Standard Percent Recoveries (%R)	X	X
Laboratory Control Samples (LCS) - %R	X	X
LCS/LCS Duplicate (LCSD) - Relative Percent Difference (RPD)	X	X
Matrix Spike (MS) - %R	X	X
MS/MS Duplicate (MSD) – RPD	X	X
Laboratory Replicate Analyses (LR) – RPD	X	X
Field Duplicate (FD) – RPD	X	X
Quantitation Below Low Standard or Above High Standard	X	X
Analyte Identification: Chromatography Column Precision Between Primary and Confirmation Columns (1C and 2C) - Percent Difference (%D) Analyte Retention Time		X X
Internal Standard Areas (IS) - %R		X
Initial Instrument Calibration: Standard Analyte Concentrations Analyte Response Factors (RF) Percent Relative Standard Deviation (%RSD) Correlation Coefficient Analyte Retention Time Windows Established Mass Spectrometer Tuning/Mass Calibration		X X X X X X
Second-Source Calibration Verification		X
Continuing Instrument Calibration: Standard Analyte Concentrations Analyte Response Factors (RF) - %D Analyte Retention Times Mass Spectrometer Tuning/Mass Calibration		X X X X
Instrument Analysis Logs (including standards and samples)		X
Preparation Logs		X
Raw Data (samples, blanks, standards, QC samples): Chromatograms Mass Spectra of Target Analytes Quantitation Reports – Recalculation		X X X
Method Detection Limit (MDL) Study Data		X

Table 4-1. Data Verification/Validation Requirements – Continued

Review Item	Performed for Data Verification[1]	Performed for Data Validation[2]
Inorganic/Metals Analyses		
Case Narrative	X	X
Chain-of-Custody Documentation	X	X
Summary of Results	X	X
Holding Times	X	X
Method Blank Analysis Results	X	X
Field Blank Analysis Results	X	X
Laboratory Control Samples (LCS) - %R	X	X
LCS/LCS Duplicate (LCSD) - Relative Percent Difference (RPD)	X	X
Matrix Spike (MS) - %R	X	X
MS/MS Duplicate (MSD) – RPD	X	X
Laboratory Replicate Analyses (LR) – RPD	X	X
Field Duplicate (FD) – RPD	X	X
Quantitation Below Low Standard or Above High Standard	X	X
Analyte Identification:		
Analyte Retention Time (ion chromatography)		X
Daily Initial Instrument Calibration:		
Instrument Calibration Curve Correlation Coefficient		X
Interference Check Standard Results (Method SW6010B only)		X
Calibration Standard Check (SW6010B only)		X
Standard Analyte Concentrations		X
Initial Calibration Verification (ICV) - %R		X
Initial Calibration Blank (ICB) Results		X
Second-Source Calibration Verification		X
Continuing Instrument Calibration:		
Standard Analyte Concentrations		X
Continuing Calibration Verification (CCV) - %R		X
Continuing Calibration Blank (CCB) Results		X
Instrument Analysis Logs (including standards and samples)		X
Sample Preparation/Digestion Logs		X
Standard Preparation Logs		X
Serial Dilution Results - %D		X
Method of Standard Additions (MSA) Results		X
Raw Data (samples, blanks, standards, QC samples):		
Chromatograms		X
Quantitation Reports		X
Calculations		X
Method Detection Limit (MDL) Study Data		X

Notes

[1]Data verification performed for all project samples and associated laboratory QC batches (Level II Data Package)

[2]Data validation performed on a minimum of 10 percent of project samples (Level IV Data Package).

4.2 Data Quality Summary and Analytical Completeness

Individual analytical results were qualified during the data validation and verification procedures. The percentage of results that are qualified as estimated or rejected due to QC deficiencies is an indication of the overall data quality for a given analytical method. The following global issues affected the general quality of the data:

- All non-detected results for antimony in soil have been rejected due to extremely low recoveries in all matrix spikes. These rejected results should be considered unusable for any purpose. Antimony was also detected in several of the blanks causing many of the detected results to be qualified as not detected. All remaining detected results for antimony should be used with caution as they may represent false positives or be biased low or high.
- The laboratory failed to provide results for methyl tertiary butyl ether (MTBE) although this volatile analyte was requested.
- The control limits for herbicide spike recoveries by Method SW8151 specified in the QAPP are tighter than can normally be achieved by analytical laboratories. This resulted in a significant number of herbicide results being qualified as estimated.
- Laboratory failure to meet instrument calibration requirements for Method SW8260B was a common problem uncovered during data validation. This failure caused a significant number of results to be qualified as estimated or rejected. Data validation was performed on only 10 percent of the laboratory data. It is likely that these same problems affect all of the data and that additional data validation would result in additional qualification of volatiles data. The data user should be aware of this issue and use the volatiles data with caution.

The following discussion presents area-specific data quality issues. Tables 4-2 through 4-16 provide a summary of the number of results that were qualified by method for each designated area within the Process Areas and ancillary operations areas.

Area 1 -- Summary of Data Quality and Analytical Completeness

In general, the results are of acceptable quality and are usable for their intended purpose. In addition to the rejected antimony results, 26 results for the herbicide Dinoseb and 18 SVOC results have been rejected due to very low LCS recoveries. These results are not usable for any purpose. All methods met the soil analytical completeness goal of 90 percent usable results (Table 4-2). Most methods had a high percentage of unqualified results (greater than 75 percent). However, a significant number of results for herbicides were qualified as estimated due primarily to spike recoveries below the control limits established in the QAPP.

Table 4-2. Area 1 Analytical Completeness by Method

				Number of results				Completeness	
Method	Parameter	Samples Analyzed (N+FD)	Analytes per sample	Total	Rejected	Estimated due to QC deficiencies	Estimated due to >MDL but <PQL	Percent usable	Percent quantitative*
ABP	Acid/Base Potential	78+13	3	273	0	4	0	100%	98.5%
SW6010B	Metals by ICP/AES	78+13	7	637	0	55	29	100%	91.4%
SW6020	Metals by ICP/MS	78+13	17	1547	86	63	237	94.4%	90.4%
SW7471A	Mercury	78+13	1	91	0	10	40	100%	89%
SW8015B	Gas, Diesel, and Motor Oil	78+13	3	273	0	27	48	100%	90.1%
SW8081A	Pesticides	78+13	21	1911	0	60	32	100%	96.9%
SW8082	PCBs	78+13	8	728	0	0	0	100%	100%
SW8151A	Herbicides	78+13	10	910	26	453	1	97.1%	47.4%
SW8260B	Volatiles	78+13	56	5096	0	81	89	100%	98.4%
SW8270C	Semivolatiles	78+13	66	6006	19	38	8	99.7%	99%

* Note: Estimations due solely to results <PQL do not affect the calculated completeness
Calculations do not include any required field or laboratory QC samples, except field duplicates.
N = normal environmental samples FD = field duplicate samples

Although data validation was performed on 10 percent of the data for this field effort, none of the Sequoia data packages containing results from Area 1 underwent data validation. Based on the general findings from data validation, it is likely that some additional qualification of data would result from evaluation of instrument calibration. Instrument calibration problems for volatiles by Method SW8260 were found in almost every validated data package which resulted in a small percentage of the results being rejected and a significant number of results being qualified as estimated.

Area 2 -- Summary of Data Quality and Analytical Completeness

In general, the results are of acceptable quality and are usable for their intended purpose. In addition to the rejected antimony results, one result for gasoline, 29 herbicide results, and three SVOC results have been rejected due primarily to extremely low spike recoveries. Forty-eight volatiles results have been rejected primarily due to instrument calibration issues. These results are not usable for any purpose. All methods met the soil analytical completeness goal of 90 percent usable results (Table 4-3). Most methods had a high percentage of unqualified results (greater than 75 percent). However, a significant number of results for herbicides were qualified as estimated due primarily to spike recoveries below the control limits established in the QAPP.

Table 4-3. Area 2 Analytical Completeness by Method

				Number of results				Completeness	
Method	Parameter	Samples Analyzed (N+FD)	Analytes per sample	Total	Rejected	Estimated due to QC deficiencies	Estimated due to >MDL but <PQL	Percent usable	Percent quantitative*
ABP	Acid/Base Potential	108+18	3	378	0	16	0	100%	95.8%
SW6010B	Metals by ICP/AES	108+18	7	882	0	62	62	100%	93%
SW6020	Metals by ICP/MS	108+18	17	2142	116	172	249	94.6%	86.6%
SW7471A	Mercury	108+18	1	126	0	27	46	100%	78%
SW8015B	Gas, Diesel, and Motor Oil	108+18	3	378	1	82	64	99.7%	78%
SW8081A	Pesticides	108+18	21	2646	0	43	88	100%	98.4%
SW8082	PCBs	108+18	8	1008	0	1	0	100%	99.9%
SW8151A	Herbicides	108+18	10	1260	29	733	1	97.7%	39.5%
SW8260B	Volatiles	108+18	56	7056	48	608	78	99.3%	90.7%
SW8270C	Semivolatiles	108+18	66	8407	13	190	28	99.8%	97.6%

* Note: Estimations due solely to results <PQL do not affect the calculated completeness
Calculations do not include any required field or laboratory QC samples, except field duplicates.
N = normal environmental samples FD = field duplicate samples

Area 3 -- Summary of Data Quality and Analytical Completeness

In general, the results are of acceptable quality and are usable for their intended purpose. In addition to the rejected antimony results, sixteen results for the herbicide Dinoseb, four volatile results, and one SVOC result have been rejected due to very low spike recoveries. These results are not usable for any purpose. All methods met the soil analytical completeness goal of 90 percent usable results Table 4-4). Most methods had a high percentage of unqualified results (greater than 75 percent). However, a significant number of results for herbicides were qualified as estimated due primarily to spike recoveries below the control limits established in the QAPP.

Table 4-4. Area 3 Analytical Completeness by Method

				Number of results				Completeness	
Method	Parameter	Samples Analyzed (N+FD)	Analytes per sample	Total	Rejected	Estimated due to QC deficiencies	Estimated due to >MDL but <PQL	Percent usable	Percent quantitative*
ABP	Acid/Base Potential	57+7	3	192	0	8	0	100%	95.8%
E901.1	Radium-226 & -228	11+2	2	26	0	2	0	100%	92.3%
E903.0	Radium-226	40+4	1	44	0	4	0	100%	90.9%
E904.0	Radium-228	40+4	1	44	0	4	0	100%	90.9%
SW6010B	Metals by ICP/AES	57+7	7	448	0	39	14	100%	91.3%
SW6020	Thorium-232 & Uranium	51+6	2	114	0	0	0	100%	100%
SW6020	Metals by ICP/MS	57+7	17	1088	59	38	165	94.6%	91.1%
SW7471A	Mercury	57+7	1	64	0	6	25	100%	90.6%
SW8015B	Gas, Diesel, and Motor Oil	57+7	3	192	0	16	35	100%	91.7%
SW8081A	Pesticides	57+7	21	1388	0	72	21	100%	94.8%
SW8082	PCBs	57+7	8	512	0	0	0	100%	100%
SW8151A	Herbicides	57+7	10	640	16	308	0	97.5%	49.4%
SW8260B	Volatiles	57+7	56	3584	4	606	53	99.9%	83%
SW8270C	Semivolatiles	57+7	66	4229	1	41	7	100%	99%

* Note: Estimations due solely to results <PQL do not affect the calculated completeness
Calculations do not include any required field or laboratory QC samples, except field duplicates.
N = normal environmental samples FD = field duplicate samples

Area 4 -- Summary of Data Quality and Analytical Completeness

In general, the results are of acceptable quality and are usable for their intended purpose. In addition to the rejected antimony results, one result for the pesticide Lindane, seventeen herbicide results, and eight SVOC results have been rejected due to very low spike recoveries. Eight results for gasoline have been rejected for gross exceedance of the holding time. These results are not usable for any purpose. All methods met the soil analytical completeness goal of 90 percent usable results (Table 4-5). Most methods had a high percentage of unqualified results (greater than 75 percent). However, a significant number of results for herbicides were qualified as estimated due primarily to spike recoveries below the control limits established in the QAPP. Blank contamination caused a significant number of gasoline results to be qualified as not detected with an estimated detection limit. Low surrogate recoveries also caused a significant number of pesticide results to be qualified as not detected with an estimated detection limit.

Table 4-5. Area 4 Analytical Completeness by Method

				Number of results				Completeness	
Method	Parameter	Samples Analyzed (N+FD)	Analytes per sample	Total	Rejected	Estimated due to QC deficiencies	Estimated due to >MDL but <PQL	Percent usable	Percent quantitative*
ABP	Acid/Base Potential	46+6	3	156	0	2	0	100%	98.7%
E901.1	Radium-226 & -228	33+6	2	78	0	6	0	100%	92.3%
E903.0	Radium-226	8	1	8	0	0	0	100%	100%
E904.0	Radium-228	8	1	8	0	1	0	100%	87.5%
SW6010B	Metals by ICP/AES	46+6	7	364	0	11	41	100%	97%
SW6020	Thorium-232 & Uranium	41+6	2	94	0	0	0	100%	100%
SW6020	Metals by ICP/MS	46+6	17	884	35	31	124	96%	92.5%
SW7471A	Mercury	46+6	1	52	0	2	9	100%	96.2
SW8015B	Gas, Diesel, and Motor Oil	46+6	3	156	8	43	24	94.9%	67.3%
SW8081A	Pesticides	46+6	21	1100	1	389	14	99.9%	64.5
SW8082	PCBs	46+6	8	376	0	56	1	100%	85.1
SW8151A	Herbicides	46+6	10	520	17	372	0	96.7%	25.2
SW8260B	Volatiles	46+6	56	2912	0	69	23	100%	97.6
SW8270C	Semivolatiles	46+6	66	3424	8	44	22	99.8%	98.5

* Note: Estimations due solely to results <PQL do not affect the calculated completeness
Calculations do not include any required field or laboratory QC samples, except field duplicates.
N = normal environmental samples FD = field duplicate samples

Area 5 -- Summary of Data Quality and Analytical Completeness

In general, the results are of acceptable quality and are usable for their intended purpose. In addition to the rejected antimony results, one result for the herbicide 2,4-DB, and one result for the pesticide Endrin aldehyde have been rejected due to very low spike recoveries. Low internal standard recovery in one sample resulted in all of the volatile results for that sample being rejected. Improper instrument calibration resulted in an additional 117 volatile results being rejected. These results are not usable for any purpose. All methods met the soil analytical completeness goal of 90 percent usable results (Table 4-6). Most methods had a high percentage of unqualified results (greater than 75 percent). However, a significant number of results for herbicides were qualified as estimated due primarily to spike recoveries below the control limits established in the QAPP.

Table 4-6. Area 5 Analytical Completeness by Method		
	Number of results	Completeness

Method	Parameter	Samples Analyzed (N+FD)	Analytes per sample	Total	Rejected	Estimated due to QC deficiencies	Estimated due to >MDL but <PQL	Percent usable	Percent quantitative*
ABP	Acid/Base Potential	60+6	3	198	0	12	0	100%	93.9%
E901.1	Radium-226 & -228	54+5	2	118	0	4	0	100%	96.6%
E903.0	Radium-226	6+1	1	7	0	0	0	100%	100%
E904.0	Radium-228	6+1	1	7	0	0	0	100%	100%
SW6010B	Metals by ICP/AES	60+6	7	462	0	31	32	100%	93.3%
SW6020	Thorium-232 & Uranium	60+6	2	132	0	4	0	100%	97%
SW6020	Metals by ICP/MS	60+6	17	1122	66	59	169	94.1%	88.9%
SW7471A	Mercury	60+6	1	66	0	10	31	100%	84.8%
SW8015B	Gas, Diesel, and Motor Oil	60+6	3	198	0	21	11	100%	89.4%
SW8081A	Pesticides	60+6	21	1393	1	202	33	99.9%	85.4%
SW8082	PCBs	60+6	8	521	0	0	0	100%	100%
SW8151A	Herbicides	60+6	10	660	1	401	1	99.8%	39.1%
SW8260B	Volatiles	60+6	56	3696	173	569	56	95.3%	79.9%
SW8270C	Semivolatiles	60+6	66	4356	0	60	9	100%	98.6%

* Note: Estimations due solely to results <PQL do not affect the calculated completeness
Calculations do not include any required field or laboratory QC samples, except field duplicates.
N = normal environmental samples FD = field duplicate samples

Area 6 -- Summary of Data Quality and Analytical Completeness

In general, the results are of acceptable quality and are usable for their intended purpose. In addition to the rejected antimony results, eight results for the herbicide Dinoseb have been rejected due to very low spike recoveries. These results are not usable for any purpose. All methods met the soil analytical completeness goal of 90 percent usable results (Table 4-7). Most methods had a high percentage of unqualified results (greater than 75 percent). However, a significant number of results for herbicides were qualified as estimated due primarily to spike recoveries below the control limits established in the QAPP.

Table 4-7. Area 6 Analytical Completeness by Method									
				Number of results				Completeness	
Method	Parameter	Samples Analyzed (N+FD)	Analytes per sample	Total	Rejected	Estimated due to QC deficiencies	Estimated due to >MDL but <PQL	Percent usable	Percent quantitative*
ABP	Acid/Base Potential	50+6	3	168	0	4	0	100%	97.6%
E901.1	Radium-226 & -228	47+5	2	104	0	1	0	100%	99%
SW6010B	Metals by ICP/AES	50+6	7	392	0	30	27	100%	92.3%
SW6020	Thorium-232 & Uranium	47+5	2	104	0	0	0	100%	100%
SW6020	Metals by ICP/MS	50+6	17	952	49	50	138	94.8%	89.6%
SW7471A	Mercury	50+6	1	56	0	5	27	100%	91.1%
SW8015B	Gas, Diesel, and Motor Oil	50+6	3	168	0	35	17	100%	79.2%
SW8081A	Pesticides	50+6	21	1176	0	3	3	100%	99.7%
SW8082	PCBs	50+6	8	442	0	16	0	100%	96.8%
SW8151A	Herbicides	50+6	10	560	8	219	3	98.6%	59.5%
SW8260B	Volatiles	50+6	56	3180	0	486	54	100%	84.7%
SW8270C	Semivolatiles	50+6	66	3696	0	90	24	100%	97.6%

* Note: Estimations due solely to results <PQL do not affect the calculated completeness
Calculations do not include any required field or laboratory QC samples, except field duplicates.
N = normal environmental samples FD = field duplicate samples

Area 7 -- Summary of Data Quality and Analytical Completeness

In general, the results are of acceptable quality and are usable for their intended purpose. In addition to the rejected antimony results, one result for the semivolatile, hexachlorobutadiene, has been rejected due to very low matrix spike recovery. These results are not usable for any purpose. All methods met the soil analytical completeness goal of 90 percent usable results (Table 4-8). Most methods had a high percentage of unqualified results (greater than 75 percent). However, a significant number of results for thorium-232, uranium, and petroleum hydrocarbons were qualified as estimated due to spike recoveries below the control limits established in the QAPP.

Table 4-8. Area 7 Analytical Completeness by Method

				Number of results				Completeness	
Method	Parameter	Samples Analyzed (N+FD)	Analytes per sample	Total	Rejected	Estimated due to QC deficiencies	Estimated due to >MDL but <PQL	Percent usable	Percent quantitative*
ABP	Acid/Base Potential	40+5	3	135	0	4	0	100%	97%
E901.1	Radium-226 & -228	40+5	2	90	0	0	0	100%	100%
SW6010B	Metals by ICP/AES	40+5	7	315	0	23	16	100%	92.7%
SW6020	Thorium-232 & Uranium	40+5	2	90	0	40	0	100%	55.6%
SW6020	Metals by ICP/MS	40+5	17	765	44	10	56	94.2%	92.9%
SW7471A	Mercury	40+5	1	45	0	3	7	100%	93.3%
SW8015B	Gas, Diesel, and Motor Oil	40+5	3	135	0	40	45	100%	70.4%
SW8081A	Pesticides	40+5	21	945	0	189	19	100%	80%
SW8082	PCBs	40+5	8	351	0	0	0	100%	100%
SW8151A	Herbicides	40+5	10	450	0	92	0	100%	79.6%
SW8260B	Volatiles	40+5	56	2520	1	73	36	100%	97.1%
SW8270C	Semivolatiles	40+5	66	2988	0	14	6	100%	99.5%

* Note: Estimations due solely to results <PQL do not affect the calculated completeness
Calculations do not include any required field or laboratory QC samples, except field duplicates.
N = normal environmental samples FD = field duplicate samples

Area 8 -- Summary of Data Quality and Analytical Completeness

In general, the results are of acceptable quality and are usable for their intended purpose. In addition to the rejected antimony results, 35 results for the herbicide Dinoseb, three semivolatile and three volatile results have been rejected due to very low spike recoveries. Improper instrument calibration resulted in four mercury results being rejected. These results are not usable for any purpose. All methods met the soil analytical completeness goal of 90 percent usable results (Table 4-9). Most methods had a high percentage of unqualified results (greater than 75 percent). However, a significant number of results for herbicides were qualified as estimated due primarily to spike recoveries below the control limits established in the QAPP.

Table 4-9. Area 8 Analytical Completeness by Method

				Number of results				Completeness	
Method	Parameter	Samples Analyzed (N+FD)	Analytes per sample	Total	Rejected	Estimated due to QC deficiencies	Estimated due to >MDL but <PQL	Percent usable	Percent quantitative*
ABP	Acid/Base Potential	104+9	3	339	0	4	0	100%	98.8%
E901.1	Radium-226 & -228	3+0	2	6	0	0	0	100%	100%
SW6010B	Metals by ICP/AES	104+9	7	791	0	59	63	100%	92.5%
SW6020	Thorium-232 & Uranium	3+0	2	6	0	0	0	100%	100%
SW6020	Metals by ICP/MS	104+9	17	1921	103	80	246	94.6%	90.5%
SW7471A	Mercury	104+9	1	113	4	17	25	96.5%	81.4%
SW8015B	Gas, Diesel, and Motor Oil	104+9	3	339	0	75	58	100%	77.9%
SW8081A	Pesticides	104+9	21	2373	0	197	45	100%	91.7%
SW8082	PCBs	104+9	8	904	0	2	1	100%	99.8%
SW8151A	Herbicides	104+9	10	1130	35	1000	15	96.9%	8.4%
SW8260B	Volatiles	104+9	56	6328	3	179	70	100%	97.1%
SW8270C	Semivolatiles	104+9	66	7465	3	72	16	100%	99%

* Note: Estimations due solely to results <PQL do not affect the calculated completeness
Calculations do not include any required field or laboratory QC samples, except field duplicates.
N = normal environmental samples FD = field duplicate samples

Area 9 -- Summary of Data Quality and Analytical Completeness

In general, the results are of acceptable quality and are usable for their intended purpose. In addition to the rejected antimony results, 34 herbicide results, 13 results for the pesticide, endrin aldehyde, and five SVOC results have been rejected due to very low spike recoveries. Improper instrument calibration resulted in 257 volatile results and four mercury results being rejected. These results are not usable for any purpose. All methods met the soil analytical completeness goal of 90 percent usable results (Table 4-10). Most methods had a high percentage of unqualified results (greater than 75 percent). However, a significant number of results for herbicides were qualified as estimated due primarily to spike recoveries below the control limits established in the QAPP. In addition, a large percentage of mercury results were qualified as estimated due to calibration problems and instrument blank issues. Almost half of the volatiles results were qualified as estimated due primarily to instrument calibration problems. Over half of the petroleum hydrocarbon results were qualified as estimated due to low spike recoveries, blank contamination, and improper sample handling.

Table 4-10. Area 9 Analytical Completeness by Method

				Number of results				Completeness	
Method	Parameter	Samples Analyzed (N+FD)	Analytes per sample	Total	Rejected	Estimated due to QC deficiencies	Estimated due to >MDL but <PQL	Percent usable	Percent quantitative*
ABP	Acid/Base Potential	125+9	3	402	0	6	0	100%	98.5%
E901.1	Radium-226 & -228	125+9	2	268	0	0	0	100%	100%
SW6010B	Metals by ICP/AES	125+9	7	938	0	82	69	100%	91.3%
SW6020	Thorium-232 & Uranium	125+9	2	268	0	0	0	100%	100%
SW6020	Metals by ICP/MS	125+9	17	2278	133	227	252	94.2%	84.2%
SW7471A	Mercury	125+9	1	134	4	87	53	97%	32.1%
SW8015B	Gas, Diesel, and Motor Oil	125+9	3	402	0	205	80	100%	49%
SW8081A	Pesticides	125+9	21	2814	13	314	45	99.5%	88.4%
SW8082	PCBs	125+9	8	1057	0	33	0	100%	96.9%
SW8151A	Herbicides	121+9	10	1300	34	883	3	97.4%	29.5%
SW8260B	Volatiles	125+9	56	7504	257	2754	126	96.6%	59.9%
SW8270C	Semivolatiles	125+9	66	8921	5	141	29	99.9%	98.4%

* Note: Estimations due solely to results <PQL do not affect the calculated completeness
Calculations do not include any required field or laboratory QC samples, except field duplicates.
N = normal environmental samples FD = field duplicate samples

Area 10 -- Summary of Data Quality and Analytical Completeness

In general, the results are of acceptable quality and are usable for their intended purpose. In addition to the rejected antimony results, one result for the herbicide Dinoseb has been rejected due to very low spike recoveries. Improper instrument calibration resulted in two volatiles results being rejected. These results are not usable for any purpose. All methods met the soil analytical completeness goal of 90 percent usable results (Table 4-11). Most methods had a high percentage of unqualified results (greater than 75 percent). However, a significant number of results for herbicides were qualified as estimated due primarily to spike recoveries below the control limits established in the QAPP. In addition, a large number of gasoline results were qualified as not detected with an estimated detection limit due to blank contamination.

Table 4-11. Area 10 Analytical Completeness by Method

				Number of results				Completeness	
Method	Parameter	Samples Analyzed (N+FD)	Analytes per sample	Total	Rejected	Estimated due to QC deficiencies	Estimated due to >MDL but <PQL	Percent usable	Percent quantitative*
ABP	Acid/Base Potential	123+10	3	399	0	10	0	100%	97.5%
E901.1	Radium-226 & -228	27+2	2	58	0	0	0	100%	100%
SW6010B	Metals by ICP/AES	123+10	7	931	0	40	75	100%	95.7%
SW6020	Thorium-232 & Uranium	27+2	2	58	0	0	0	100%	100%
SW6020	Metals by ICP/MS	123+10	17	2261	129	144	314	94.3%	87.9%
SW7471A	Mercury	123+10	1	133	0	14	54	100%	89.5%
SW8015B	Gas, Diesel, and Motor Oil	123+10	3	399	0	111	45	100%	72.2%
SW8081A	Pesticides	123+10	21	2793	0	347	18	100%	87.6%
SW8082	PCBs	123+10	8	1024	0	0	0	100%	100%
SW8151A	Herbicides	123+10	10	1330	1	594	0	99.9%	55.3%
SW8260B	Volatiles	123+10	56	7668	2	838	65	100%	89%
SW8270C	Semivolatiles	123+10	66	8783	0	543	13	100%	93.8%

* Note: Estimations due solely to results <PQL do not affect the calculated completeness
Calculations do not include any required field or laboratory QC samples, except field duplicates.
N = normal environmental samples FD = field duplicate samples

Area 11 -- Summary of Data Quality and Analytical Completeness

In general, the results are of acceptable quality and are usable for their intended purpose. In addition to the rejected antimony results, three results for the herbicide, Dinoseb, three volatile and 49 SVOC results have been rejected due to very low spike recoveries. Improper instrument calibration resulted in 49 volatile results being rejected. These results are not usable for any purpose. All methods met the soil analytical completeness goal of 90 percent usable results (Table 4-12). Most methods had a high percentage of unqualified results (greater than 75 percent). However, a significant number of results for herbicides and uranium were qualified as estimated due primarily to spike recoveries below the control limits established in the QAPP. In addition, a large number of gasoline results were qualified as not detected with an estimated detection limit due to blank contamination.

Table 4-12. Area 11 Analytical Completeness by Method

				Number of results				Completeness	
Method	Parameter	Samples Analyzed (N+FD)	Analytes per sample	Total	Rejected	Estimated due to QC deficiencies	Estimated due to >MDL but <PQL	Percent usable	Percent quantitative*
ABP	Acid/Base Potential	188+17	3	615	0	8	0	100%	98.7%
E901.1	Radium-226 & -228	21+4	2	50	0	4	0	100%	92%
SW6010B	Metals by ICP/AES	188+17	7	1435	0	89	110	100%	93.8%
SW6020	Thorium-232 & Uranium	21+4	2	50	0	17	0	100%	66%
SW6020	Metals by ICP/MS	188+17	17	3485	191	236	495	94.5%	87.7%
SW7471A	Mercury	188+17	1	205	0	29	81	100%	85.9%
SW8015B	Gas, Diesel, and Motor Oil	188+17	3	615	0	179	85	100%	70.9%
SW8081A	Pesticides	188+17	21	4305	0	384	98	100%	91.1%
SW8082	PCBs	182+16	8	1513	0	0	2	100%	100%
SW8151A	Herbicides	188+17	10	2050	3	1135	0	99.9%	44.5%
SW8260B	Volatiles	188+17	56	11557	51	2639	146	99.6%	76.7%
SW8270C	Semivolatiles	188+17	66	13573	49	2495	46	99.6%	81.3%

* Note: Estimations due solely to results <PQL do not affect the calculated completeness
Calculations do not include any required field or laboratory QC samples, except field duplicates.
N = normal environmental samples FD = field duplicate samples

Area 12 -- Summary of Data Quality and Analytical Completeness

In general, the results are of acceptable quality and are usable for their intended purpose. All antimony results have been rejected. These results are not usable for any purpose. All methods met the soil analytical completeness goal of 90 percent usable results (Table 4-13). Most methods had a high percentage of unqualified results (greater than 75 percent). However, a significant number of results for herbicides were qualified as estimated due primarily to spike recoveries below the control limits established in the QAPP. In addition, a large number of gasoline results were qualified as not detected with an estimated detection limit due to blank contamination.

Table 4-13. Area 12 Analytical Completeness by Method									
				Number of results				Completeness	
Method	Parameter	Samples Analyzed (N+FD)	Analytes per sample	Total	Rejected	Estimated due to QC deficiencies	Estimated due to >MDL but <PQL	Percent usable	Percent quantitative*
ABP	Acid/Base Potential	49+8	3	171	0	2	0	100%	98.8%
E901.1	Radium-226 & -228	24+3	2	54	0	0	0	100%	100%
SW6010B	Metals by ICP/AES	50+8	7	406	0	30	20	100%	92.6%
SW6020	Thorium-232 & Uranium	24+3	2	54	0	0	0	100%	100%
SW6020	Metals by ICP/MS	50+8	17	986	49	42	123	95%	90.8%
SW7471A	Mercury	50+8	1	58	0	5	11	100%	91.4%
SW8015B	Gas, Diesel, and Motor Oil	50+8	3	164	0	56	35	100%	65.8%
SW8081A	Pesticides	50+8	21	1218	0	84	4	100%	93.1%
SW8082	PCBs	50+8	8	424	0	0	2	100%	100%
SW8151A	Herbicides	50+8	10	580	0	210	0	100%	63.8%
SW8260B	Volatiles	42+6	56	2688	0	649	13	100%	75.9%
SW8270C	Semivolatiles	50+8	66	3875	0	13	14	100%	99.7%

* Note: Estimations due solely to results <PQL do not affect the calculated completeness
Calculations do not include any required field or laboratory QC samples, except field duplicates.
N = normal environmental samples FD = field duplicate samples

Stained Soil Areas (EX) -- Summary of Data Quality and Analytical Completeness

In general, the results are of acceptable quality and are usable for their intended purpose. In addition to the rejected antimony results, 28 herbicide results have been rejected due to very low spike recoveries. These results are not usable for any purpose. The analytical completeness goal of 90 percent usable results was not met for herbicides by Method SW8151A. All other methods met the soil analytical completeness goal (Table 4-14). Most methods had a high percentage of unqualified results (greater than 75 percent). However, a significant number of results for herbicides and pesticides were qualified as estimated due primarily to spike recoveries below the control limits established in the QAPP. In addition, a large percentage of gasoline results were qualified as not detected with an estimated detection limit due to blank contamination.

Table 4-14. Stained Soil Areas (EX) Analytical Completeness by Method

				Number of results				Completeness	
Method	Parameter	Samples Analyzed (N+FD)	Analytes per sample	Total	Rejected	Estimated due to QC deficiencies	Estimated due to >MDL but <PQL	Percent usable	Percent quantitative*
ABP	Acid/Base Potential	3+0	3	9	0	0	0	100%	100%
E903.0	Radium-226	3+0	1	3	0	0	0	100%	100%
E904.0	Radium-228	3+0	1	3	0	0	0	100%	100%
SW6010B	Metals by ICP/AES	9+0	7	63	0	9	2	100%	85.7%
SW6020	Thorium-232 & Uranium	3+0	2	6	0	0	0	100%	100%
SW6020	Metals by ICP/MS	9+0	17	153	9	5	21	94.1%	90.8%
SW7471A	Mercury	9+0	1	9	0	0	1	100%	100%
SW8015B	Gas, Diesel, and Motor Oil	9+0	3	27	0	8	0	100%	70.4%
SW8081A	Pesticides	9+0	21	189	0	65	6	100%	65.6%
SW8082	PCBs	9+0	8	72	0	14	0	100%	80.6%
SW8151A	Herbicides	9+0	10	90	28	28	0	68.9%	37.8%
SW8260B	Volatiles	9+0	56	504	0	10	36	100%	98%
SW8270C	Semivolatiles	9+0	66	594	0	58	9	100%	90.2%

* Note: Estimations due solely to results <PQL do not affect the calculated completeness
Calculations do not include any required field or laboratory QC samples, except field duplicates.
N = normal environmental samples FD = field duplicate samples

Electrical Transformers (TR) -- Summary of Data Quality and Analytical Completeness

In general, the results are of acceptable quality and are usable for their intended purpose. Antimony was detected in all samples for this site. However, these antimony results should be used with caution as they may represent false positives, or be biased either high or low. Five results for gasoline have been rejected due to gross exceedance of the holding time. These results are not usable for any purpose. The analytical completeness goal of 90 percent usable results was not met for gasoline by Method SW8015B. All other methods met the soil analytical completeness goal (Table 4-15). Most methods had a high percentage of unqualified results (greater than 75 percent). However, a significant number of results for herbicides were qualified as estimated due primarily to spike recoveries below the control limits established in the QAPP.

Table 4-15. Electrical Transformers (TR) Analytical Completeness by Method

				Number of results				Completeness	
Method	Parameter	Samples Analyzed (N+FD)	Analytes per sample	Total	Rejected	Estimated due to QC deficiencies	Estimated due to >MDL but <PQL	Percent usable	Percent quantitative*
ABP	Acid/Base Potential	5+0	3	15	0	0	0	100%	100%
SW6010B	Metals by ICP/AES	5+0	7	35	0	2	2	100%	94.3%
SW6020	Metals by ICP/MS	5+0	17	85	0	10	10	100%	88.2%
SW7471A	Mercury	5+0	1	5	0	0	0	100%	100%
SW8015B	Gas, Diesel, and Motor Oil	5+0	3	15	5	1	0	66.7%	60%
SW8081A	Pesticides	5+0	21	110	0	22	17	100%	80%
SW8082	PCBs	5+0	7	35	0	1	0	100%	97.1%
SW8151A	Herbicides	5+0	10	50	0	26	0	100%	48%
SW8260B	Volatiles	5+0	56	280	0	5	19	100%	98.2%
SW8270C	Semivolatiles	5+0	66	325	0	61	15	100%	81.2%

* Note: Estimations due solely to results <PQL do not affect the calculated completeness
Calculations do not include any required field or laboratory QC samples, except field duplicates.
N = normal environmental samples FD = field duplicate samples

Utility Pipelines (U) -- Summary of Data Quality and Analytical Completeness

In general, the results are of acceptable quality and are usable for their intended purpose. In addition to the rejected antimony results, 43 pesticide results 14 PCB results, 112 herbicide results, and 32 SVOC results have been rejected due to very low spike recoveries. These results are not usable for any purpose. The analytical completeness goal of 90 percent usable results was not met for herbicides by Method SW8151A. All other methods met the soil analytical completeness goal (Table 4-16). Most methods had a high percentage of unqualified results (greater than 75 percent). However, a significant number of results for herbicides were qualified as estimated due primarily to spike recoveries below the control limits established in the QAPP.

Table 4-16. Utility Pipelines (U) Analytical Completeness by Method

				Number of results				Completeness	
Method	Parameter	Samples Analyzed (N+FD)	Analytes per sample	Total	Rejected	Estimated due to QC deficiencies	Estimated due to >MDL but <PQL	Percent usable	Percent quantitative*
ABP	Acid/Base Potential	60+5	3	195	0	0	0	100%	100%
E901.1	Radium-226 & -228	12+1	2	26	0	0	0	100%	100%
E903.0	Radium-226	48+4	1	52	0	1	0	100%	98.1%
E904.0	Radium-228	48+4	1	52	0	5	0	100%	90.4%
SW6010B	Metals by ICP/AES	60+5	7	472	0	54	15	100%	88.6%
SW6020	Thorium-232 & Uranium	60+5	2	130	0	4	0	100%	96.9%
SW6020	Metals by ICP/MS	60+5	17	1088	62	133	97	94.3%	82.1%
SW7471A	Mercury	60+5	1	65	0	7	7	100%	89.2%
SW8015B	Gas, Diesel, and Motor Oil	60+5	3	195	0	7	26	100%	96.4%
SW8081A	Pesticides	60+5	21	1430	43	170	9	97%	85.1%
SW8082	PCBs	60+5	7	455	14	35	0	96.9%	89.2%
SW8151A	Herbicides	60+5	10	650	112	286	0	82.8%	38.8%
SW8260B	Volatiles	60+5	56	3640	0	83	113	100%	97.7%
SW8270C	Semivolatiles	60+5	66	4277	32	799	32	99.3%	80.6%

* Note: Estimations due solely to results <PQL do not affect the calculated completeness
Calculations do not include any required field or laboratory QC samples, except field duplicates.
N = normal environmental samples FD = field duplicate samples

4.3 Comparability with EPA Split Sample Data

EPA's contractor, TetraTech, was onsite during some of the sampling activities in the Process Areas to observe sampling techniques and collect split samples for comparison to the analytical results from the soil samples collected by ARC. TetraTech took split samples at 11 borehole locations, resulting in a total of 40 samples collected. Table 4-17 lists the locations and sample IDs of the split samples collected. A complete comparison of ARC's primary and EPA's split samples is included in Appendix F.

Split samples were analyzed by two separate laboratories as a measure of comparability. Due to the large extent of organic analyses requested, the split samples were not homogenized prior to submission to the laboratories, and some variability in analytical results would be expected. In general, results from both laboratories were similar. However, differences in detection limits and the target analyte list from each of the two laboratories limits the comparison. Results from one lab often were detected at concentrations below the detection limit from the other lab.

Table 4-17. EPA Split Samples

Borehole Location	Sample ID	Borehole Location	Sample ID
PA-BBB2	PA-BBB2-5 PA-BBB2-10 PA-BBB2-15 PA-BBB2-20 PA-BBB2-25	PA-K9	PA-K9-1 PA-K9-5 PA-K9-10
PA-C2	PA-C2-1 PA-C2-5 PA-C2-10	PA-O1	PA-O1-1 PA-O1-5 PA-O1-10
PA-EE14	PA-EE14-1 PA-EE14-5 PA-EE14-10 PA-EE14-15 PA-EE14-20	PA-P17	PA-P17-15 PA-P17-20 PA-P17-25
PA-HH8	PA-HH8-5 PA-HH8-10 PA-HH8-15 PA-HH8-20 PA-HH8-25	PA-P19	PA-P19-5 PA-P19-10 PA-P19-15 PA-P19-20 PA-P19-25
PA-HH10	PA-HH10-5 PA-HH10-10 PA-HH10-15 PA-HH10-20	PA-Q1	PA-Q1-1 PA-Q1-5 PA-Q1-10
PA-HH11	PA-HH11-5 PA-HH11-10 PA-HH11-15 PA-HH11-20 PA-HH11-25	PA-V1	PA-V1-1 PA-V1-5 PA-V1-10

Forty seven split samples from twelve locations (PA-BBB2, PA-C2, PA-EE14, PA-HH8, PA-HH10, PA-HH11, PA-K9, PA-O1, PA-P17, PA-P19, PA-Q1, and PA-V1) were collected from various depths below ground surface, and analyzed for metals. Most of the metals results from both laboratories were below the industrial PRGs, and are of little concern. Significant discrepancies between the primary and split samples were noted for the following analytical results:

- Antimony at PA-O1 at 1 foot bgs
- Copper at PA-EE-14 at 1 foot bgs
- Copper at PA-P19 at 20 feet bgs

A total of 24 samples from 6 locations (PA-EE14, PA-HH10, PA-HH11, PA-HH8, PA-P17, and PA-P19) were collected as split samples for the analysis of selected radionuclides. Comparisons of the results for uranium and thorium from the two laboratories were not made at this time due to differences in reported isotopes, but further comparison of the data will be presented in the Radiological Assessment Report by November 30, 2005.

Both laboratories reported results for radium-226 and radium-228. The reported results from both laboratories are below the industrial PRGs in all cases except one. The reported result from the split laboratory for radium-226 from 20 feet bgs at location PA-P19 is above the industrial PRG. The primary laboratory reported a result well below the industrial PRG at this location.

A total of 32 samples from 8 locations (PA-BBB2, PA-EE14, PA-HH10, PA-HH11, PA-HH8, PA-K9, PA-P17, and PA-P19) were collected as split samples for the analysis of pesticides and PCBs. Pesticide results were below detection limits from both laboratories in all but a few instances. Detected pesticides were reported at location PA-K9. However, the majority of these detections were reported by the primary laboratory at levels below the detection limit of the split laboratory. The pesticide DDT with associated breakdown products (DDD and DDE) was detected by both laboratories at similar levels at location PA-K9. These results were well below any preliminary screening criteria. PCBs were not detected by either laboratory in any of the split samples.

Forty-one split samples from eleven locations (PA-BBB2, PA-C2, PA-EE14, PA-HH8, PA-HH10, PA-HH11, PA-K9, PA-P17, PA-P19, PA-Q1, and PA-V1) were collected as split samples and analyzed for SVOCs and TPH (diesel and motor oil). SVOC results were below detection limits from both laboratories in all but three instances. In all three of these cases, presented below, the other laboratory reported the result as not detected.

- 0.16 mg/kg of 2-methylnaphthalene at 1 foot below ground surface at PA-C2
- 0.023 mg/kg of di-n-butyl phthalate at 5 feet below ground surface at PA-HH11
- 0.12 mg/kg of phenanthrene at 1 foot below ground surface at PA-C2

Most of the results for TPH as diesel and motor oil were reported as not detected at the associated detection limit. A few locations had low level detections by one laboratory that were reported as not detected by the other laboratory. However, in some cases, the result from one lab is well below the industrial PRG and the other lab is reporting a concentration well above the preliminary screening criteria. Additional investigation may be required to determine which data set more accurately reflects site conditions. The following locations and analytes are in this category:

- TPH as diesel at PA-C2 (1 foot bgs)
- TPH as motor oil at PA-C2 (1 foot bgs)
- TPH as motor oil at PA-K9 (1 foot bgs)

A total of 27 samples from eight locations (PA-BBB2, PA-C2, PA-EE14, PA-HH10, PA-K9, PA-P19, PA-Q1, and PA-V1) were collected as split samples for the analysis of TPH as gasoline. Most of the results for TPH as gasoline were reported as not detected at the associated detection limit. However, a few locations had low level detections by one laboratory that were reported as not detected by the other laboratory.

Twenty-nine split samples from eight locations (PA-BBB2, PA-C2, PA-EE14, PA-HH10, PA-K9, PA-P19, PA-Q1, and PA-V1) were collected as split samples and analyzed for volatile compounds. Volatile organic compound results were below detection limits from both laboratories in all but 15 instances. In every case, the detection was not confirmed by the other laboratory. Methylene chloride, a common laboratory contaminant, accounted for six of the detections. All detected volatile results were significantly below the industrial PRGs.

SECTION 5.0

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