CERCLA IMMINENT HAZARD
MINING AND MINERAL PROCESSING FACILITIES

Office of Solid Waste
U.S. Environmental Protection Agency

February 1997

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CHAPTER 1. OVERVIEW

Section 106 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) provides for abatement action by a State, local government, or the President, when there exists an "imminent and substantial endangerment to the public health or welfare or the environment because of an actual or threatened release of a hazardous substance." In addition, Section 106 contains severe penalties for noncompliance, forcing potentially responsible parties to clean up a site, or pay as much as $25,000 a day. These orders are EPA's means of enforcement, which achieve cleanup at sites posing significant threat to human health and the environment where negotiations over Superfund cleanups have failed. CERCLA § 106 authority has been invoked in response to hazards posed by a substantial number of abandoned mining and mineral processing sites. This document summarizes available information for forty CERCLA § 106 actions taken at these sites.

The information used to develop this document was taken from a number of sources: the Superfund Emergency Response Actions Library; the EPA RODS Database; the CERCLIS Database; National Priority List Fact Sheets (http://www.superfund/oerr/impm/products/nplsites/usmap.htm.); the Right-to-Know Network (http://www.RTK.NET); U.S. Environmental Protection Agency, Office of Solid Waste, *Mining Sites on the NPL - Draft*, 1995; U.S. Environmental Protection Agency, Office of Solid Waste, *Mining Waste National Priorities Site Summary Report- Final Draft*, 1991; U.S. Environmental Protection Agency, *Action Memorandum*, for a number of sites; and other Regional documents collected from Superfund Record Centers in Regions V, VIII, and X.

The table below, Exhibit 1, summarizes the information available in this document for each site, including site name and location, source of contamination, cost of cleanup, and the nature of the damage resulting from the contamination. Detailed information for each site listed is provided in Chapter 2. Sites are grouped by State and listed alphabetically for each State.

Exhibit 1

Site		Source of Contamination	Cost of Cleanup	Nature of Damage			
Name	State			Ground water	Surface water	Human Exposure	Other
Iron Mountain Mine	CA	Mining and processing of copper, silver, gold, zinc, and pyrite.	$68.1 million		Contaminated by sulfuric acid, copper, zinc, and cadmium.	Potential for human health risk.	Potential for accumulation of contaminants in fish. Steady decline in nearby fish populations.
California Gulch	CO	Mining of gold, silver, lead, copper , zinc, and manganese. Smelting and processing of silver, lead, and zinc.	$14.8 million	Contaminated with heavy metals.	Contaminated with heavy metals.	Potential for human health risk. Water in some wells exceeds drinking water standards for cadmium and zinc.	Adverse effects on nearby fish populations and vegetation. Sediments also contaminated with heavy metals.
Captain Jack Mine and Mill	CO	Silver mining and milling, ore processing, storage of 55 gallon drums containing corrosive waste.	$24,137			Potential for human health risk.	Potential for adverse effect on aquatic life and downstream users.
Central City-Clear Creek	CO	Mining of gold, silver, copper, lead, molybdenum, and zinc.	$26 million	Contaminated with heavy metals.	Contaminated with heavy metals.	Potential for human health risk.	Soils contaminated with heavy metals. Aquatic life affected by elevated levels of metals in Clear Creek.
Denver Radium Site	CO	Radium processing activities.	NA			Limited immediate threat to public health and environment.	Soil is contaminated with radium, thorium, uranium, arsenic, and lead. Build up of radon gas.
Eagle Mine	CO	Copper, silver, and zinc mining. Zinc ore roasting.	NA	Contaminated with heavy metals.	Contaminated with heavy metals.	Wind-blown particles from a tailings pile threatens nearby middle school.	Fish populations have declined in the river near the mine. Soils contaminated with heavy metals.
Herold Blackhawk	CO	Metals reclamation operation.	$117,057			Site posed a number of potential human health threats.	

NA = Information Not Available

Site		Source of Contamination	Cost of Cleanup	Nature of Damage			
Name	State			Ground water	Surface water	Human Exposure	Other
Smeltertown	CO	Smelting, wood treating, and zinc sulfate manufacturing.	$3,000	Contaminated with zinc.			Contaminated soil and slag contain elevated levels of arsenic, copper, lead, manganese, and zinc.
Smuggler Mountain	CO	Mining and processing of silver, lead, and zinc.	$7.2 million	Potential for contamination.		Potential for human exposure exists through direct contact of soils and inhalation of contaminant-laden dust.	Soil contaminated with lead, cadmium, and arsenic.
Summitville Mine	CO	Mining operations; gold recovery operations through cyanide heap leaching.	$3.5 million to date		Contaminated with cyanide and metals.		Fish kills reported twenty miles downstream from site.
Canyon Creek Mine	ID	Mining, milling, and related activities.	$2,298,750	Contaminated with cadmium lead, and zinc.	Contaminated with cadmium, lead, and zinc.	Potential for human health risks.	Surface water transport of contaminants may harm other areas.
Cinnabar Mine	ID	Mercury mining operations.	$909,998			Site conditions presented imminent threat to public health.	Contamination threatened nearby fisheries as well as several endangered species.
Douglas Mine	ID	Mining and milling of lead, silver, and zinc.	$200,000	Contaminated with zinc, cadmium, and lead.	Contaminated with zinc, cadmium, and lead.	Potential threat to human health from exposure to contaminants.	Aquatic food chain organisms threatened by release of contaminants. Surface water transport of contaminants may harm other areas.
Stibnite Mine	ID	Mining of tungsten, antimony, and gold. Gold leaching and smelting.	$919,000	Elevated levels or iron and arsenic are prevalent in drainages below waste rock piles.	Contaminants are released into water that comes into contact with the tailings pile.	Potential human health risk from arsenic.	Sediment, algae, and fish samples from nearby rivers contain elevated concentrations of heavy metals and cyanide.

NA = Information Not Available

Site		Source of Contamination	Cost of Cleanup	Nature of Damage			
Name	State			Ground water	Surface water	Human Exposure	Other
Success Mine	ID	Mining of zinc, lead, and silver.	$1,076,230	High concentrations of zinc, lead, copper, and cadmium in ground water.			Ground water has transported heavy metals from the tailings to a nearby creek. Water quality in the creek is severely degraded and the creek itself is lifeless.
Circle Smelting Corporation	IL	Primary zinc smelting. Secondary smelting activities.	$9,446,000		Contaminants have been detected downstream from facility. Drainage aqueducts from facility have received contaminated run-off.	Potential lead exposure risk to children. Residential area near site has elevated metals concentrations.	Potential for ecological damage.
Cherokee County	KA	Lead and zinc mining.	NA	Shallow ground water contaminated with lead, cadmium, selenium, zinc, and chromium.	Run-off from the waste piles and drainage aqueducts has moved contaminants into nearby streams.	Potential human exposure risk from inhalation and ingestion. Heavy metals found in private wells.	Contamination has been found in nearby fish populations.
Torch Lake	MI	Copper mining and reclamation activities.	NA	Potential for ground water contamination.	Sediment and surface water are contaminated with copper and cupric ammonium carbonate	Contact with or ingestion of contaminated surface water or sediment poses a human health hazard.	Fish and aquatic vegetation in the lake are threatened. Physical hazards, such as old machinery and equipment, and rusting barrels are also a concern.
Oronogo-Duenweg Mining Belt	MO	Mining, smelting and processing of lead and zinc.	NA	On site ground water contaminated with lead, zinc, and cadmium.	On site surface water contaminated with lead, zinc, and cadmium.	Potential human exposure through ingestion of contaminated water or contact with contaminated soils.	Soils contaminated with heavy metals.

NA = Information Not Available

Site		Source of Contamination	Cost of Cleanup	Nature of Damage			
Name	State			Ground water	Surface water	Human Exposure	Other
Anaconda Company Smelter	MT	Copper smelting.	NA	Ground water contains arsenic, cadmium, copper, zinc, and lead.	Surface water contains arsenic, cadmium, copper, zinc, and lead.	Contamination posed an imminent and substantial threat to nearby residents through accidental ingestion of contaminated soil or inhalation of airborne contaminants. Some residents needed to be relocated.	Soils contain heavy metals.
McLaren Tailings	MT	Gold and silver extraction and processing.	$247,600		Soda Butte Creek contaminated by leachate from tailings and run-off from mill site.		Aluminum, copper, iron, and manganese are present in high enough concentrations to pose a threat to aquatic life. Flooding at the site could cause severe ecological problems downstream.
Silver Bow Creek/Butte Area	MT	Mining of copper, silver, gold, zinc, lead, manganese, and molybdenum. Milling and smelting also carried out.	$57,037,000 in addition to $379,000 annually for maintenance.	Ground water contaminated with arsenic, copper, zinc, iron, cadmium, mercury, and lead.	Surface water contaminated with arsenic, copper, zinc, iron, cadmium, mercury, and lead.	Potential human health risks include direct contact and accidental inhalation of contaminated soil, ground water, surface water, and inhalation of contaminated air particles.	Tailings dispersed along the creek severely limit aquatic life forms. Soils contaminated with arsenic, copper, zinc, iron, cadmium, mercury, and lead.
Cimarron Mining Corporation	NM	Processed waste materials from gold extraction, metal recovery activities.	$710,000	Ground water contains elevated levels of cyanide. Deeper aquifer used for drinking water could have become contaminated if treatment of the ground water had not occurred.		Levels of cyanide at the site were potentially toxic to people. Direct contact or accidental ingestion of wastes and contaminated soils posed a substantial health risk prior to clean up.	Soils and sediments contain lead.

NA = Information Not Available

Site		Source of Contamination	Cost of Cleanup	Nature of Damage			
Name	State			Ground water	Surface water	Human Exposure	Other
Cuba Smelter Site	NM	Lead smelting.	$1,921,000			Potential threats to human health result from exposure to lead, mercury, zinc, copper, arsenic, and thallium.	Threats posed by contaminants (lead, mercury, zinc, copper, arsenic, and thallium) include direct contact, biological threats, and soil contamination.
LI Tungsten Corporation	NY	Processing ore and scrap tungsten. Industrial waste storage.	NA	Ground water contains chlorides, sulfates, lead, cadmium, tungsten, chromium, arsenic, barium, silver, and PCBs.	Chlorides, sulfates, lead, cadmium, tungsten, chromium, arsenic, barium, silver, and PCBs detected in on-site monitoring wells.	Potential risk through ingestion of contaminated ground water. Public and private wells within 4 miles of this site serve as the drinking water source for an estimated 51,000 people.	
National Zinc Corporation	OK	Zinc smelting activities.	NA			People who ingest contaminated soils could be at risk. Ten percent of children in contaminated area have elevated blood-lead levels.	Eight square miles of surface soil is contaminated with lead and cadmium.
Ambler Asbestos Piles	PA	Three asbestos-containing waste piles and a series of filter bed lagoons.	$60,000	Contaminated with asbestos.	Contaminated with asbestos.	Potential exposure of children to asbestos in nearby playground.	Air, soil, and sediments contaminated with asbestos.
Annie Creek Mine Tailings	SD	Gold ore beneficiation.	NA	Ground water contaminated with low levels of arsenic.	Surface water contaminated with low levels of arsenic.	Ingesting or coming into contact with contaminated soil, sediments, or water may pose a threat to people and animals.	Soil and sediments contaminated with arsenic. Ingesting or coming into contact with contaminated soil, sediments, or water may pose a threat to people and animals.

NA = Information Not Available

Site		Source of Contamination	Cost of Cleanup	Nature of Damage			
Name	State			Ground water	Surface water	Human Exposure	Other
Bingham Creek Channel - Phase I	UT	Extensive copper and lead mining.	$3,250,000		Continued release of lead posed threat to surface water.	High concentrations of lead posed threat to children in the surrounding area.	Exposure of lead to livestock was a primary threat. Large amount of soil contaminated with high levels of lead.
Bingham Creek Channel - Phase II	UT	Open pit mining activities.	NA	Potential adverse impacts from migration of contamination in soils.	Potential adverse impacts from migration of contamination in soils.	Incidental ingestion of contaminated soil or inhalation of contaminated dust particles presented an actual and potential threat to human health.	Potential adverse impacts on surrounding ecosystem.
Bingham Reservoir	UT	Copper tailings.	NA- EPA costs limited to oversight.	Ground water has been contaminated by heavy metals up to two miles from site.	Surface water quality in nearby creeks and rivers threatened.	Toxic effects of several heavy metals (copper, lead, nickel, zinc) posed a substantial potential threat to public health.	Copper and zinc concentrations were toxic to aquatic life.
Essex Copper Processing Plant	UT	Copper processing facility.	$392,200			High concentrations of PCBs, phenol, and phenol compounds posed an imminent and substantial threat to human health.	Wildlife in adjacent areas threatened by exposure to contaminated soil, standing water, and sediments.
Kennecott Tailings (North Zone)	UT	Mineral processing activities.	NA	Wastes deposited in unlined impoundments and spills have caused metal-bearing ground water contamination.		Potential health risks for those using private wells or those who ingest soils contaminated with lead and arsenic.	Wetlands on or near the site are threatened. Early smelter emissions devastated surrounding vegetation.
Kennecott Tailings (South Zone)	UT	Mining of gold, silver, and copper.	NA	Plume of ground water contaminated with metals, acids and sulfates. Leach water escaping the collection system contaminated a principal aquifer.		Potential health risks are associated with direct contact and ingestion of contaminated soils and groundwater.	

NA = Information Not Available

Site		Source of Contamination	Cost of Cleanup	Nature of Damage			
Name	State			Ground water	Surface water	Human Exposure	Other
Kern River/Bingham Creek Pipeline	UT	Mineral extraction and beneficiation activities.	NA		Upper two inches of soil are contaminated with high levels of lead, which are released into surrounding waters.	Potential exposure to lead constitutes an imminent and substantial endangerment to human health.	Contamination poses threat to livestock and wildlife. Soils have elevated levels of lead and arsenic.
Leeds Silver Reclamation Site	UT	Silver and copper extraction. Stockpile, leach pile and collection pond are specific sources.	$579,000	Arsenic, beryllium, and mercury are present in sub-surface waters.	Arsenic, beryllium, and mercury are present in surface waters.	Potential for substantial risk to human health if sediment or waste water released.	The sediment and water in the site ponds are acutely toxic to aquatic organisms and a release would result in severe ecological damage.
Midvale Slag	UT	Copper and lead smelting activities	NA	Ground water and sediments are contaminated with heavy metals including arsenic, cadmium, lead, and chromium.	Nearby river is potentially contaminated from run-off from the site and groundwater discharge.	Drinking contaminated ground and surface water as well as ingesting contaminated soil pose potential human health risks.	On-site soils contaminated with cadmium, lead, arsenic, and chromium.
Sandy Smelter	UT	Lead, copper, and zinc smelting activities.	$5,880,900			Lead contamination of soils posed an immediate risk to human health.	
Sharon Steel (Midvale Tailings)	UT	Milling and smelting operations.	$5,063,000	Shallow ground water contaminated with heavy metals such as arsenic, iron, manganese, and zinc.	Nearby river contaminated with heavy metals.	Exposure to lead and arsenic through direct contact with or inhalation of contaminated soils poses greatest potential human health risk.	Soil contaminated with heavy metals. Nearby wetlands contain heavy metals and zinc tailings.
Yttrium Processing Plant	WY	Extraction of yttrium from ore.	$49,200			Threat to human health posed by exposure to lead, uranium and other radiological contaminants.	Site soils had high concentrations of lead, radium, yttrium, zinc, copper and mercury.

NA = Information Not Available

CHAPTER 2. CERCLA § 106 ACTION EVALUATIONS

This chapter presents 72 abatement actions that have taken place at mineral extraction, beneficiation, and processing sites since 1985. These federal actions were taken in response to an "imminent and substantial endangerment to the public health or welfare or the environment because of an actual or threatened release of a hazardous substance from a facility." The actions are listed alphabetically by state and within each state alphabetically by site name, as shown in Exhibit 2-1. Detailed information on each of the actions follows this exhibit.

Also, the following sites are summarized and are in addition to the sites in exhibit 1.

1. Blackbird Mine, Lemhi County, Idaho-IDD 980725832-This is an abandoned mine and mill which covers 830 acres with an 18 acre open pit and 4.8 million tons of waste rock. Operations ceased in 1967. There is evidence of soil, surface water and ground water contamination at the site. In 1993, Noranda entered into an Administrative Order to divert the west fork of Blackbird Creek. EPA Action memo for a Non-Time Critical Removal dated June 16, 1995, estimated the removal cost at $24,000,000. In 1993 the state filed a natural resource damage claim which has not yet been finalized.

2. Success mine, Wallace, Shoshone County, Idaho-IDD 984674986-This closed zinc, lead and silver mine operated from 1900 to 1945. The main source of soil, surface water and ground water contamination are runoff through large tailings piles. Heavy metal contamination is noted at the site. EPA Action Memo for Removal Action dated September, 21, 1993 estimated the cost of the removal at $905,000.

3. Arsenic mines, Kent, New York-This abandoned arsenic mine includes two shafts. The site has caused ground water contamination. EPA Preliminary Assessment and Request for CERCLA Funding dated July 7, 1988 estimated the cost of removal at $125,000.

4. Aluminum Company of America-Riverdale Iowa-This site produced aluminum ingots, aluminum sheet and plate, and foil rolling mills. It is referred to as the Alcoa-Davenport Works. Alcoa entered into a 1990 Administrative Order on consent (Docket 90-F-0027) to address groundwater contamination from on-site impoundments holding grease, solvents, pickle liquors, paint coatings, and PCBs. EPA Administrative order on Consent for Removal Action and RI/FS dated August 14, 1995 (CERCLA Docket 95-F-0026) indicated that contamination from the impoundments required additional action to control ground water contamination. No cost estimates for this removal have been prepared pending completion of the RI/FS.

Iron Mountain Mine

Site Overview: This site is located nine miles northwest of Redding, California. From 1865 to 1963, this site was mined for iron, silver, gold, copper, zinc, and pyrite. Underground mine workings, waste rock dumps, piles of ore mine tailings, and an open mine pit still remain at the site today. Surface water has been contaminated by sulfuric acid, zinc, copper, and cadmium.

Site Mining Activity: From 1865 to 1963, this 4,400-acre site was used for the mining and processing of copper, silver, gold, zinc, and pyrite. Although mining operations were discontinued in 1963, underground mine workings, waste rock dumps, piles of ore, mill tailings, and an open mine pit remain at the site. In recent years, metal recovery activity has been limited to extracting copper from acid mine drainage using copper cementation.

Nature and Type of Contamination: The mining activity at this site fractured the mountain, exposing minerals in the mountain to surface water, rain water, and oxygen. Exposure of pyrite to moisture and oxygen resulted in the formation of sulfuric acid. This sulfuric acid runs through the mountain and leaches out copper, cadmium, zinc, and other heavy metals, flowing out of the seeps and portals of the mine. Much of the drainage is channeled into the Spring Creek Reservoir by creeks surrounding the site.

Nature of Environmental Damages: Surface water has been contaminated by the release of sulfuric acid, copper, zinc, and cadmium from the mine. Accidental ingestion or direct contact with contaminated water or mine drainage poses a human health risk. There is a potential for accumulation of contaminants in fish. The unplanned release of contaminants acutely toxic to fisheries into Spring Creek Reservoir has led to the steady decline in fish populations and contributed to the listing of the Winter Run Chinook Salmon as an endangered species.

Type of Cleanup Utilized: This site is being addressed in five stages: emergency actions and four long-term remedial phases focusing on water management, and cleanup of Boulder Creek, the Old Mine/No. 8 Mine, and the entire site. The Spring Creek Debris Dam was constructed in 1963 to act as a sediment basin and to control acid mine drainage. Cementation plants were constructed in 1940 and 1977 to recover copper from the drainage. In February 1989, EPA constructed an emergency lime neutralization plant to reduce metal discharges from the site by 50 percent.

Estimated or Actual Costs of Cleanup: The cost of cleanup has been estimated at $68.1 million.

Party(ies) Responsible for the Action: This site is being addressed through Federal and potentially responsible parties' actions.

California Gulch

Site Overview: This site, located 100 miles west of Denver, Colorado, is a 130-year old mining area covering eighteen and one-half square miles of a watershed area along the California Gulch. Surface water, sediments, and ground water are contaminated with heavy metals. The Arkansas River receives water from the California Gulch and is heavily used for irrigation, livestock watering, public water supply, fisheries, and recreation. Approximately 4,000 people live in nearby Leadville and Lake County.

Site Mining Activity: This site covers a watershed area that drains along California Gulch to the Arkansas River. The area was mined extensively for gold, silver, lead, copper, zinc, and manganese. The Yak Tunnel was built by miners to drain water from the mine works and to make mineral exploration and development easier. Seventeen smelters operated at various times around the city of Leadville and processed silver, lead, and zinc.

Nature and Type of Contamination: California Gulch collects large amounts of highly-contaminated water draining from former mining, milling, and smelting operations; this contaminated water flows to a nearby major river, where measured concentrations of cadmium and zinc have exceeded EPA's drinking water standards. Copper, lead, and arsenic are also present in this contaminated water flow. It is estimated that the Yak Tunnel drains hundreds of miles of mine workings and discharges water containing 210 tons of various heavy metals each year. Residues of heavy metals are present in many parts of Leadville, and contaminated run-off flows through the local town storm drains and streets.

Nature of Environmental Damages: The surface water, sediments, and ground water are contaminated with heavy metals such as cadmium, copper, lead, arsenic, and zinc. The water in shallow ground water wells and some private wells exceeds EPA's drinking water standards for cadmium and zinc. Arsenic, cadmium, and lead are present in waste piles and soils. There have been adverse effects observed in the fish population of the Arkansas River, and vegetation in pastures downstream are contaminated. Other potential threats to the health of the resident population include direct contact with contaminants in the soil.

Type of Cleanup Utilized: The site is being addressed in six stages. In 1986, EPA emergency response workers extended public water supply system lines to residences using private wells. In 1990, the storm water drainage system in the area was improved to prevent contaminated surface water from coming into contact with residential areas. Other early actions addressed mine tailing impoundments and mine waste rock piles at the site, as well as stream sediment. In 1991, the EPA modified remedy features by installing a surge pond to capture tunnel drainage and dissipate the effect of surges from the tunnel, constructing a treatment system for tunnel water before it was discharged, installing a flow control bulkhead in the tunnel to stop the uncontrolled discharge of mine drainage, preparing a contingency plan, and establishing a surface water and ground water monitoring system. These operations have improved water quality significantly. In addition, metal-contaminated sludges resulting from treatment plant operations are being shipped off-site for recycling at a potentially responsible party's East Helena Smelter.

Estimated or Actual Costs of Cleanup: The cost of the cleanup was to be paid by the potentially responsible parties, ASARCO and Resurrection Mining Company. However, both alleged that the United States was liable for mining operations conducted in Leadville during World War II. Therefore, the United States and the State of Colorado are paying $6.1 million and $225,000 respectively to the potentially responsible parties to be used in site cleanup. Eight and one-half million dollars was paid for immediate site work and the operations addressing contamination in the Yak Tunnel. One and a quarter million dollars was paid for immediate site work and the cleanup of slag piles throughout the site.

Party(ies) Responsible for the Action: This site is being addressed through Federal and potentially responsible parties' actions.

Captain Jack Mine and Mill

Site Overview: The Captain Jack Mill and Mine are located in the foothills above Boulder, Colorado approximately two miles southwest of the town Ward. The site is adjacent to Left Hand Creek.

Site Mining Activity: The site was an active silver mining and milling facility for 29 years, ceasing operations in 1984. However, recent maintenance work is evident, implying that the site is not totally abandoned. Residents near the mill area indicate that the mill facility probably processed ore from other mines after its closure and may occasionally perform processing activities. The mill site consists of ore milling and processing equipment and a mine shaft situated on what appears to be old tailings. Further upstream is another mine shaft with a water discharge and a tailings pile and pond.

Nature and Type of Contamination: Seven 55-gallon drums containing a slightly corrosive substance and seven 30-gallon drums containing "Aerofix," an acidic liquid used in film development, were found on-site. Tailings contained in the area may contain high concentrations of heavy metals and elevated levels of arsenic and cyanide from the treatment and processing of the ore. Samples from drum piles indicated elevated levels of lead and arsenic, possibly from the spillage of materials from drums or contamination from various processes that occurred on-site. The tailings pile, pond, and upper mine shaft discharge are typical of other front range mining operations and pose no immediate threat. These areas, however, do present potential long-term environmental concerns.

Nature of Environmental Damages: The deteriorating drums were close to the access road and Left Hand Creek, and access to the site was unrestricted. The corrosive nature of the drums' contents created potential threat to public health and welfare and the environment. Contact by the public with the low pH liquids would have caused burns to the exposed skin or eyes, and ingestion of the material would also have been harmful. A release of the liquids would have affected aquatic life, and posed a threat to downstream users.

Type of Cleanup Utilized: Removal activities began on December 8, 1987, when Emergency Response Cleanup Services were activated. Due to the deteriorated condition of the drums, the liquids were pumped into 55-gallon poly-drums and secured on-site until disposal arrangements were finalized. The drums were later disposed of at a RCRA-permitted disposal facility.

Estimated or Actual Costs of Cleanup: The actual cost of the cleanup was $24,137, including EPA payroll, EPA indirect, Technical Assistance Team cost, and ERCS cost.

Party(ies) Responsible for the Action: The Mine Safety Health Administration reported the potential release to EPA. The only identified potentially responsible parties at the site were Captain Jack Company and the current property owner. The current property owner provided access, but did not participate in the removal. The Colorado Department of Health was informed of the Removal Action, but did not assist. The Technical Assistance Team completed the sampling activities and the Emergency Response Cleanup Services conducted the removal.

Central City/ Clear Creek

Site Overview: This site is located approximately 30 miles west of Denver, Colorado. Extensive gold mining took place during the late 1800s, contaminating the soils with heavy metals. Recreational uses of Clear Creek include fishing, kayaking, rafting, tubing, gold panning, and wildlife watching. Clear Creek and its tributaries are used in whole or in part as a drinking water source by several municipalities. Active mines are still present at some locations in Gilpin and Clear Creek Counties, where the Upper Clear Creek drainage basin is located.

Site Mining Activity: Gold, silver, copper, lead, molybdenum, and zinc mining began in the late 1800s. There are 25 mines and six milling operations currently active. Due to the nature of the contamination this site has not been narrowly defined, but the EPA has identified and prioritized the contamination within the drainage basin of Clear Creek.

Nature and Type of Contamination: Hundreds of mine waste rock and tailings piles remain as a result of operations since the 1800s. In addition, numerous mine tunnels, constructed for the hauling of ore and mine water drainage, continue to drain acid water into the nearby watershed. Discharges of acid mine drainage from gold, silver, copper, lead, molybdenum, and zinc mines, as well as milling and mining wastes from five mines/tunnels in the Clear Creek and North Clear Creek drainage, have caused significant environmental damages.

Nature of Environmental Damages: Soils, including tailings and waste rock, are contaminated with heavy metals such as arsenic, cadmium, chromium, copper, and lead. Children may be at risk from playing on these contaminated soils. In addition, ground water and surface water contain heavy metals, exposing people to site contamination through drinking contaminated ground water from private wells. Finally, the aquatic environment continues to be severely affected by the elevated levels of metals in Clear Creek and its tributaries.

Type of Cleanup Utilized: In 1987, EPA built a retaining wall to support the waste rock and tailings known as the Gregory Incline Mine Waste Piles, and to prevent it from collapsing into North Creek. EPA provided residents with bottled water as an interim measure until their homes could be connected to the Idaho Springs municipal water supply. In 1991, mercury and mercury-contaminated waste were removed from an abandoned trailer near Idaho Springs that had previously housed a mine laboratory. EPA negotiated five Administrative Orders on Consent with gaming developers in the area, and required them to clean up their property prior to the construction of casinos or casino-support facilities. The cleanup of mine discharges was completed in mid-1995. EPA and the State constructed a system to treat the mine tunnel discharge from the Burleigh Mine Tunnel before it reaches Clear Creek. Erosion and storm water control measures were completed at the Argo Tunnel and the Gregory Incline Mine Waste Piles in 1991. Much of the contaminated material was removed and the piles were capped. Capping or erosion control measures are now underway at several other tailings and waste rock piles, and these efforts will continue into 1997. Additional cleanup activities are underway to control acid mine drainage, remove contaminated sediment, and replace wetlands.

Estimated or Actual Costs of Cleanup: The costs for mine-tunnel discharge remediation and for tailings and waste rock remediation are estimated at $25 million and $1.05 million, respectively.

Party(ies) Responsible for the Action: This site is being addressed through Federal, State, and potentially responsible parties' actions.

Denver Radium

Site Overview: This site, located in Denver, Colorado, is contaminated with radioactive soils and debris. This contaminated material was abandoned after the demise of the radium industry in the 1920s.

Site Mining Activity: After the collapse of Denver's World War I-era radium industry in the late 1920s, many sites were abandoned that contained radioactive soils and debris. Thirty-five sites were discovered in 1979 where radium had been processed, refined, or fabricated into various devices or products. Today 49 sites have been identified in the Denver area, and have been combined into nine groups for cleanup.

Nature and Type of Contamination: Radium-contaminated wastes were discarded or left on facility property when the facilities were closed. The residues, including sandy tailings, iron calcium precipitates, and leaching/precipitation residues, were used as cover, fill, foundation material, and aggregate.

Nature of Environmental Damages: The soil is contaminated with radium, thorium, uranium, arsenic, and lead. There is limited immediate threat to public health and the environment; however, the redevelopment of contaminated properties or the mismanagement of the wastes could increase the risk of exposure if contaminated materials are not removed and disposed of safely. The buildup of radon gas in structures built over the contaminated soil poses the principal threat. In addition, direct contact may pose a health risk.

Type of Cleanup Utilized: In 1985, emergency actions were taken to remove radon gas. EPA installed ventilation systems to decrease radon concentrations below EPA standards. Extensive cleanup work at all of the properties followed from 1987 to the present, including the removal and disposal of over 310,000 tons of contaminated materials. Cleanup actions have addressed immediate sources of radon and have protected workers from short-term exposure. Additional actions are underway to continue the reduction of sources and levels of contamination.

Estimated or Actual Costs of Cleanup: Not available.

Party(ies) Responsible for the Action: This site is being addressed through Federal, State, and a potentially responsible party's actions.

Eagle Mine

Site Overview: This site is eight miles west of Vail, Colorado, and encompasses an area of approximately five to seven miles along the Eagle River. This site is contaminated with toxic metals from over 100 years of zinc mining. The closest residence to the Eagle Mine site is located approximately 1,000 feet to the northwest. The closest population center has 1,500 people, and its filter ponds and municipal wells lie 2,000 feet to the northwest of the mine tailings and across Cross Creek. A middle school is located only 400 yards from the largest tailings pile.

Site Mining Activity: This site includes the Eagle Mine workings; the town of Gilman, Colorado; the mill tailings pond areas; Rex Flats; Rock Creek Canyon; and waste rock and roaster piles. Over the past 100 years, zinc miners deposited about ten million tons of mine wastes and mill tailings along the Eagle River. Zinc mining activities operated from 1905-1931 and from 1941-1977. Zinc ores were roasted on-site until 1919. Copper and silver mining continued until 1984.

Nature and Type of Contamination: Mining activities contributed to five major sources of contamination at the site: acid mine water forming in the Eagle Mine's underground workings; two tailings ponds; tailings placed along acres of pipeline corridor and in a wetlands area; five roaster piles; and twelve waste rock piles. The mining conditions and wastes formed acid, which leached toxic metals into surrounding surface water and ground water.

Nature of Environmental Damages: Soil, surface water, and ground water below the tailings piles and the now-flooded mine contain various heavy metals, including arsenic, cadmium, chromium, copper, lead, and zinc. Fish populations have declined in the river near mine waste areas. Well water located near the site also could be contaminated. Maloit Park is a wetland area located adjacent to the New Tailings Pile and has been affected by surface water and ground water flowing from the pile and from mass wastage spreading from the pile. Finally, wind-blown particles from the tailings pile are of concern because of the proximity of the middle school.

Type of Cleanup Utilized: Between 1976 and 1979, the mine owners began cleanup activities such as treating mine water, revegetating small test plot areas, and building surface water diversion ditches along the old and new tailings ponds. Half the tailings deposited on Rex Flats were removed and a surface run-off ditch, a seepage collection pond, and a sump and liming facility between the pond and the Eagle River were constructed. In 1983 the mine was abandoned and the pumps were turned off. This caused the mine to begin flooding, which forced EPA emergency workers to remove transformers containing PCBs to avoid contamination. EPA also built dikes in the mine to divert water from the upper mine areas. In 1988, the State completed the following: plugging the mine portals; removing the roaster piles, Rex Flats tailings, and tailings pile; consolidating waste to a "new" tailings pile and capping it; pumping ground water; and monitoring the Eagle River. At this time, the former owners built five concrete bulkheads in mine openings to prevent discharge of contaminated water to the river from the mine. They also plugged the mine and reworked the mine tailings. In 1990, it was discovered that mine seepage, a failed ground water pump-back system, and run-off from tailings were discharging large quantities of metals into the river. The State and the potentially responsible parties therefore agreed to locate a water treatment plant on-site and collect and treat mine seepage. After a study in 1993, soil contamination was found to be of no concern to surrounding areas. However, heavy metal levels were elevated on the Maloit Park Wetlands, and a remedy for the soils area of the site was selected. Water drainage treatment and river impact monitoring will continue while long-term cleanup actions and additional site investigations are underway to protect the Eagle River from contaminated run-off from the site.

Estimated or Actual Costs of Cleanup: Not available.

Party(ies) Responsible for the Action: This site is being addressed through Federal, State, and potentially responsible parties' actions.

Herold Blackhawk

Site Overview: This three-acre site is located in the town of Black Hawk, Colorado. The site is on a bluff overlooking North Clear Creek, which flows past the site and through the town of Black Hawk.

Site Mining Activity: The site consisted of a trailer house, two portable buildings, a metal vat, numerous drums and containers, process equipment, one mine shaft, and an assortment of scrap material. The materials found on-site indicated that the site was used for a metals reclaiming operation, although other materials were suspected to have been used in the production of narcotics. The portable building on the south side of the site was obviously used as a laboratory, containing laboratory chemicals, several drums, bottles of unknown solutions, and broken glassware. As of October 1986, the site had been abandoned for at least six months.

Nature and Type of Contamination: Acids, bases, and cyanide solutions were found on-site, in addition to a one-gallon container of photo ionizer and various unidentifiable chemicals. The mine contained approximately twenty drums, in addition to another twenty on the nearby hillside. Other unidentifiable chemicals were also found on the hillside.

Nature of Environmental Damages: This site posed a number of potential threats. The mixing of the cyanide and acids or a release due to routine meteorological events were a concern. Direct exposure to the cyanides and acids on the site could cause irritation of the respiratory tract when inhaled, along with burning, choking, coughing, and sever breathing difficulty. Severe burns could result from spilling acid on the skin. Ingestion of the acids might cause burns of the mouth, throat, and stomach. The release of HCN gas also was a grave concern, because the gas, when liberated from cyanide salts and inhaled, will cause asphyxiation. People having low level exposure to HCN show the symptoms of vomiting and decreased respiratory rate. Skin contact with the dust may be irritating and produce ulcers which are slow in healing. Finally, the contamination of North Clear Creek in the event of a release was a concern. The site drains under the highway and directly into a heavily-used water body. Any substantial release from the site could have immediately affected the highway, the creek, and the Town of Black Hawk.

Type of Cleanup Utilized: The Emergency Response Contract Services (ERCS) mobilized in September 1986, aided by the US Coast Guard Pacific Strike Team and the Regional Technical Assistance Team. Mine shaft portals were inspected by the Mine Safety and Health Administration (MSHA). HazMat analysis was completed on 155 samples from the various containers, and all drums were moved to a common loading area. All cyanide solutions were combined into a single 600-gallon vat. Decaying and deteriorating containers were repackaged, and disposed of at a RCRA-approved disposal facility. The PCB wastes were manifested through General Electric Company. The USPCI Grassy Mountain disposal facility received 45 drums of acid and base wastes, in addition to the 600 gallons of cyanide wastes, which were first neutralized by the ERCS contractor. Security was maintained by an unarmed, 24-hour security guard, until all hazardous substances were removed from the premises.

Estimated or Actual Costs of Cleanup: The actual cost of cleanup, including extramural expenses, intramural expenses, and US Coast Guard expenses, was $117,057.

Party(ies) Responsible for the Action: The primary potentially responsible party, Mr. Joe Harold, was financially unable to perform or conduct a potentially responsible party funded removal action under a CERCLA 106 order, and declined to participate in the site cleanup. The Colorado Department of Health was on-site during the removal and participated in the coordination of the site cleanup. The Black Hawk Town Marshall assisted EPA with site security. MSHA, EPA, and USCG Pacific Strike Team assisted with the Removal Action.

Smeltertown

Site Overview: This site, located in Salida, Colorado, encompasses 120 acres. This site is contaminated with arsenic, cadmium, copper, lead, manganese, and zinc as a result of smelting, wood treating, and zinc sulfate manufacturing activities that took place from the turn of the century until 1920.

Site Mining Activity: The Smeltertown site has been affected by three different industrial activities: smelting; wood treating; and zinc sulfate manufacturing. Beginning in 1925, wood treatment occurred at this site using creosote and possibly pentachlorophenol (PCP). The site also was used to dispose molten slag for eighteen years.

Nature and Type of Contamination: Hot slag extracted from furnaces was dumped along the banks of the Arkansas River, and still lines the eastern bank of the river today. Creosote and PCP used in wood treatment were allowed to drip onto the ground after the lumber was treated, resulting in creosote-contaminated soils.

Nature of Environmental Damages: Contaminated soils and slag contain elevated levels of arsenic, cadmium, copper, lead, manganese, and zinc. Soil is also contaminated with creosote and PCP from wood treatment. The ground water is contaminated with zinc. Localized areas of contamination include several drum piles, sludge disposal and storage areas, and two wastewater lagoons.

Type of Cleanup Utilized: In 1986 and 1992, creosote-contaminated soils were removed from the site. In 1993, residents were provided with bottled water in response to zinc contamination in residential wells, and lead- and creosote-contaminated soils were removed from residences. The EPA completed its investigation of the contamination in 1994 and selected a cleanup remedy in 1995. Additional cleanup activities are still in the planning stages.

Estimated or Actual Costs of Cleanup: $3,000 was spent to provide an alternative water supply and to remove contaminated soils.

Party(ies) Responsible for the Action: This site is being addressed through Federal and potentially responsible parties' actions.

Smuggler Mountain

Site Overview: This 116-acre site in the northeast corner of Aspen, Colorado is an inactive silver and lead mining site that operated from 1879 to the mid- 1900s. Limited mineral production activities are still conducted on the site. Tailings and mine waste have contaminated the soil with lead, cadmium, and arsenic. In addition to a year-round population of 4,500, this area also receives a substantial number of seasonal visitors. The City of Aspen obtains its drinking water from the Roaring Fork River, 1,000 feet downstream from the site.

Site Mining Activity: Silver, lead, and zinc mining began in the late 1880s and continued, along with processing operations, through the 1960s. Most mines are abandoned, and tailings and mine waste have mixed with native soil and spread across the site.

Nature and Type of Contamination: Waste rock and mill tailings from mines in the area have been deposited between the Roaring Fork River and the Western side of Smuggler Mountain. The total volume of mine waste material is approximately 1,300,000 cubic yards. This waste has been dispersed over the years due to the establishment of a reprocessing facility in the 1960s and by subsequent residential development. Development in this area has in many cases taken place directly over the contaminated soils, and this soil has also been used as fill material in some areas.

Nature of Environmental Damages: The soil is contaminated with lead, cadmium, and arsenic. Potential threats at the site include: accidental ingestion of contaminated soil; consumption of vegetables grown in contaminated soils; and future contamination of the Roaring Fork River. Presently, the potential for human exposure exists through direct contact of soils and inhalation of contaminant-laden dust by people on-site and nearby residents.

Type of Cleanup Utilized: Fencing was installed and warning signs were posted by a potentially responsible party around portions of the site. In 1990, EPA excavated, recontoured, and capped contaminated soil on two residential properties as a demonstration project. In 1993 EPA chose the following remedies: capping and revegetating the berm area; covering, revegetating, and monitoring the common-use areas of exposed mine waste; implementing a blood-lead surveillance program for young children in the area; planting vegetable gardens in at least twelve inches of clean soil; and using the local Health Department to evaluate site construction projects or land use changes to determine whether they present a threat of soil exposure to young children. EPA is currently conducting an environmental engineering/cost evaluation to examine alternatives for addressing contamination in the mine area.

Estimated or Actual Costs of Cleanup: The estimated cost for remedial actions at the two operable units at the site is $7.2 million.

Party(ies) Responsible for the Action: This site is being addressed through Federal, State, and potentially responsible parties' actions.

Summitville

Site Overview: This site is located in Del Norte, Colorado, covering 1,400 acres of the San Juan Mountains. Mining operations at the site began in the late 1800s and continued until 1986, when problems with discharges contaminated surface waters with cyanide and metals.

Site Mining Activity: Mining operations began at this site in the late 1800s and continued until 1986. In 1986, the present operator began open-pit mining and gold recovery operations through cyanide heap leaching. The mining operation was originally designed as a non-discharging wastewater facility, but was eventually forced to obtain a National Pollutant Discharge Elimination System (NPDES) permit from the State to open a wastewater treatment plant. Several releases of water contaminated with cyanide and metals have occurred. The State has issued Notices of Violation to the operator for the unpermitted releases of contaminated water.

Nature and Type of Contamination: The tunnels that were used in the mining operations were the source of acid mine drainage and heavy metal contamination. In addition, cyanided leakage occurred, penetrating the soil at a rate of 10 feet per year. In 1991, a cyanide spill flowed directly into surrounding waters.

Nature of Environmental Damages: Water contaminated with cyanide and metals has been released into the surrounding environment. Fish kills have been reported from Wightman Fork to the Terrace Reservoir, approximately twenty miles downstream from the site.

Type of Cleanup Utilized: EPA is currently maintaining the site to ensure that no accidental releases of contaminated waters occur while cleanup activities are planned. A time critical removal action was initiated in September 1993, when the system which drains water from the historic underground mine workings was plugged. This flooded the mine workings and is expected to reduce production of the acidic, metal-contaminated water. Other non-time critical removal actions included: the removal of the Cropsy Waste Pile; construction of a cap to be placed over the waste in the mine pits that will reduce infiltration of water into the waste material and existing underground workings; the detoxification and closure of the heap leach pad; and the stabilization and control of erosion and generation of acid mine drainage.

Estimated or Actual Costs of Cleanup: Costs have risen to $3.5 million, at an average cost of $30,000 per day. The ultimate cost of cleanup has not been determined.

Party(ies) Responsible for the Action: This site is being addressed through Federal and State actions. The most recent operator has declared bankruptcy, and EPA is maintaining the site using CERCLA emergency funds.

Canyon Creek Mine

Site Overview: This 100-acre site is located on Canyon Creek, a tributary of the South Fork Coeur d'Alene River (SFCDR), within the Coeur D'Alene River Basin. The site is near the communities of Woodland Park and Wallace, Idaho. Woodland Park is a residential area with a population of approximately 120 people, and Wallace is a residential and commercial area with a population of approximately 1,300 people.

Site Mining Activity: Mining, milling, and related activities took place in this historic mining district. The site is relatively flat and was used as an impoundment area for the upstream milling operations. In the early 1900s, a wooden dam was erected across Canyon Creek to contain the tailings. The site is now used for recreational activities.

Nature and Type of Contamination: The site contains approximately 400,000 cubic yards of mine wastes and contaminated sediments. These contaminated materials have been distributed across the entire site, and are available for hydraulic transport. Contaminated materials, including elevated levels of cadmium, lead, and zinc, are present in the soil, sediment, surface water, and ground water. The majority of the site is covered with fluvially deposited tailings along the stream course.

Nature of Environmental Damages: The site is sparsely vegetated, due to limiting soils factors such as acidity, heavy metals, lack of horizon structure, and low organic matter. The aquatic system is also very degraded, due to channelization and the deposition of sediments that have depleted the pool/riffle stream structure. Decreased stream depth and the absence of riparian habitat has permitted increased water temperatures and impaired the development of riffle structures. Human health concerns include the airborne dusts that may result in respiratory risk and that may redistribute contaminated particles to surrounding residential areas; the contaminated ground water that may present excessive risk through potential ingestion of contaminants of concern; and the surface water transport of contaminants of concern and contaminated sediments that can redistribute the contaminants to other areas accessible by the local population.

Type of Cleanup Utilized or Proposed: The contaminated materials at the site will continue to affect downstream water quality unless they are removed from erosional and metal dissolving forces. For this reason, a lack of cleanup may present an imminent and substantial endangerment to the public welfare or the environment. The excavation of tailings and contaminated sediments, followed by on-site disposal, is the proposed removal action. This would involve the removal of the tailings and contaminated sediments with conventional earth moving equipment, using a road system internal to the project area. The repository would be located at an elevation above the 100-year flood plain and would require basal fill. The soil cover would be graded and compacted to promote drainage. Then, the surface of both the tailings pond and the repository would be revegetated with native grasses to provide cover stability, limit human contact, reduce infiltration, and improve aesthetic qualities. The excavated areas also would be regraded and the soil would be amended and revegetated using native upland and wetland species. Instream structures would be installed to establish and enhance aquatic and riparian habitat. The State of Idaho Silver Valley Natural Resource Trustees would be responsible for the operations and maintenance of cover, drainage, and erosion control features for two years following the final placement of contaminated materials in the repository. Thereafter, Hecla Mining Company will be responsible for these operations and maintenance activities.

Estimated or Actual Costs of Cleanup: The estimated cost of the above-discussed cleanup is $2,298,750, including direct capital cost, indirect capital cost, and operations and maintenance.

Party(ies) Responsible for the Action: Those participating in the evaluation of this site and its proposed cleanup include the Idaho Department of Environmental Quality and the State of Idaho Silver Valley Natural Resources Trustees. In addition, other State and local representatives have been involved as a consequence of their

participation in the Coeur d'Alene Basin Restoration Project or public involvement opportunities. Project participants have been and continue to be involved in project implementation and management.

Cinnabar Mine

Site Overview: This 50-acre site is located 15 miles east of Yellow Pine, Idaho. The site consists of mine adits, an old wooden dormitory, several smaller abandoned buildings, a collapsed processing plant, storage tanks, tailings piles, tailings impoundments, and miscellaneous debris. There is a gate with a Forest Service padlock at the site to restrict access by recreational forest users. Cinnabar Mine is part of a remote area at the headwaters of the Salmon River drainage basin. Cinnabar Creek enters Sugar Creek two miles above the confluence of Sugar Creek and the Salmon River. Both Sugar Creek and the Salmon River have native salmon and trout populations. The nearest residence is a mining camp approximately two miles south of the site.

Site Mining Activity: Mercury mining operations occurred from 1921 through 1958. Historically, the ore processing method was to roast the ore, containing mercuric sulfide, with oxygen to produce free mercury vapor and sulfur dioxide gas. Mercury was collected when the vapor was cooled by flue condensers using an uncontrolled process. During operations, mercury could be collected from the walls and rain-gutters of the process buildings. A fire in 1965 destroyed the processing mill, and the plant was rebuilt with a new extraction process that utilized wet flotation and electro-separation. The mine has since been abandoned.

Nature and Type of Contamination: Two tailings piles were located at the site, which had a combined estimated volume of 100,000 tons. These piles contained mercury, arsenic, and antimony, and were not protected from erosion and were subject to run-off. Two tailings impoundments were located on Cinnabar Creek directly downstream from the site, containing tailings generated by the flotation mill. These tailings were estimated at 5,000 cubic yards and were not vegetated. Three transformers were located on the site; one was on a downed pole and the other two were broken apart and lying on the ground. A condenser stack was located in Cinnabar Creek, which was reported to contain high concentrations of mercury which could migrate through the surface water and sediment. Materials potentially containing asbestos also existed on the site. A number of tanks in various stages of decomposition on the site included fifty 55-gallon drums containing sodium carbonate decahydrate, drums containing white powder and blue-green materials speculated to be copper sulfate, and drums containing diesel oil. In May 1988, at least 1,000 gallons of oil were inadvertently released into Cinnabar Creek from the largest tank on site.

Nature of Environmental Damages: Actual and threatened releases of hazardous substances, pollutants and contaminants from the site presented an imminent endangerment to public health. The site was not secured against visitation by hikers and hunters, and contained no warning signs. Potential for exposure to asbestos, PCBs, caustic chemicals, arsenic, mercury, and physical hazards existed on the site. Insulation in a decaying state that most likely contained asbestos remained on the site, as well as caustic chemicals, residue in the old building, and decaying containers. The contamination threatened Sugar Creek and the Salmon River, which support sport fisheries within 15 miles downstream and are the habitats for the Snake River Spring/Summer Chinook Salmon, the West Slope Cutthroat Trout, the Bull Trout, and the Steelhead Trout. The surrounding wilderness area is also the home of the endangered grey wolf, peregrine falcon, bald eagle, and grizzly bear.

Type of Cleanup Utilized: In September 1992, the banks of Cinnabar Creek through the south tailings impoundments were fortified with rip-rap through a U.S. Department of Agriculture, Forest Service directive. The Idaho Department of Health and Welfare and the State of Idaho/Central District Health Department jointly performed an investigation at the site in 1984. The report concluded that the mine should be given a high priority for the cleanup of toxic wastes and compounds which may degrade the environment. The recommendations included: site stabilization, additional sampling, and remedial action. The EPA Region 10 Emergency Response Team and the EPA Region 10 Technical Assistance Team jointly performed a preliminary site assessment in June 1985, sampling water, soil, sediment, polychlorinated biphenyl in diesel, and air. The U.S. Department of Agriculture Forest Service, following notification of an oil spill in 1988, attempted to control the flow of oil by

diverting melted snow, constructing berms, and placing absorbent materials around the faulty tank. A report also was completed to assess water quality around the mine. It concluded that severe stress conditions were affecting the ecosystem downstream from the site. Presently, EPA is completing a time-critical removal at the Cinnabar Mine site. Activities began on September 9, 1996, and include diverting Cinnabar Creek so that is does not flow through the lower mine tailings piles. The tailings piles were then regraded and covered with soil already present at the site. This will allow vegetation to grow, stabilizing the tailings piles for the long-term. In addition, EPA is in the process of completing the following: bagging and disposing of the asbestos in a landfill on-site; stabilizing debris and sediment contaminated with mercury and arsenic, and placing it in an on-site landfill; removing the stack from Cinnabar Creek, cutting it into sections, and sealing the sections; removing and disposing of PCB-contaminated transformer parts and soil; removing and disposing of any fuel or sludge remaining in the storage tanks; removing caustic and other chemical wastes remaining on the site for proper disposal; and posting warning signs on the access road and trails that lead onto the site.

Estimated or Actual Costs of Cleanup: The cost of cleanup for this site has been estimated at $909,998.

Party(ies) Responsible for the Action: The only activity by the State of Idaho for this site has been the past site investigations. The Forest Service is willing to assist EPA in gaining access to the site by rebuilding the roads which have been washed out. The Forest Service has also assisted with access to the site for site visits and has provided technical assistance for past site activities and studies. The on-going time-critical removal is being completed by an EPA Emergency Response Unit.

Douglas Mine

Site Overview: This 40-acre site is located seven miles upstream of Pinehurst, Idaho. The area's population is estimated at zero within a two-mile radius, at ten within a two- to three-mile radius, and at 162 within a three- to four-mile radius. The region is mountainous, with narrow stream valleys and dense conifer forests. The majority of the site is within the East Fork Pine Creek (EFPC) floodplain.

Site Mining Activity: The site is a former lead, silver, and zinc mine and mill, where production originated in 1915 and continued through 1972. A 100-ton-capacity selective flotation mill was built in the early 1940s, but operated only between 1943 and 1949.

Nature and Type of Contamination: The site is composed of a mine and mill site and tailings impoundments. The mine and mill site consist of three mine adits, mill remnants and concrete foundations, and mine waste dumps. The mine waste dumps are estimated to contain 16,500 cubic yards of material. The tailings impoundments are separated from the mine and mill site by a county road, covering 2.5 acres and containing 40,000 cubic yards of material. Steambank cutting and tailings impoundment raveling are visually apparent, and the impoundment will adversely affect downstream water quality unless physically removed from erosional forces.

Nature of Environmental Damages: Zinc, cadmium, and lead contaminate the ground water, surface water, and sediments of Pine Creek, and downstream waters are contaminated as a result of erosion of the tailings impoundments during erosional, high flow events. The site is unsecured and there is evidence of trespassing. In addition, this site appears to be used as a recreational resource. There is a potential threat to human health from exposure to contaminants, through airborne dusts that can result in respiratory risk, ingestion of mine waste materials, and surface water transport of dissolved metals and contaminated sediments that may redistribute contaminants to areas accessible by the local populations. Finally, aquatic food chain organisms are threatened by the release of dissolved metal contaminants at the site. Continual exposure to contaminants will further delay the biological recovery of the downstream environment.

Type of Cleanup Utilized: The proposed remedial action is to remove the materials from the tailings impoundments and dispose of them in a nearby repository. This will mitigate solid- and dissolved-phase contaminant loadings to surface water and will eliminate the airborne, direct contact, and ingestion pathways. Mobilization for the proposed removal action was expected to occur in September 1996 and last 45 days.

Estimated or Actual Costs of Cleanup: The total estimated project ceiling for this site cleanup is $200,000.

Party(ies) Responsible for the Action: State and local governments have been and will continue to be involved with planning for and implementing removal actions within the Pine Creek watershed as a result of participating in the Coeur d'Alene Basin Restoration Project and public involvement opportunities.

Stibnite Mine

Site Overview: The Meadow Creek area of Stibnite Mine is located fourteen miles east of Yellow Pine, Idaho, and includes a large valley and Meadow Creek. Meadow Creek is a tributary of the East Fork and the South Fork of the Salmon River. This site is surrounded by U.S. Forest Service land. The nearest permanent residences are in Yellow Pine, 14 miles west. Mining has been, and continues to be, the primary land use in the area, however other uses include recreation and access to the Frank Church River of No Return Wilderness, located four and one-half miles downstream. Meadow Creek was diverted from the valley floor to a diversion channel at an elevation 20 feet higher in 1981. The creek reconnects with its original channel downstream of the tailings pile, north of a dam that was installed in 1982 to contain the contaminated tailings.

Site Mining Activity: This area has been mined for tungsten, antimony, and gold since the early 1900s, and operations ceased in 1993. Mining began as an underground operation, but in 1943 an open-pit operation was begun. After World War II, operations were converted to mill low-grade gold and gold-antimony ore, and a smelter was constructed to process the concentrates. In 1979, a commercial processing plant and mine were developed, and full-scale cyanide-heap leach processing started in 1982. A large tailings pile, approximately 3.7 million cubic yards, was deposited from 1939 to 1945, and is overlain by coarse spent ore that was deposited from 1982 to 1993.

Nature and Type of Contamination: A large tailings pile is located in the south end of Meadow Creek Valley, and is composed of silt- to sand-sized particles containing elevated concentrations of antimony, arsenic, cadmium, copper, mercury, nickel, and lead. Old mining process chemicals have been found abandoned in the area. The creek's diversion dike shows signs of leakage, erosion, and channeling. The point of diversion, where the creek takes a sharp curve to enter the diversion channel, is particularly unstable. Water flowing through the old channel on the valley floor is in direct contact with the contaminated tailings, and contaminated tailings line the banks of Meadow Creek for almost one mile downstream of the keyway. Tailings adjacent to the stream channel are exposed and continue to enter the creek during high spring flows. The tailings pile shows elevated concentrations of antimony, arsenic, cadmium, copper, mercury, nickel, and lead.

Nature of Environmental Damages: In the event of flooding of Meadow Creek, failure of the diversion dike could occur, resulting in the flooding of the old creek channel and subsequent transport of contaminated tailings and spent ore downstream to the Salmon River. The Salmon River provides habitat for the endangered chinook salmon as well as for cutthroat trout, whitefish, rainbow trout, and Dolly Varden. Downstream sediment, algae, and fish samples from both Meadow Creek and the Salmon River contain elevated concentrations of heavy metals and cyanide above background and reference values. This high level of metals in aquatic sediments indicates that bio-uptake has occurred. Recent water quality monitoring also suggests that contaminants continue to be released into water that comes into contact with the tailings pile. Currently, arsenic levels exist above those set for drinking water standards, elevated concentrations of iron and arsenic are prevalent in drainages below the waste rock piles, old tailings areas are devoid of vegetation, and two elk have died, presumably from ingestion of cyanide.

Type of Cleanup Utilized: Cleanup has not yet been initiated, though steps have been identified. Stabilizing the present Meadow Creek channel would prevent a failure of the diversion dike and would reduce the imminent or substantial threat to human health and the environment posed. It also would improve water quality in Meadow Creek and the Salmon River by minimizing contact of creek water with contaminated tailings in the pile and along the channel downstream of the keyway. This effort would include re-grading the point of diversion and isolating the creek from the pile to prevent deleterious metals impact on water quality. In the 1980s, a Preliminary Assessment/Site Investigation, including surface and ground water sampling, occurred. EPA initiated a CERCLA investigation into the site in 1985. The Idaho Department of Health and Public Welfare, Division of Environmental Quality, is currently reviewing a permit application for ore processing by cyanidation at the site.

Estimated or Actual Costs of Cleanup: The estimated cost of replacing or repairing the channel at the current location is $690,000. The total estimated cost, including extramural costs and intramural costs, is $919,000.

Party(ies) Responsible for the Action: The EPA will administer the removal action selected for this site in coordination with the U.S. Forest Service and the Idaho Department of Health and Public Welfare, Division of Environmental Quality. Stibnite Mine, Inc., pursuant to an Administrative Order on Consent, will be responsible for performing the removal action.

Success Mine

Site Overview: This site, located in Wallace, Idaho, is an inactive waste management facility. This site consists of an approximately fifteen acre parcel at the abandoned mine site on the East Fork Ninemile Creek (EFNC). This site is 0.5 miles from the nearest residence downstream, and one residence is located in the watershed upstream. The area is forested except in mine operation locations.

Site Mining Activity: Success Mine operated from 1900 through 1945, mining zinc, lead, and silver. This site is now an inactive waste management facility.

Nature and Type of Contamination: The milling fines in the tailings pile were deposited at the mine site from about 1910 through 1930. Tailings were deposited in the three downstream locations between 1930 and 1940. The overburden rock was deposited during some subsequent period. There are high concentrations of toxic metals in both the mine tailings and the ground water, including zinc, lead, copper, and cadmium. There is similar contamination in the tailings pile, including zinc, lead, and copper in the particulate materials. High surface flow from the creek results in erosion from the toe of the tailings pile, while similar high flow from a swale directly above the tailings pile hydraulically transports fines from the inside of the tailings pile and releases these fines to the EFNC near the bottom of the pile.

Nature of Environmental Damages: Actual and threatened releases of zinc, lead, cadmium, and copper from the tailings posed an imminent and substantial threat to the environment. Groundwater contamination due to toxic metals significantly affect a nearby perennial stream during the spring runoff. The tailings were in direct contact with the EFNC along a stretch 2,000 feet in length, and erosive forces contributed to stream loading of contaminated particulate and undercut the toe of the tailings pile. This erosion threatened to produce a catastrophic slope failure and associated stream loading. Drainage from the mine adit, overland surface water run-off, and ground water have transported heavy metals from the tailings to the creek. Water samples indicate high concentrations of metals that are toxic to aquatic organisms. These contributions, in conjunction with upgradient sources, have severely degraded the water quality and rendered the creek essentially lifeless.

Type of Cleanup Utilized: Emergency Response actions at the site involved a removal action at the Coeur D'Alene Basin. The objective of this removal action was to physically protect EFNC while improving its water quality. In-place isolation/stabilization of the mine wastes was accomplished by eliminating the road and relocating the creek to the former road bed location. Because this is not an NPL site, no remedial activities are in progress or planned at this time. No human health related problems appear to be associated with the site at this time, and no endangered species will be affected by proposed cleanup projects. Water quality and soil samples have been collected and analyzed, and the Idaho Division of Environmental Quality (IDEQ) is initiating an action at the site to address collection and diversion of surface water, mine adit drainage, and ground water. The IDEQ is also involved in a water quality monitoring and collection/diversion project on the site. State or local government funding is not available for conducting this removal action. Conditions exist at the site which meet the criteria for a removal action as stated in the National Contingency Plan (NCP), including possible imminent and substantial endangerment to the public welfare or the environment.

Estimated or Actual Costs of Cleanup: Cleanup costs for Emergency Response actions were estimated at $1,076,230 in 1993.

Party(ies) Responsible for the Action: This site was addressed through Federal Emergency Response actions. The removal of metals from the Coeur D'Alene Basin was a joint interagency (state, federal and local), tribe, and landowner effort.

Circle Smelting Corporation

Site Overview: The Circle Smelting Corporation occupies a 28-acre site in Beckemeyer, Illinois. Surface water from the site flows to an eastern or western drainage ditch. The site is bordered by vacant and residential land, populated by 1,070 residents. The village obtains its water supply from the City of Carlyle (Lake Carlyle). Several shallow wells outside the village limits use shallow ground water for water supply.

Site Mining Activity: Primary zinc smelting occurred on the property from 1904 through the 1920s, when the facility was converted for secondary zinc smelting operations. The primary smelting by-products were coal cinders and clinkers containing heavy metals. This waste was stockpiled on-site and used locally as underlayment for roads and walkway surfacing materials. Circle Smelting purchased the facility in 1965 and continued active secondary smelting operations at a much lower rate of production until 1995. The facility consists of eight smelting furnaces, an employee locker room, an office, and thirteen other production or support buildings. The northern half of the site contains a 17-acre unvegetated area that was used to store cinders during past operations. As of today, the facility is no longer in operation.

Nature and Type of Contamination: Smelter waste includes cinders from coal combustion in the smelting process, and clinker waste materials and various forms of slag with high levels of heavy metals that were generated and stockpiled on-site. Also on-site are numerous retort casings that contain residual cinder material with elevated metals concentrations. The Village of Beckemeyer has been contaminated by smelting activities where the cinder material was used as fill or walkway surfacing material. The chemicals of potential concern are antimony, arsenic, cadmium, copper, lead, mercury, nickel, silver, and zinc. Lead is the metal of primary concern because of the lasting detrimental effects it can have on infants and children.

Nature of Environmental Damages: The concentration of metals in soils and cinders are above background levels, and site contaminants have been detected as far downstream as the confluence of the unnamed intermittent creek with Beaver Creek. The drainage ways north of the smelter have received contaminated runoff, and a residential area south of the site has elevated metal concentrations caused by air deposition of materials released from the site as dust or fugitive stack emissions. Ecological effects also exist from elevated concentrations of arsenic, lead, and zinc, and both federal- and Illinois-listed threatened and endangered species have been identified five miles from the site near Carlyle Lake.

Type of Cleanup Utilized: In May 1996, the excavation of residential soils and sediment with on-site disposal, and the containment of on-site soils and materials with a soil cap, were proposed. This removal would consist of the following: excavation of observable soils and cinders from the residential area and soil in areas of deposition south of the plant and transportation to the smelter property; excavation of drainage way sediments and removal to plant; consolidation and placement of a clay and soil cover over contaminated cinder and soils from the residential area and smelter property, and sediment from drainage ways, with erosion control to prevent continued release to surface water and stream sediments; and placement of clay and soil cover over the former pond area with erosion control. This removal would introduce risk to the community during excavation of cinders and soil, as residents would be in direct contact with dust containing heavy metals. In addition, heavy vehicular traffic and noise could be a community nuisance. However, removal would eliminate the risk to residents from the contaminated sediments and the risk to biota in the drainage ways by eliminating runoff. The impacts to ground water after this removal are unknown at this time.

Estimated or Actual Costs of Cleanup: The estimated cost of the above cleanup is $9,446,000.

Party(ies) Responsible for the Action: Sampling and site assessment work has been completed by the Illinois State Water Survey, Illinois State Geologic Survey, Illinois EPA, US EPA, and US EPA Technical Assistance Team.

Cherokee County

Site Overview: This site, located in Cherokee County, Kansas, is a result of 100 years of lead and zinc mining. This 110 square-mile site has contaminated ground water, soil, air, and surface water with lead, cadmium, selenium, zinc, and chromium. Surrounding lands are used for residences, business, light industry, farming, and grazing. Cherokee County has a population of 22,320, and many of the residents live in areas that depend on ground water from the contaminated aquifer for drinking.

Site Mining Activity: One hundred years of lead and zinc mining created piles of mill tailings, covering this 110 square mile site. The EPA has divided this site into six subsites that correspond to six general mining locations.

Nature and Type of Contamination: Portions of this site have large tracts of mine and mill wastes, water-filled craters where the ground has collapsed, open mineshafts, and pits. The mill tailings, containing lead, zinc, and cadmium, have leached contaminants into the shallow ground water. Run-off from the waste piles also moves contaminants into nearby streams. The site is covered with huge mine waste piles known as chat piles, composed of chert limestone and calcite, in addition to small amounts of lead, zinc, cadmium, and asbestos. Acidic water in the mineshafts contains high concentrations of toxic metals.

Nature of Environmental Damages: The wastes have contaminated shallow ground water with lead, cadmium, selenium, zinc, and chromium. This ground water is a primary drinking water source for the residents in the area. Several heavy metals also were found in water samples from private wells. Acidic waters in mineshafts throughout the site, tailing piles, surface waters in the mine pits, and streams across the site contain significant concentrations of lead, cadmium, and zinc. Radon gas from the mining operations has been detected in the air around one of the subsites. Risks to public health include accidental ingestion of soil or mine wastes; inhalation of contaminated household dust; and ingestion of contaminated surface waters, foodstuffs, or ground water. Acid mine drainage containing dissolved heavy metals contributes to the transport of heavy metals into the Spring River, Short Creek, and Shoal Creek. Contamination has also been found in fish from local surface waters.

Type of Cleanup Utilized: The immediate actions taken by the EPA included the installation of water treatment units on eight contaminated wells and the evaluation of water supply monitoring programs for public and private sources of water. In 1987, EPA collected clean ground water and distributed it through a pipeline network to houses, businesses, and farms which needed alternate water supplies. Later, the EPA constructed two deep aquifer wells to collect water, as well as two water storage tanks, which are maintained and operated independently. Water line easement acquisition activities began in 1991 and were completed in 1993. These activities have reduced the potential for exposure to contaminants at the Cherokee county site while remaining cleanup investigations are underway.

Estimated or Actual Costs of Cleanup: Not available.

Party(ies) Responsible for the Action: This site is being addressed through Federal and potentially responsible parties' actions.

Torch Lake

Site Overview: Torch Lake is a 2,700-acre lake located in the Keweenaw Waterway of Michigan's Upper Peninsula. Copper mining activities from the 1890s until 1969 generated mill tailings that have contaminated the lake sediments and shoreline. Approximately 4,000 people live within one mile of the lake, and most drinking water for the area comes from springs or a municipal well located one-fourth of a mile north of the lake.

Site Mining Activity: From 1890 to 1969, copper mining activities produced mill tailings that contaminated the lake sediments and shoreline. Currently, the only active industry in the area is the Peninsula Copper Company, which reclaims copper oxide from scrap electronic circuit boards.

Nature and Type of Contamination: Approximately 200 million tons of copper mill tailings were dumped into the lake, where contaminated sediments are believed to be up to 70 feet thick, and surface sediments contain up to 2,000 parts per million of copper. The tailings were dredged up in the early 1900s, and were processed with flotation chemicals to reclaim copper. Substantial quantities of these tailings and flotation chemicals returned to the lake and the shoreline. The lake also has received mine pumpage, leaching chemicals, explosive residues and by-products, municipal and industrial trash, and sanitary wastes. In 1972, an estimated 27,000 gallons of cupric ammonium carbonate were released into the lake from storage vats. During the early 1980s, the Peninsula Copper Company dumped processing water containing 2,400 times the local sewage authority's allowable limits for copper and 100 times the limit for ammonia into the Tamarack lagoon system.

Nature of Environmental Damages: The sediment and surface water are contaminated with copper and cupric ammonium carbonate. Direct contact or ingestion of these contaminated sediments and surface water poses a health hazard. The Michigan Department of Health issued a fish consumption advisory, because the contaminants already have affected the lake's fish and aquatic vegetation. Physical hazards on the shoreline and in the water, such as abandoned buildings, old machinery and equipment, and other discarded metal objects such as rusting barrels, also are a concern.

Type of Cleanup Utilized: This site is being addressed in three stages: immediate actions; cleanup of on-site tailings/slag piles; and cleanup of surface water, sediment, and ground water. Immediate actions began in 1988 when EPA conducted field investigation activities to determine the nature and extent of contamination. A geological survey located twenty empty drums on the surface, which were excavated, sampled, and removed. In 1990, twelve more drums were located and removed. EPA also removed all the contaminated soil from beneath the drums. Cleanup of the on-site tailings/slag piles began in 1990, when EPA completed a bathymetric survey to locate submerged tailings and slag piles on the shore. These data were used to study the nature and extent of contamination and to identify cleanup alternatives. In 1992, EPA began covering these piles with soil and vegetation, a remedy expected to be completed in late 1997. Surface water, sediment, and ground water contamination were within safety standards when EPA completed sampling under all tailings piles. Therefore, a "No Action" remedy for surface water, sediment, and ground water was selected in early 1994.

Estimated or Actual Costs of Cleanup: Not available.

Party(ies) Responsible for the Action: This site is being addressed through Federal, State, and potentially responsible parties' actions.

Oronogo-Duenweg Mining Belt

Site Overview: This site is located 2 miles northeast of Joplin in Jasper County. Mining operations for lead and zinc ores, as well as some cadmium ores, occurred from 1848 until the late 1960s. Approximately 1,500 people obtain drinking water from private wells located within 3 miles of the site.

Site Mining Activity: The Oronogo-Duenweg Mining Belt site, which covers 6,400 acres, is considered to be part of the Tri-State Mining District of Missouri, Kansas, and Oklahoma. At the turn of the century, at least 17 primary lead and zinc smelters were located within the site. One of these smelters, located in northwest Joplin, continued processing and smelting lead ore until the mid-1900s. Smelting operations resulted in release of fugitive dust and stack emissions fallout that has contaminated soil in large areas of the site. Lead and zinc ores, as well as cadmium ores, were mined from 1848 to the late 1960s, with the greatest activity occurring in an area between Oronogo and Duenweg, northeast of Joplin. The site is honeycombed with underground workings, pits, shafts (open, closed, and collapsed), mine tailings, waste piles, and ponds holding tailing waters.

Nature and Type of Contamination: An estimated 10 million tons of wastes or tailings are on the site. Throughout the mining era, ground water had to be pumped to prevent the flooding of mines. When mining ceased, the shafts and underground workings filled with water. Tailing piles have been left uncovered and unstabilized. Leachate and run-off from the piles can enter open shafts and pits.

Nature of Environmental Damages: Tests conducted in 1977 by the U.S. Geological Survey, and by the potentially responsible parties in 1993 and 1994, found soil, on-site ground water, and surface water to be contaminated with heavy metals including lead, zinc, and cadmium from the mining operations. Potential risks may exist through ingesting contaminated surface water and ground water or coming into direct contact with contaminated soil or mine wastes.

Type of Cleanup Utilized: This site is being addressed in three phases: initial actions and two long-term remedial actions focusing on cleanup of mine and mill wastes and ground water. Providing bottled water to affected residences and removing contaminated residential yard soil has reduced the potential for exposure to contamination at the Oronogo-Duenweg Mining Belt site while final cleanup activities are being planned.

Estimated or Actual Costs of Cleanup: Not available.

Party(ies) Responsible for the Action: This site is being addressed through Federal and potentially responsible parties' actions.

Anaconda Company Smelter

Site Overview: This site, located in Deer Lodge Valley, Montana, covers 6,000 acres. Wastes from nearly 100 years of smelting operations have contaminated the air, soil, surface water, and ground water with a number of heavy metals and other pollutants. Anaconda, with a population of 10,000 people, is located one-half mile west of the smelter.

Site Mining Activity: Copper smelting began in the 1880s and did not cease until 1980. Ore was mechanically concentrated, roasted, and smelted in furnaces to produce copper matte and slag as a waste product. The slag material was sold for sand blasting, and was also used as a road-sanding material by the Montana Department of Highways.

Nature and Type of Contamination: Wastes from nearly 100 years of smelting operations were distributed over this vast site by mechanical operations, slurry ditches, and the wind. The smelting process produced wastes high in metals, including 185 million cubic yards of concentrated ore wastes called mill tailings, 27 million cubic yards of furnace slags, tens of square miles of contaminated soils, and 360,000 cubic yards of flue dust.

Nature of Environmental Damages: Surface water, ground water, and soil contain heavy metals such as arsenic, cadmium, copper, zinc, and lead. The contamination posed an imminent and substantial threat to the health of the residents. Potential human health risks include the accidental ingestion of contaminated soil or ground water and inhalation of airborne contaminants such as arsenic, cadmium, and lead from wind-blown contaminated soil. Mill Creek, the closest residential community, was found to have the highest levels of contamination of any of the inhabited areas around the smelter.

Type of Cleanup Utilized: This site is being addressed through a number of response actions. To date, an Emergency Response action, four removals, and two long-term remedial actions have been completed. A number of ongoing studies are focusing on the cleanup of remaining areas of contamination at the site. The Emergency Response action in 1987 involved permanently relocating residents of Mill Creek, storing and disposing of the debris from relocation and demolition, monitoring and maintaining the vegetation and the fence installed around the area, and imposing controls on access and land use. In 1992, wastes from the banks of Warm Springs Creek were removed, fencing and signs were installed to restrict access to waste piles and ponds, and breaks in the levee along Warm Springs Creek were repaired. A temporary compacted soil cover also was placed on the repository and a final cover was installed in 1995.
A remedy for flue dust also was selected that included stabilizing approximately 316,500 cubic yards of flue dust using cement and lime, and placing treated materials in an engineered repository.

Estimated or Actual Costs of Cleanup: Not Available.

Party(ies) Responsible for the Action: This site is being addressed through Federal, State, and potentially responsible parties' actions.

McLaren Tailings

Site Overview: This ten-acre site is located in Park County, approximately one-half mile east of Cooke City, Montana. The site lies in the Soda Butte Creek valley floor, comprised of both Gallatin National Forest land and private property. Adjacent to Soda Butte Creek, McLaren Tailings is five miles upstream from the northeast entrance to Yellowstone National Park.

Site Mining Activity: Placer gold was discovered in the Cooke City area in 1869. From the 1870s to 1967, ore from the McLaren Mine (part of the New World Mining District) was processed at the McLaren Tailings site for gold and silver extraction. A cyanide leaching process was used for this process until 1967. The first lode ore processing began in 1875, and a Mexican-type furnace was constructed for lead production. A smelter for processing lead-silver-zinc ore was constructed in 1875 as well, and a cyanide mill for gold ore beneficiation followed in 1893.

Nature and Type of Contamination: During the period that the mill was operational, approximately 150,000 cubic yards of waste material and tailings were deposited on the valley floor of Soda Butte Creek, which originally meandered through the area currently overlain by the tailings. During the late 1960s, Bear Creek Mining Company leveled the tailings piles, capped them with soil material, and re-routed Soda Butte Creek around the north edge of the tailings. Approximately two-thirds of the surface acreage consisted of soil-capped mill tailings which were impounded behind an earthfill dam and a small downstream dike. The lower tailings pond was located downstream from the tailings dam, and was impounded by a shallow, earth dike. The remainder of the site was covered with landscape ore piles and a mill site on the hillside north of Soda Butte Creek.

Nature of Environmental Damages: Soda Butte Creek has experienced serious degradation caused by the flow of leachate from the tailings and surface run-off from the mill site. In 1989, the tailings were not found to pose a significant threat to human health because the major routes (air, direct contact, surface water, and groundwater consumption) for human exposure to toxic quantities of heavy metal contaminants did not exist. The major impact of the tailings was determined to be environmental, because the continuous release of acidic, heavy metal-contaminated water from the tailings was severely degrading the ecosystem of Soda Butte Creek. The tailings and the seeps emitted from the tailings were also violating State water quality standards for Soda Butte Creek and compromising water quality. The heavy metals aluminum, copper, iron, and manganese were present at high concentrations that were toxic to aquatic life. A substantial flooding potential also existed at the site, and the failure of the tailings dam could result in a substantial release of contaminated material into the creek, significantly affecting the ecosystems downstream. These effects could include the following: deposition of metal laden sediment within the channel, smothering fish spawning grounds; a decrease in the available substrate for aquatic invertebrate production; and possible loss of aquatic organisms. Indirect impact from the tailings dam failure would have been equally significant for the wildlife dependent upon surface water and the riparian habitat in the creek. The endangered species which utilize these riparian habitats are the grizzly bear and the bald eagle.

Type of Cleanup Utilized: Cleanup at the site began with subsurface geologic investigations in September and October, 1989, to provide data for designed site stabilization structures. The results of the investigation led to specifications for remediation which commenced in April 1990. The following work was performed: construction of a stability berm along the downstream face of the tailings dam; construction of an eight-inch diameter embankment drain within the stability berm; construction of a soil-bentonite slurry trench cutoff wall immediately downgradient of the emergency dike; and construction of an eight-inch diameter subsurface drain along the southern perimeter of the tailings. In August 1991, additional tasks were requested by EPA and completed by the potentially responsible party. These included: running the bulldozer parallel to the slope of the dam to enhance reseeding operations; filling in some of the exploration holes in the tailings cover; and leveling the slope over the toe drain in the area where the seep occurred to encourage water to flow into the drain. Construction was completed on August 20, 1991.

Estimated or Actual Costs of Cleanup: The estimated cost of cleanup was $247,600.

Party(ies) Responsible for the Action: The primary potentially responsible party, Kennecott Copper Company, opted to perform the site stabilization work.

Silver Bow Creek/ Butte Area

Site Overview: This site is located in Butte, Montana, and covers 140 miles of stream and riparian habitat. This area was used as a conduit for mining, smelting, industrial, and municipal wastes for over 100 years, contaminating the ground water, surface water, soil, and air. This site includes the cities of Butte and Walkerville (population 38,000) and is approximately 450 acres in size.

Site Mining Activity: This site begins above Butte, near the Continental Divide, and extends westward along Silver Bow Creek and the Clark Fork River to the Milltown Reservoir. Most of the ore mined in this area was shipped 26 miles west to Anaconda, MT. Copper, silver, gold, zinc, lead, manganese, and molybdenum have been mined from both underground mines and open-pit mines in this area. Over 3,500 miles of underground workings exist in the area, some of which are over 5,000 feet in depth.

Nature and Type of Contamination: Silver Bow Creek has historically received discharge from mining, smelting, wood treating, and other industrial and municipal sources for over 100 years. Vast mill tailings deposits are found along the creek and river, which have been dispersed over the entire flood plain. These deposits contain elevated levels of metals. Prior to 1911, when pollution control measures were first initiated, all mining, milling, and smelting wastes were discharged directly to Silver Bow Creek.

Nature of Environmental Damages: Wind-blown particles, ground water, surface water, and soil are contaminated with arsenic, copper, zinc, iron, cadmium, mercury, and lead. Silver Bow Creek and Clark Fork River contain metals from Butte to Milltown. The tailings dispersed along the creek and river severely limit aquatic life forms. Potential health risks include direct contact and accidental inhalation of contaminated soil, ground water, and surface water, as well as inhalation of contaminated air particles. In addition, the ROD for the Warm Springs Operable Unit identified a number of human health risks: workers at the site face an increased cancer risk due to incidental ingestion of arsenic in contaminated soils, sediments, and tailings; people at the site for recreational purposes face an increased cancer risk from exposure to arsenic; workers and other people at the site face additional cancer and non-cancer risks due to ingestion of lead and other hazardous substances in the contaminated soils, sediments, and tailings; the contaminated ground water poses a threat to ground water users; and the berms protecting the ponds fail to meet current safety standards.

Type of Cleanup Utilized: Many cleanups have been completed at this site, including: the excavation of contaminated soil in Walkerville, Timber Butte, and 25 other waste rock dumps in residential neighborhoods; the construction and implementation of a pumping and piping system in the West Camp/Travona Shaft area; and the removal of contaminated soil in the Rocker Timber Framing and Treating area. These actions have reduced the potential health threats to the surrounding communities. However, EPA has determined that high concentrations of metals in the soil and drainage from the mine waste dumps still pose risk to human health and the environment, and will be addressed in future cleanups.

Estimated or Actual Costs of Cleanup: The estimated cost of remedial measures is $57,037,000, in addition to $379,000 annually for operation and maintenance at the site.

Party(ies) Responsible for the Action: This site is being addressed through Federal, State, and potentially responsible parties' actions.

Bluewater Uranium

Site Overview: The Bluewater Uranium Mine sites include the Brown-Vandever-Nanabah mines and the Navajo-Desiderio mine, located five miles west of Prewitt, NM. The site is within the Grants Uranium Mining District, located on four Indian Allotments and one parcel of Federal land which is administered by the Bureau of Indian Affairs. Several families live and work on the site.

Site Mining Activity: The mines on this site were operated periodically from 1952-1970 by several mining firms. Operations at both mine sites consisted of both open pits and underground mines. Open pit mining was conducted predominantly with large front end loaders and haul trucks. Underground mining was conducted by driving adits to the ore zones within the limestone deposit. It is estimated by the Navajo Nation that 25,000 tons of uranium ore were removed from these mines.

Nature and Type of Contamination: The uranium ore on-site is primarily calcium carnoite, which disseminates through the Jurassic Todilto limestone. The mining activities at the site and the absence of reclamation activities resulted in large open pits with exposed uranium bearing tailings, protore, and tailings piles. Soil at the site was contaminated with both uranium and radium isotopes. Soil sampling indicated that radionuclide levels exceeded regulatory guidelines.

Nature of Environmental Damages: There existed no restriction preventing local residents and livestock from accessing the tailings piles or mine shafts. Local children were known to play on or near the tailings. There was also evidence that many of the surrounding home owners used mine tailings as foundation materials for their structures. The actual or potential exposure to hazardous materials on-site was a threat to the local human and animal populations. The local population was potentially being exposed to the radiation through the following pathways: inhalation of radon daughters; direct exposure to elevated gamma radiation; inhalation and ingestion of airborne radioactive particles; and ingestion of contaminated meat. Constant or frequent exposure to elevated gamma radiation is known to cause severe health effects. In addition, the high levels of hazardous substances in soils at or near the surface can migrate to other areas. The severe thunderstorms and flash flooding in the area was also breaking down and transporting the mine tailings. The high emissions of gamma radiation being emitted from the tailing piles may also adversely affect the local biota and wildlife. The radionuclides could enter the local food chain as the livestock ingest contaminated biota.

Type of Cleanup Utilized: EPA completed removal actions at the site in 1991. The following was completed: areas emitting elevated gamma radiation were filled, graded, and covered with earth; mine adits, inclines, and shafts were filled, sealed, and capped; warning signs were posted to advise people to not disturb reclamated areas; and affected lands were revegetated with natural grasses.

Estimated or Actual Costs of Cleanup: The cost of this removal was estimated at $629,770.

Party(ies) Responsible for the Action: The Navajo Superfund Program has been actively investigating this site since 1989. The Navajo Superfund Program assisted in site assessments and studies prior to cleanup. EPA completed the removal action.

Cimarron Mining Corporation

Site Overview: This site is located in Carrizozo, New Mexico. Before 1979, gold was extracted from this site. Between 1979 and 1982, a metal recovery mill operated on the site. Currently, the site consists of an inactive production facility. Approximately 1,000 people obtain drinking water from 29 municipal wells within three miles of the site. The nearest municipal well is about two miles away from the Cimarron Mining Corporation area and one half mile from the Sierra Blanca mill area. Wells also are used to irrigate food crops.

Site Mining Activity: Before 1979, this ten-acre site was used primarily for the extraction of gold using cyanide. From 1979 to 1982, the site operated as a metal recovery mill using a solution of cyanide salt and metal stripper. The milling facility was originally constructed to recover iron from ores. This iron-recovery process did not originally use cyanide, but between 1979 and 1982 cyanide was used to recover precious metals. The site is currently an inactive mill for pulverizing rock ores. It consists of a one-acre area bounded by a county road, containing an evaporated tailings pond. There are also several mounds of cyanide-treated mine tailings.

Nature and Type of Contamination: The precious metal recovery facility consisted of a conventional agitation cyanidation mill, and discharged contaminated liquids which resulted in the stockpiling of contaminated tailings and waste trench sediment at the site. The sources of environmental cyanide contamination at the site are the processed waste materials, the cyanide solution and tailings spillage areas, and the cyanide solution recycling and disposal areas. These areas of prolonged contact between cyanide solution and underlying soil led to cyanide contamination in the shallow aquifer. A nearby property, the Sierra Blanca property, operated as a precious metals recovery mill using a flotation process. This process resulted in a lead-contaminated slurry, which was disposed of in open pits.

Nature of Environmental Damages: The ground water at Cimarron Mining Corporation contains elevated levels of cyanide. The sediments and soil at the Sierra Blanca Mill area were found to contain lead. The levels of cyanide on the site were potentially toxic to people, and direct contact with or accidental ingestion of wastes and contaminated soils posed a health risk prior to cleanup. The deeper aquifer used for drinking water could have become contaminated if treatment of the ground water had not occurred. There was an exposure potential from breathing airborne dust. Several process tanks and soil and sediments in the discharge pits associated with the Sierra Blanca Site contained lead and arsenic.

Type of Cleanup Utilized: Constructing a fence to limit access, extracting and treating ground water, and cleaning up contaminated soils and equipment have reduced the threats to the public and the environment at this site while ground water treatment continues. Emergency Response actions included a fence, off-site disposal, and over packing containers. In 1990, the Sierra Blanca property, located approximately 3/4 mile south of the Cimarron Mining Corporation site, was incorporated into cleanup actions at the Cimarron Mining Corporation site.

Estimated or Actual Costs of Cleanup: Cleanup costs for Emergency Response actions were estimated at $710,000 between July 15, 1991 and May 28, 1992.

Party(ies) Responsible for the Action: This site is being addressed through Federal actions.

Cuba Smelter Site

Site Overview: This site is located in Socorro, New Mexico. The facility has a lead smelter which was in operation until the turn of the century. Contaminants at this site included lead, mercury, and zinc. The threats included direct contact and biological threats.

Site Mining Activity: This site has an abandoned lead smelter.

Nature and Type of Contamination: The primary contaminants at this site included lead, mercury, zinc, copper, arsenic, and thallium.

Nature of Environmental Damages: Threats posed by these contaminants included direct contact (inhalation, dermal, ingestion), biological threats, and soil contamination.

Type of Cleanup Utilized: Emergency Response actions included excavated soil extraction, backfill, and off-site disposal.

Estimated or Actual Costs of Cleanup: Cleanup costs for Emergency Response actions were estimated at $1,921,000 from September 27, 1993 to May 26, 1994.

Party(ies) Responsible for the Action: This site was addressed through Federal Emergency Response actions. Additional information was not available.

LI Tungsten Corporation

Site Overview: This site is located north of Glen Cove Creek in Nassau County, New York. Operations involved processing ore and scrap tungsten concentrates. These operations started in the 1940s and ended in 1985. Public and private wells within 4 miles of the site serve as the drinking water source for an estimated 51,000 people; the nearest well is slightly more than a mile from the site.

Site Mining Activity: The LI Tungsten Corporation site is 26 acres in size and located in an industrial area along the north bank of Glen Cove Creek. Operations involved processing ore and scrap tungsten concentrates to ammonium paratungstate (APT) and subsequently formulating APT to metal tungsten carbide powder. Other specialty products such as tungsten carbide powder plus cobalt, tungsten titanium carbide powder, tungsten spray powder, crystalline tungsten powder, and molybdenum spray powder also were produced.

Nature and Type of Contamination: Materials contaminated with heavy metals from the processing operations have leaked from an on-site pond. There are seven waste piles on this site that contain approximately 8,000 cubic yards of solid wastes. There are also three concrete oil recovery sumps, two unlined settling ponds, and a lined settling pond known as a mud pond. Site investigations were undertaken by the New York State Department of Environmental Control (NYDEC) in 1989, the results of which indicated that considerable contamination remained at the site: an estimated 100 drums containing chemicals such as cyanide, acids, and alkalis; numerous storage tanks holding chemicals of an unknown nature; 26 pressurized cylinders containing chemicals; leaking transformers suspected of containing polychlorinated biphenyls (PCBs); waste piles with elevated radiation levels; tungsten ore stored in wooden crates and drums, some of which were broken; and asbestos fibers from decaying tank covers and pipe-wrapping materials. Plumes discovered in contaminated ground water contain heavy metals. Chlorides, sulfates, lead, cadmium, tungsten, chromium, arsenic, barium, silver, and PCBs were detected in on-site monitoring wells.

Nature of Environmental Damages: Individuals may be at risk of drinking contaminated ground water or touching contaminated liquids or soils on-site. Ground water contains chlorides, sulfates, lead, cadmium, tungsten, chromium, arsenic, barium, silver, and PCBs. Waste piles have elevated radiation levels that are a potential risk to individuals on-site.

Type of Cleanup Utilized: This site is being addressed in two stages: immediate actions and a long-term remedial phase which will focus on comprehensive site cleanup. In 1988, fifty tanks were inspected to ensure security against rupture and leakage. Three tanks were removed from the site. Over 100 drums containing acids, organics, and waste oil were over packed or staged and then disposed of off-site. Identifiable laboratory chemicals also were packed and removed from the site. Finally, a 24-hour security system has been installed at the site. These efforts have contained the source of contamination and reduced the immediate health risks to nearby residents and workers while additional site studies are being planned.

Estimated or Actual Costs of Cleanup: Not available.

Party(ies) Responsible for the Action: This site is being addressed through Federal, State, and potentially responsible parties' actions.

National Zinc Corporation

Site Overview: This site is located on the west side of Bartlesville, Oklahoma. Zinc smelting operations were conducted beginning in 1907. The site is a mixed residential, commercial, and industrial area, including schools, day care facilities, and playgrounds, which could potentially be affected by site contamination. Approximately 5,000 people live within 3 miles of the site. An estimated 1,700 students attend two schools and three day care centers located nearby which are known to have contaminated soils. Approximately 170 people work at these nearby facilities.

Site Mining Activity: This site is approximately 150 acres in size and located on the west side of Bartlesville. Zinc smelting operations have been conducted at the site since 1907.

Nature and Type of Contamination: Widespread contamination off-site, including a large portion of west Bartlesville and much of the downtown area, has been traced back to the uncontrolled air emissions of the smelting operations as well as the use of smelter slag and other waste for fill projects throughout the area.

Nature of Environmental Damages: Approximately eight square miles of surface soil is contaminated with the heavy metals lead and cadmium. According to 1992 EPA reports, lead and cadmium levels in the top two feet of soil are greater than three times natural background levels. Concentrations are highest at the smelter and decrease with distance away from the smelter. Although the extent of the area of contamination has not been fully determined, it includes soils at two schools and three day care centers. Blood lead studies performed by the Oklahoma State Department of Health in 1991 and 1992 indicate that approximately ten percent of the children in the contaminated area have elevated blood lead levels. The study revealed that children on the west side of Bartlesville, the side where the facility is located, had elevated levels of blood lead whereas the children on the east side did not. People who incidentally touch or ingest contaminated soils could be at risk.

Type of Cleanup Utilized: This site is being addressed in two stages: initial actions and a long-term remedial phase focusing on the cleanup of the entire site. In late 1992, contamination was removed from 20 easily accessible areas, including schools, day care facilities, and playgrounds. These activities included excavating contaminated soil, transporting soil to an on-site staging area, and backfilling with clean soil. Contaminated soil was then stabilitzed at the staging area and sent to a non-hazardous commercial landfill. In 1993, lead- and cadmium-contaminated soils from residences were excavated and areas were back-filled with clean soil. Final cleanup remedies were chosen in late 1994, including replacing soil excavated from residential properties and treating contaminated soil at commercial properties. Contamination within the site's fenced boundaries is being addressed by EPA's RCRA program, whereas the contamination outside the fenced boundaries is being addressed by the Superfund program. By having removed contaminated soil from public and residential areas, EPA has reduced the immediate threat posed by contaminants at the National Zinc Company site. Further cleanup of contaminated properties is expected to begin shortly.

Estimated or Actual Costs of Cleanup: Not available.

Party(ies) Responsible for the Action: The site is being addressed through Federal and potentially responsible parties' actions.

Ambler Asbestos Piles

Site Overview: This site is located in Ambler, Pennsylvania, and consists of two large piles of asbestos tailings. The area is surrounded by a mixed commercial and residential area. Approximately 6,000 people live within one-half mile of the site, and the nearest residence is located within 200 feet of one of the piles. Wissahickon Creek and its flood plain border the site.

Site Mining Activity: This 25-acre site in Ambler, Pennsylvania consists of three asbestos-containing waste piles and a series of filter bed lagoons. In 1867, a manufacturer of asbestos products began dumping its waste next to its Ambler Plant. The total volume of the waste piles exceeds one and one-half million cubic yards.

Nature and Type of Contamination: Dumping of asbestos-containing waste began in the early 1930s and continued until 1974. The contamination is a result of both solid and liquid asbestos wastes and waste slurries that were pumped into cinder berms and allowed to dry. Other contamination is due to dumping of broken wallboard and asbestos pipe products, which were further broken and compacted by tractors.

Nature of Environmental Damages: Preliminary investigations by EPA found asbestos in the soil, in the filter bed lagoon sludges, and on equipment in the adjacent Locust Street Playground. The air, ground water, soil, sediments, and surface water are contaminated with asbestos.

Type of Cleanup Utilized: Immediate actions at the site consisted of installing a vegetated soil cover to contain the asbestos pile in 1977, followed by the removal of contaminated playground equipment and the closing of the playground in 1984. At this time, the site was partially fenced off and the remaining piles were also covered. Erosion gullies were repaired, reseeded, and regraded. In 1989, EPA installed additional fencing to restrict access to the site and to limit residential contact with the contaminated areas. More recently, EPA has selected additional remedies for the piles, including: design and construction of specially-engineered covers on each asbestos pile to prevent the release of asbestos fiber, allow proper drainage, and prevent erosion; removal, filtration, and discharge of water from the lagoon and the settling basins; backfilling, grading, and reseeding of the lagoons with clean soil; renovation of fencing to restrict access; installation of erosion control structures where the asbestos piles adjoin the Wissahickon Creek and Stuart Farm Creek banks; regrading of pile plateaus; posting of warning signs; and air monitoring. Construction of all cleanup remedies is complete, minimizing the potential for exposure to asbestos from the Ambler Asbestos Piles site. EPA will continue to monitor air quality at the site to ensure that the remedies remain protective of human health and the environment.

Estimated or Actual Costs of Cleanup: Cleanup costs for Emergency Response actions were estimated at $60,000, and included the neutralization of materials and the capping of the piles.

Party(ies) Responsible for the Action: This site is being addressed through Federal and potentially responsible parties' actions.

Annie Creek Mine Tailings

Site Overview: This site is located in the Black Hills National Forest in Lawrence County, South Dakota. Gold ore was processed at the mine from 1907 to 1916. In 1989, EPA conducted sampling which detected arsenic-contaminated tailings in Annie and Spearfish Creeks.

Site Mining Activity: The Annie Creek Mine Tailings site is located in the Black Hills National Forest, three and one-half miles west of Lead, South Dakota. This site is situated in mountainous terrain and wetlands border the entire length of the Annie Creek corridor. Between 1907 and 1916, gold ore was beneficiated at the mine in a small cyanide mill. Tailings were disposed of in an impoundment at the head waters of Annie Creek, where a timber crib dam was constructed.

Nature and Type of Contamination: Annie Creek flows into Spearfish Creek. Erosion of the arsenic-bearing tailings from the site over the years has deposited tailings, tailings mixed with soil, and sediment in Annie Creek and in the streambed sediments of Spearfish Creek.

Nature of Environmental Damages: The soil and sediments in Annie and Spearfish Creeks are contaminated with arsenic. The surface water and ground water are contaminated with low levels of arsenic and are being monitored. Wetlands border the entire length of the Annie Creek corridor. Ingesting or coming into contact with contaminated soil, sediments, or water may pose a threat to people and animals.

Type of Cleanup Utilized: This site is being addressed in two stages: initial actions and a long-term remedial phase focusing on cleanup of the entire site. In early 1994, EPA covered an exposed area of arsenic-contaminated mill tailings with clean soil, revegetated the cover, and established drainage controls to divert surface water run-off from entering Annie Creek. These activities were completed in the summer of 1994. Institutional controls are scheduled to be implemented by late 1995 and include deed and access restrictions, land-use limitations, ground water use restrictions, surface water and ground water monitoring, and public information programs. No further cleanup actions are planned at this site.

Estimated or Actual Costs of Cleanup: Not available.

Party(ies) Responsible for the Action: This site is being addressed through Federal and potentially responsibility parties' actions.

Bingham Creek Channel - Phase I

Site Overview: This site is located in West Jordan, Utah. The site includes 54 homes located in the flood plain, and is a populated suburban setting with approximately 90 families. The site runs from the mining area of Bingham Canyon to the Jordan River.

Site Mining Activity: Historical mining activities in the Bingham Canyon took place beginning in 1862. Bingham mine is upstream from the site, and conducted extensive copper and lead mining for over 100 years. Presently, the Bingham pit, a large open pit copper mining and ore concentration facility, occupies much of the upstream area.

Nature and Type of Contamination: The various mining activities that took place in Bingham Canyon are believed to be the source of heavy metals, such as lead and arsenic, in the soil. Early practices in the mining industry allowed for discharges of waste material contaminated with lead, arsenic, cadmium, and other base metals into the creek bed. This material washed down to the residential areas during times when precipitation caused flooding or water flow. There were an estimated 200,000 cubic yards of soil contaminated with high concentrations of lead. In addition, mill tailings were present on the upper reaches of the channel. The channel was redirected on several occasions, and flood events appeared to be the main cause of contaminant distribution outside the channel banks. Contaminated soil also was wind blown and disturbed during development activities. Irrigating systems through the area allowed surface migration of contaminants.

Nature of Environmental Damages: High concentrations of lead were discovered on and near residential properties with over twenty children under the age of seven in the immediate vicinity. The primary threat on-site was human and livestock exposure to contaminants. However, the continued release and presence of these hazardous substances also posed a threat to surface water and vegetation. Ground water was not a concern as no drinking water wells were in use in the area.

Type of Cleanup Utilized: Emergency response actions included excavation, backfilling, and seeding. Yards of nearby residents were tested, and soil was excavated at 50 homes and a vacant lot. The yards were backfilled, reseeded, and sodded. A vacant 22-acre parcel was fenced. Approximately 74,000 cubic yards of lead-contaminated soils were placed in a repository with a clay liner and a leachate and storm water collection system.

Estimated or Actual Costs of Cleanup: The cost of cleanup for Emergency Response actions was estimated at $3,250,000 in 1991.

Party(ies) Responsible for the Action: The State of Utah and local agencies were involved in EPA activities on the site. Two potentially responsible parties, Kennecott Utah Copper Corporation and the Atlantic Richfield Corporation were identified and issued General Notice letters. Kennecott aided in the cleanup by agreeing to pay a portion of the site assessment cost and up to two million dollars for removal activities. It is anticipated that State, city, and county governments will be involved to ensure long-term maintenance of the response action.

Bingham Creek Channel - Phase II

Site Overview: The Bingham Creek Channel - Phase II site, located in West Jordan, Utah, includes the Bingham Creek Channel from Redwood Road to the base of the Bingham Reservoir. The channel is eleven miles long, and approximately five miles downstream from the mining district. It also includes residential properties along the channel. West Jordan has a population of approximately 42,000. Bingham Creek is a tributary of the Jordan River and is generally dry.

Site Mining Activity: Bingham Creek was used to drain the Bingham mining area of the Oquirrh Mountains beginning in the late 1800s. Mining activities continue to this day. The Bingham Pit, still operating, is one of the largest open pit mining operations in the world.

Nature and Type of Contamination: Historic mining activities took place throughout Bingham Canyon, and were the source of mine tailings and heavy metals in the soil. Mine tailings impoundments, as well as other large deposits of tailings, were present in the channel. Tailings were discharged directly to the channel during normal mining operations and transported down the channel during run-off events. Flood events appear to be the main cause of contaminant distribution outside the channel banks. The channel was redirected or meandered on several occasions, which also contributed to the distribution of the contamination.

Nature of Environmental Damages: Residential soils and the channel contained elevated levels of lead and arsenic. There was obvious clustering of high lead levels in one community along the channel located in the area of a flood plain. Dust-sized particles of contaminated soil were wind-blown and disturbed during development activities, transporting contamination into yards and homes. In addition, irrigating systems contributed to the migration of contaminated soil in the channel and the channel received water released from the irrigation canals. Other threats included: human or animal actual or potential exposure to hazardous substances, pollutants, or contaminants; high levels of hazardous substances in soils at or near the surface that could migrate; and potential impacts to the ecosystem and surface and ground water. The estimated extent of human exposure from incidental ingestion of typically small contaminated soil and the sensitive sub-populations of younger children at risk for irreversible health effects were considered as the two significant risk factors when deciding upon a removal action.

Type of Cleanup Utilized: The Phase II cleanup began in November 1993 with the covering of the sections of the creek adjacent to residential properties with a dense vegetative cover to impede the flow in the channel. Pre-removal sampling of the channel was completed to determine the extent and depth of removal to conducted. Due to the high volume of water in the creek during removal, diversion and holding dams were constructed upgradient of the removal area. Contaminated material was excavated and a multi-layer soil cover was placed over the remaining material. Site restoration consisted of backfilling the excavated channel to establish design grade and profiles. An engineered soil barrier was utilized to provide an adequate cap for areas where impacted soils remain in place to prevent further erosion. Operations and maintenance measures included revegetation, as necessary, and maintenance of the revegetated areas. Phase II cleanup was completed in February 1993.

Estimated or Actual Costs of Cleanup: Not available.

Party(ies) Responsible for the Action: The State of Utah and local agencies were involved in EPA activities on the site. EPA Region VIII completed the removal.

Bingham Reservoir

Site Overview: The Bingham Reservoir is located in Salt Lake County, Utah, one-half mile east of Copperton, Utah. It is located within the Bingham Creek drainage, which flows west to east, and is approximately eleven miles above the confluence of Bingham Creek with the Jordan River. The population of Salt Lake County is approximately 718,000 people.

Site Mining Activity: Copper tailings were historically deposited on this site and placed over native soil. This area later became the Bingham Reservoir site, owned and operated by Kennecott Utah Copper Corporation. The reservoir was created in 1965 to impound run-off water from the upper reaches of Bingham Creek, which originated in and flows through the open pit mine. The unlined reservoir has a 500 million gallon capacity, and receives flow from ground water that is collected and pumped from Bingham Creek alluvium above the reservoir, in addition to storm water and leachate of mine waste dumps during emergency conditions.

Nature and Type of Contamination: Approximately 1,000,000 cubic yards of tailings from mining and milling activities were present in the water reservoir when the dam was constructed in 1965. The reservoir also held between 900,000 and 1,000,000 cubic yards of sludge, containing iron hydroxides and sulfate-rich pore waters, the result of settling of suspended material and precipitation of metals. Water from the site was evaporated or recycled to waste dumps where it was used for dust suppression, but no water has been released to down-gradient Bingham Creek since 1985. Heavy metals, including arsenic, cadmium, chromium, copper, lead, nickel, and zinc were present in elevated concentrations within the tailings, sludge, and water of the site. Acidic conditions solubilized the metals and maintained them in a form that was readily transportable. Ground water has been contaminated up to two miles from the reservoir due to seepage.

Nature of Environmental Damages: The presence of heavy metals in ground water posed a substantial threat for a release to surface water and downstream environments by direct overflow, flooding, or damage to the reservoir's dam. Chronic exposure, inhalation, and/or ingestion of cadmium, arsenic, chromium, copper, lead, nickel, and zinc could have caused a variety of human health effects. The toxic effects of these heavy metals posed a substantial endangerment to public health. The elevated levels of heavy metals which dissolved in the acidic conditions of the reservoir contaminated ground water. Surface water quality in Bingham Creek and the Jordan River was threatened by overflow or by dam failure conditions. Copper and zinc concentrations were toxic to aquatic life.

Type of Cleanup Utilized: The reservoir was drained in 1991 to prevent further groundwater contamination, but the sludge and tailings deposits remained on the reservoir floor. The remaining sludge and tailings deposits were removed, transported, and deposited on the waste dumps of Bingham Mine. The sludge was mixed with dry alluvium prior to hauling and then dumped down the slope of the waste dump bench. The excavated soil from the reservoir was mixed with the sludge/waste rock mixture and pushed out as an eight to ten inch cap on the modified slope of waste rock. The new slope was then seeded and mulched. When the excavation of contaminated materials was complete, the bottom of the reservoir was sampled to ensure that all contamination had been removed. A divider dike was then constructed, and removal was complete in June 1994.

Estimated or Actual Costs of Cleanup: Specific cost estimates were not available. However, the potentially responsible party, Kennecott, funded the cleanup. EPA's expenditures included only costs for oversight activities.

Party(ies) Responsible for the Action: The potentially responsible party, Kennecott Corporation, completed the Removal Actions for the site pursuant to an Administrative Order of Consent. State and local authorities were kept informed of activities on-site by EPA, in addition to providing background data, support, and community relations assistance. The Utah Department of Natural Resources evaluated and approved the divider dike design.

Essex Copper Processing

Site Overview: Located in the Escalante Desert, approximately three miles northwest of Milford, Utah, this 80-acre site is characterized by a fairly remote location in a semi-arid area in the western portion of south-central Utah.

Site Mining Activity: The site is an abandoned copper processing facility.

Nature and Type of Contamination: Buildings and machinery on-site were in disrepair, and 88 corroded and leaking drums were scattered on the grounds. There also were a number of buried drums located on-site. Several large storage tanks remained on-site, most of which contained only a small amount of solid material. Electrical transformers containing PCBs were on deteriorating poles, laying on the ground, or within site buildings. Oil stains could be seen under many transformers and capacitors. Several amber jars and bottles filled with hazardous substances remained in a laboratory room, and numerous caustic materials, flammable materials, and vehicle batteries occupied a former maintenance shop area.

Nature of Environmental Damages: The threat of direct exposure through contact or ingestion of PCBs, phenol, phenol compounds, and other hazardous substances existed on-site. Access to the site was unrestricted, increasing the possibility of direct contact. The high concentrations of phenol in the drums and the PCBs in the transformers posed an imminent and substantial threat to human health and the environment. Phenol is an irritant of the eyes, mucous membranes, and skin, as well as the cause of liver and kidney damage. Phenol also causes genetic mutations and could pose a cancer risk. PCBs also cause mutations and pose a cancer risk, in addition to causing skin lesions, eye irritation, nausea, vomiting, weakness, weigh loss, skin rash, numbness and tingling of extremities, liver enzymes ,and elevated serum triglycerides. Wildlife in adjacent areas could have been exposed to the contamination through direct contact with soil, standing water, sediments, or consumption of other animals. The potential existed for terrestrial wildlife species to manifest chronic exposures of sufficient magnitude to lead to adverse effects.

Type of Cleanup Utilized: The first phase of this Time-Critical Removal Action involved determining the approximate volume and extent of contamination on-site. An inventory of drums, tanks, transformers, capacitors, laboratory chemicals, and small container chemicals was completed, and soil was sampled. The second phase of cleanup began with the removal and disposal of the drums. The EPA Region VIII Technical Assistance Team moved the corroded drums into new drums and overpacks. The contents of other drums and small containers were combined into new drums or overpacks based on compatibility. The newly packed drums were then divided into groups for sampling and disposal. Next, the transformers and capacitors were removed and disposed. Twenty-five transformers, 38 capacitors, three oil fuses, and two oil switches were packed in drums with sawdust and placed in a staging area. Units with unknown PCB concentrations were placed on plastic sheeting to prevent contamination of soil in the staging area. After all drums were overpacked or bulked and relocated to the staging area, the soil from the drum storage area was excavated as well. Finally, all drums, transformers, capacitors, and soil were transported to disposal facilities.

Estimated or Actual Costs of Cleanup: The estimated cost of this removal was $392,200.

Party(ies) Responsible for the Action: Sampling was conducted by the Utah Department of Environmental Quality and the Utah Division of Environmental Response and Remediation in 1992. The removal action was completed by the Emergency Response Cleanup Services (ERCS) and the EPA Region VIII Technical Assistance Team.

Kennecott Tailings/North Zone

Site Overview: This site is located North of the Oquirrh Mountains on the shores of the Great Salt Lake in Salt Lake County, Utah. Mineral processing has occurred at the site since 1906. Early smelter emissions devastated the vegetation nearby and metal-bearing wastes caused ground water contamination.

Site Mining Activity: The Kennecott North Zone site encompasses an industrial area at the northern end of the Oquirrh Mountains on the shores of the Great Salt Lake. The area has been used for mineral processing since 1906. Current and former facilities include mills for grinding ores, concentrators for separating minerals from the ore by flotation or leaching, smelters, refineries, and associated storage facilities and waste impoundments.

Nature and Type of Contamination: The wastes produced by the various facilities contain several hazardous substances including metals and selenium. Early smelter emissions devastated the vegetation near the smelter and dusts from the tailings pond were largely uncontrolled until recently. Wastes deposited in unlined impoundments and spills associated with several facilities have caused metal-bearing ground water contamination.

Nature of Environmental Damages: Potential health risks may exist for those using private wells, or those who ingest soils contaminated with lead and arsenic. Wetlands on and near the site are threatened.

Type of Cleanup Utilized: This site is currently being addressed in two stages: early actions and long-term remedial phases focusing on cleanup of the wastewater treatment plant sludge pond. In 1994, EPA completed an investigation and determined that the ponds contain the sludges produced by treatment of process waters from the refinery and smelter, as well as high levels of arsenic and selenium. The state is assessing off-site contamination, while the potentially responsible party is evaluating possible cleanup actions for the sludge pond sediments and phosphogypsum tailings.

Estimated or Actual Costs of Cleanup: Not available.

Party(ies) Responsible for the Action: The site is being addressed through Federal and potentially responsible parties' actions.

Kennecott Bingham/South Zone

Site Overview: This site is located in the Oquirrh Mountains in Salt Lake County, Utah. Since the 1860s, copper, gold, and silver have been mined and processed. The site is adjacent to several Salt Lake Valley communities, with a combined population of 70,000.

Site Mining Activity: The Kennecott Bingham/South Zone site encompasses the Bingham Mining District in the Oquirrh Mountains of Utah. Mining activities began in the area in the 1860s. Smaller companies mined gold, silver, and copper, and erected mills and smelters in the area. A large open-pit copper mine is currently operating at the site. Overburden from the mine is placed on huge waste rock dumps. A portion of the dumps is used for active leaching operations.

Nature and Type of Contamination: The South Zone includes wastes associated with extracting and concentrating copper ore. The main sources identified at the South Zone are the open pit, Bingham Creek/Anaconda Tailings, Large Bingham Reservoir, Small Bingham Reservoir, Leach Dumps, Leachate Collection Syustem, evaporation ponds, and residential soils. The greatest amount of contamination associated with this site was due to a leak in the leach water collection system, resulting in a plume of contaminated ground water. Wastes typically were deposited in the creek or adjacent to the creek where they eroded and deposited downstream.

Nature of Environmental Damages: Mining wastes with elevated levels of lead and arsenic have been washed downstream and deposited in the floodplain of Bingham Creek. Neighborhoods have been built on the floodplain, and in some cases, on historic channels. Leach water escaping the collection system has contaminated the principal aquifer underlying the southwestern Salt Lake Valley. A small part of the ground water plume near the contaminating sources is acidic and metal-bearing. Further out, the plume contains elevated levels of sulfates. Potential health risks are associated with direct contact and ingestion of contaminated soils and ground water. Well drilling permits have been suspended in the area. Immediate threats to human health and the environment have been or are being addressed, protecting the public and the environment while investigations into the ground water contamination are underway.

Type of Cleanup Utilized: This site is being addressed through a number of early actions at various waste locations and a long-term remedial action focusing on cleaning up ground water contamination. In 1991, residential yards in Bingham Creek with surface soils containing chemical concentrations posing an immediate threat were removed to a repository, soils were replaced, and the yards were revegetated. To prevent further migration of mining wastes downstream, the mining wastes from Bingham Creek channel were cleaned out and placed in repositories. This work was finished in 1994. In 1991, the sludges, tailings, and underlying soils from the Large Bingham Reservoir were removed. The new Bingham Reservoir was then lined. This work was completed in 1995. Cleanup of residential yards posing a long-term threat was planned to take place in 1995.

Estimated or Actual Costs of Cleanup: Not available.

Party(ies) Responsible for the Action: The site is being addressed through Federal and potentially responsible parties' actions. The primary potentially responsible party, Kennecott Copper Corporation, has performed or participated in cleanup work under EPA enforcement orders. ARCO Inc. is also participating in the cleanup.

Kern River/Bingham Creek Pipeline

Site Overview: This site is located along the Bingham Creek Channel in Salt Lake County, Utah.

Site Mining Activity: Historical mineral extraction and benefication activities have occurred in Bingham Canyon beginning in 1870. Kern River Gas Transmission Company is currently constructing a pipeline adjacent to the Bingham Creek Channel.

Nature and Type of Contamination: Certain areas of soils at the site have been found to contain elevated levels of lead and arsenic. The contamination is believed to originate from tailings piles, waste rock dumps, slag heaps, and other sources related to mineral extraction and benefication activities. Large quantities of tailings, waste rock, slag heaps, and other sources of contamination also were produced by lead mining operations in Bingham Canyon. These sources are believed to have been washed down Bingham Canyon over time, during normal run-off and flood events, depositing lead and arsenic along Bingham Creek Channel.

Nature of Environmental Damages: Sampling activities at the site have indicated that there is a significant potential for exposure to nearby human populations. The upper two inches of soil are contaminated with high concentrations of lead, which are released into the environment, including surrounding waters. These conditions may constitute an imminent and substantial endangerment to human health and the environment. Lead is a cumulative poison which can cause neurologic, kidney, and blood cell damage in humans. Some lead compounds also are animal carcinogens adversely affecting the lungs and kidneys. Arsenic is a human carcinogen and can be fatal if ingested or inhaled in sufficient quantities by humans, livestock, and wildlife. Direct contact, ingestion, and inhalation are the exposure routes that are considered threats at this site.

Type of Cleanup Utilized: An emergency soil removal action of contaminated soils within the Bingham Pipeline corridor was completed by Kern River Gas Transmission Company prior to pipeline construction in late 1991. Visibly contaminated soils, including a minimum of six inch over-excavation, was removed. A high berm was then constructed with the contaminated soils. The excavated areas were backfilled with an offsite granular borrow material to maintain the integrity of the powerline anchors. After the visibly contaminated and over-excavated soils were removed, a clean soil berm was constructed adjacent to the contaminated soil berm by pushing clean material onto the side of the contaminated berm. The excavated soil was then hauled and placed within the Bluewater I North Repository. A surface water control system was constructed to ensure that surface waters originating from outside the pipeline corridor did not wash contaminated material across the project area. The surface water control system consisted of diversion ditches and culverts to transfer storm water across the pipeline corridor. Quantitative air monitoring was performed intermittently from October through November 1991 using low volume monitors.

Estimated or Actual Costs of Cleanup: Not available.

Party(ies) Responsible for the Action: Kern River Gas Transmission Company entered into an Administrative Order on Consent with EPA Region VIII to conduct an emergency removal action. Kennecott Corporation served as the prime construction contractor for the soil removal action, and subcontracted North American Exploration to collect and document sampling procedures. Envirocon, Inc. Provided air quality monitoring.

Leeds Silver Reclamation

Site Name: Leeds Silver Reclamation

Site Overview: This site is located in Washington County, Utah, approximately one mile northwest of Leeds. Historical mining activities have contaminated the surrounding ground water, surface water, and soil. The town of Silver Reef is located within one mile of the site, and the community of St. George is a few miles north. Numerous residences are located to the east and south of the site. This site is a popular tourist and recreational area, with motorcycle riding, horseback riding, four-wheel driving, and hiking occurring on and near the site on a daily basis.

Site Mining Activity: The site is located in a narrow, steep-walled valley formed by Buckeye Reef and White Reef. The entire area contains historical structures from the late 1800s, including gravestones, old building foundations, and numerous adits. The site is an inoperative ore processing facility which utilized an acid heap leach process for the extraction of copper and silver. Much of the facility was constructed in 1978, and operated until 1983. Copper and silver sandstone ores were processed through acid heap leach operations.

Nature and Type of Contamination: A centrally located pile of crushed ore, underlain by asphalt, covers approximately four acres of the site, and is referred to as a heap leach pad. A small collection pond was constructed at the south end of the leach pad, with an overflow pond designed to intercept and contain excess solution when the capacity of the collection pond was exceeded. A canal diverting water from Leeds Creek flows along Buckeye Reef and drains into the wetland south of the overflow pond. The canal flows into a pond used for pasture, lawn and garden irrigation, and livestock watering. Three 72-gallon electrical transformers and a one acre ore stockpile also are present on the site. A warehouse and test area, associated with on-site operations, also contain several transformers. A network of perforated polyvinyl chloride pipe traverses the surface of the ore pile and was used to distribute an acidic solution across the surface of the pile. As the acid solution percolated through the pile, it leached metals from the ore. The metal-bearing solution flowed down slope along the pad and ultimately drained into the collection pond. The solution was pumped from the pond and copper, silver, and other metals were recovered.

Nature of Environmental Damages: The on-site sources, including the ore stockpile, the leach pile, and the collection and overflow pond, are the sources of contamination. Metals, especially arsenic, beryllium, and mercury, are present in the soil, surface waters, and subsurface waters. Both the sediment and the water in the site ponds are acutely toxic to aquatic organisms and a release of the sediment or water would result in contamination of surface water used from drinking water, in lawn and garden irrigation, and for livestock. Such a release would also result in significant ecological damage. Wildlife in adjacent habitats may be exposed to contamination through direct contact or consumption. The acidic content of waters on the site present may cause skin irritation or burns. In addition, the acidic pH in the pond may solubilize heavy metals in the sediment and carry them to the ground water. The PCB concentrations present in the transformers pose a threat to human health. Buried containers on-site are accessible to the public and contain materials which are highly ignitible. Direct access, airborne migration of hazardous substances, migration of contamination into the ground water, and migration of contaminants to ponds, wetlands, wells, and other surface waters pose serious threats to human health. There is no fence inhibiting public access to the site, and residential properties are located nearby.

Type of Cleanup Utilized: The proposed action called for the evaporation and removal of the collection pond water, the lining of the area, and the utilization of the pond for the tailings' stockpile. Water in the holding pond will be sampled and analyzed for contaminants. If this water does not contain contaminants, it will be pumped out of the holding pond and flow directly into the wetlands. Otherwise, an evaporation pond will be created and the water will be pumped to this location. The sediment left after evaporation will be placed on the heap leach pad or in the collection pond. The holding pond will then be excavated and contaminated soil will be removed and placed into the collection pond. The dike will be removed to allow free-flow of drainage water into the wetlands area.

To prevent further contamination, the asphalt liner in the holding pond will be removed and placed on the heap leach pad. The ore piles will be excavated of their contaminated material, which will then be placed in the collection pond. The heap leach pad and the collection pond will be capped with a geosynthetic membrane, filter layer, geomembrane/geonet layer, and topsoil. Grass will then be planted. PCB transformers and contaminated concrete and debris will be removed and disposed of pursuant to the Toxic Substances Control Act, buried ignitable waste will be excavated, overpacked, and disposed of, corrosive material in tanks will be drummed and disposed of, and tanks containing process residue will be evaporated or solidified and incorporated into the heap for capping.

Estimated or Actual Costs of Cleanup: The cost of cleanup has been estimated at $579,000.

Party(ies) Responsible for the Action: The Utah Division of Oil and Gas Mining has regulated activities at the site since 1987. The Utah Department of Environmental Quality has conducted site sampling, and continued in discussions with EPA. EPA Region VIII attempted to enter into an Administrative Order on Consent for removal action with the potentially responsible party, 5M. 5M declined to conduct the necessary removal action and refused EPA access to the site. An Action Memorandum Amendment was written in December 1995, requesting legal and judicial means to enter the site.

Midvale Slag

Site Overview: This former copper and lead smelting facility operated from 1902 to 1992 and is located in Midvale, Utah. Although the smelter no longer exists, large piles of slag and other smelter wastes containing lead, arsenic, and cadmium remain on-site. Ground water, soil, and sediments are contaminated with heavy metals. There are approximately 1,500 people living within one-quarter mile of the site.

Site Mining Activity: The 530-acre Midvale Slag site is a former copper and lead smelting facility. The Midvale Smelter originally was constructed on this site in 1902 as a copper plant. Over the years, the plant was changed to a lead facility, producing gold-lead-silver bullion. From 1918 to 1928, approximately 400,000 tons of lead were produced. Although the smelter no longer exists, there are two and one-half million tons of slag that contain lead, arsenic, and cadmium present on-site. The operators of the site processed the slag for use as sandblasting and railroad bed material. Operations on this site were halted by the owners in late July 1992.

Nature and Type of Contamination: The contaminated shallow aquifer on-site has been reported to discharge into the Jordan River at some locations.

Nature of Environmental Damages: Ground water and sediments are contaminated with heavy metals including arsenic, cadmium, lead, and chromium. On-site soils are contaminated with heavy metals, including cadmium, lead, arsenic, and chromium. Explosives found on the site posed a potential threat to on-site workers. The Jordan River is potentially contaminated from run-off from the site and ground water discharge. Public and municipal wells located near the site are used for domestic purposes, but these wells do not seem to be affected by site contamination. However, potential health threats include drinking contaminated ground water and surface water and coming into direct contact with or ingesting contaminated soil.

Type of Cleanup Utilized: This site is being addressed in three stages: immediate actions and two long-term remedial phases focusing on cleanup of the Northern and Southern Zones. In 1990, abandoned chemicals found in an assay lab were over packed and removed, and approximately twenty pounds of explosives were detonated. A clay berm has been constructed to prevent storm water run-off from the site into the bordering Jordan River. Removal of explosives and abandoned chemicals at the Midvale Slag site and fencing the site have reduced the threat to human health while investigations of the Northern and Southern Zones are underway and cleanup activities are being planned. Because the Remedial Investigation is in its early stages, no remedial actions have been taken.

Estimated or Actual Costs of Cleanup: Not available.

Party(ies) Responsible for the Action: This site is being addressed through Federal actions.

Sandy Smelter

Site Overview: This site is located in Sandy, Utah, which is also referred to as Historic Sandy City. Sandy City is located fifteen miles south of Salt Lake City and has a population of approximately 80,000. There is one elementary school on the site, in addition to one middle school and one high school adjacent to the site. Two parks, including a recreation area, are also located within site boundaries. The site also includes the East Jordan Canal which transects the site, and is still utilized by some of the nearby residents to irrigate their gardens.

Site Mining Activity: In the late 1800s, Sandy City housed four smelters, the largest of these being the Mingo Smelter. This smelter processed lead, copper, and zinc ores. Across the street from the Mingo Smelter was the Saturn Mining and Smelting Company, which processed lead ore. The Last Chance Smelter also processed lead ore. These smelting operations all produced stack emissions with elevated metal content. All of the smelters, which have been inactive for years, are located in what are now residential areas.

Nature and Type of Contamination: Neither the sediments surrounding the East Jordan Canal, nor the water in the canal, were contaminated with heavy metals. Railroad tracks run through the site, where slag was used as a ballast and can be seen on the side of the road and in some of the residential property gardens. The release at the Sandy Smelter site appears to be predominantly from stack emissions produced by smelting operations. Soil sampling and investigations of homes on-site indicated lead contamination that posed an immediate risk to human health.

Nature of Environmental Damages: The site has unrestricted access, and includes many private properties where children live. The levels of lead found in the contaminated soils on the site range in concentration, and all sources of lead are readily accessible to children by both ingestion and inhalation as they play in the dirt, kick up dust, have contact with pets, and place their dirty toys or fingers in their mouths. There are properties on-site with elevated lead concentrations that are accessible to all populations. Exposure to lead could result in neurotoxic effects and chronic kidney disease.

Type of Cleanup Utilized: In July 1992, surface soil screening samples were collected to identify the perimeter of the high lead contamination areas. This was known as Phase I. Between November 1992 and March 1993, Phase II required the collection of soil samples, in addition to dust, tap water, and paint samples from the interior of residences. Removal in 1994 occurred for all properties with surface soil lead concentrations greater than 4000 ppm. Contaminated soil was removed and taken to an industrial landfill or other acceptable disposal facilities. Cleanup levels for this action consisted of excavating soil to a depth of eighteen inches or to depths where lead contamination levels were less than 800 ppm. Some excavation included the demolition of small structures and the removal of trees and shrubbery, which were then tested for residual lead contamination. The debris was then, if applicable, disposed of in a construction or municipal landfill. Dust control and hazardous materials release controls were established for stockpiles of contaminated materials during the removal, including air monitoring for releases of hazardous substances during removal operations. Clean soil was brought in to replace the removed soil, and the site was returned to its original grade. All areas which were excavated or regraded were contoured to assist in drainage, which was directed away from the foundations of houses and buildings. Irrigation ditches were replaced in the same configuration as they were originally found and constructed of compacted clay to prevent erosion. Residential sprinkler systems were also replaced.

Estimated or Actual Costs of Cleanup: The estimated cost for this removal was $5,880,900.

Party(ies) Responsible for the Action: The Utah Department of Environmental Quality and EPA were in close contact with the Sandy City Government. EPA took the lead responsibility after negotiations between the State and American Smelting and Refining Company failed.

Sharon Steel (Midvale Tailings)

Site Overview: This former milling and smelting site is located in Midvale, Utah. Approximately 1,400 people live within one-quarter mile of the site; approximately 8,000 people live within one mile. The Jordan River supplies water to 160 acres of farm land through 10 irrigation intakes within three miles of the site. Two smaller drainage ditches, the North Jordan Canal and Galena Canal, are nearby. A twenty-two acre wetland and several small ponds are also on the mill site. The deep aquifer underlying the site is a source of drinking water for the metropolitan Salt Lake City area. Municipal wells that draw from this aquifer are within 3 miles of the site.

Site Mining Activity: The Sharon Steel site is a former milling and smelting operation covering 268 acres in Midvale. Operations began in 1905. The smelter closed in 1958 and the milling operations closed in 1971. Sulfide concentrates of lead, copper, zinc, and other metals were extracted from ore during the milling operations.

Nature and Type of Contamination: The U.S. Geological Survey (USGS) found arsenic in ground water underneath the site. Wastes from production processes on this site resulted in an estimated accumulation of ten million tons of 40 to 50 foot deep mine tailings piles.

Nature of Environmental Damages: The shallow ground water is contaminated with heavy metals such as arsenic, iron, manganese, and zinc from the mill site. Sediments from the Jordan River, which is classified by the State for cold-water game fishing and recreation other than swimming, are contaminated with heavy metals. Soil is contaminated with heavy metals including lead, arsenic, cadmium, and zinc. The wetlands on the site contain heavy metals and zinc tailings. The greatest potential health threat to people is exposure to lead and arsenic through direct contact with or inhalation of contaminated soils, including dust; children playing in nearby neighborhood soils or sandboxes are especially at risk.

Type of Cleanup Utilized: The site is being addressed in three stages: immediate actions and long-term remedial phases focusing on cleanup of the ground water and soils at the mill site and grounds, and off-site properties. By constructing a fence to restrict access to the mill site and grounds, dismantling the mill buildings, recycling scrap metals and other materials, and removing contaminated soils from nearby 400 properties, the potentially responsible parties, the State of Utah, and EPA have reduced the possibility of direct exposure to the contaminants on the Sharon Steel site. However, EPA is continuing to evaluate the reprocessing of tailings as an alternative for remediation at Operable Unit 1. The design of remaining cleanup remedies is underway.

Estimated or Actual Costs of Cleanup: From March 29, 1991 to April 10, 1992, cleanup costs reached $315,000, and from September 28, 1992 to December 15, 1993 they reached $4,748,000.

Party(ies) Responsible for the Action: This site is being addressed through Federal, State, and potentially responsible parties' actions.

Yttrium Processing Plant

Site Overview: The two-acre Yttrium Processing Plant site is in Laramie, Wyoming. The plant began operations as a pilot plant in the 1950s to extract the rare metal, yttrium, from ore. There is a residential area adjacent to the site. The site is now a junkyard, frequented by residents and children for various reasons.

Site Mining Activity: The original processing plant was located in a small building south of the main building, but a larger-scale version of the process was started in the main building at a later date. Ore was brought to the plant, crushed, and then treated with acid. It was then run through columns and a dewatering/filtering mechanism. The final product, a white to yellow powdery substance, is thought to be yttrium oxide/hydroxide. The source of the ore, the amount processed, the exact method of extraction, and the exact site used for the disposal of residual materials are unknown. No commercial product ever resulted from the operations, and the plant closed in 1957. A former operator of the plant removed all of the ore from the building and hauled it to the Laramie Dump. Currently, a garbage collection business is using the main building for its operation.

Nature and Type of Contamination: Yttrium is not normally radioactive, but is often associated with uranium (U-238), radium (Ra-226), and thorium (Th-228/232) in the raw ore.

Nature of Environmental Damages: Site soils had high concentrations of lead, radium, yttrium, zinc, copper, and mercury. However, toxicity analytical results indicated that there was no RCRA waste at the site. Lead, copper, and mercury were selected as the contaminants of concern. Zinc was not selected because of its relatively low toxicity. Cadmium was not selected because its site concentrations were only marginally above local background concentrations. Yttrium was not selected because very little information is available on its toxicological properties. The most significant danger to human health was the threat posed by the lead, uranium, and radiological contamination to children who trespassed and played on the site. Otherwise, the site did not appear to present a danger to the general environment or public, or anyone who did not enter the site itself.

Type of Cleanup Utilized: In November 1984, the Region VIII Radiation Program Branch and the Office of Radiation Programs in Las Vegas conducted a radiological survey and sampling of the site, identifying two areas of radiatiological contamination. In November 1988, the Emergency Response Branch conducted sampling at the site, including XRF field screening, collecting soil samples to identify the boundary and volume of soils with contaminants, and collecting composite radioactive samples from locations identified in the 1984 Radiation Programs Branch report to determine disposal options. On May 26, 1989, the EPA On-Scene Coordinator and the Emergency Response Cleanup Services personnel visited the site to evaluate removal needs. In June 1988, the following removal activities were completed: the site was surveyed and monitored for radioactivity levels; contaminated soils, debris, and contaminated objects were drummed; the floors of the building were cleaned; the buildings were monitored after cleanup to ensure that EPA standards were met; and the drums filled with contaminated soil were taken to the City landfill to await disposal.

Estimated or Actual Costs of Cleanup: The estimated cost of the cleanup was $49,200. To date, only $37,390 has been spent.

Party(ies) Responsible for the Action: The Wyoming Department of Environmental Quality conducted the site preliminary assessment and then requested that EPA assume the lead role in any further evaluation/removal activities. EPA provided sampling and analytical services and completed removal activities.