Mining and Mineral Processing Sites on the NPL

U. S. Environmental Protection Agency
Office of Solid Waste

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This technical background document, ***Mining and Mineral Processing Sites on the NPL***, was submitted for public review to EPA's RCRA Docket # F-97-2P4P-FFFFF. It provides supplementary information and support for the May 12, 1997 Supplemental Proposed Rule, *Land Disposal Restrictions Phase IV; Second Supplemental Proposal on Treatment Standards for Metal Wastes and Mineral Processing Wastes, Mineral Processing and Bevill Exclusion Issues, and the Use of Hazardous Waste as Fill* (62 FR 26041). The Agency has received comments from the public on this document, has listed these comments and Agency responses in the final section of the document, and has amended the document based on comments. The Agency finalizes this document as of April 1998 and submits it to RCRA Docket # F-98-2P4F-FFFFF to provide supplementary information and support for the April 1998 Final Rule, *Land Disposal Restrictions Phase IV: Final Rule Promulgating Treatment Standards for Metal Wastes and Mineral Processing Wastes; Mineral Processing Secondary Materials and Bevill Exclusion Issues; Treatment Standards for Hazardous Soils, and Exclusion of Recycled Wood Preserving Wastewaters.*

SECTOR	SITE	STATE
ALUMINUM	Alcoa, Vancouver Smelter	WA.
	Ormet Corp.	OH.
	****National Southwire Aluminum Co.**	**KY.**
	****Reynolds Metal**	**OR.**
ASBESTOS	Atlas Asbestos Mine	CA.
	Johns-Manville coalinga Asbestos	CA.
CHROMIUM	Mouat Industries	MT.
	Shield Alloy Corp.	NJ.
COPPER		
	Anaconda Smelter	MT.
	Celtor Chemical Works	CA.
	Commencement Bay Nearshore/Tideflats	WA.
	Milltown Reservior Sediments	MT.
	Silver Bow Creek/Butte Area	MT.
	Torch Lake	MI.
	U.S. Smelter and Lead Refinery INC.	IN.
GOLD/SILVER		
	Carson River Mercury	NV.
	Cimarron Mining Landfill	NM.
	Clear Creek/Central City Site	CO.
	Denver Radium	CO.
	Silver Mountain Mine (deleted 9/97)	WA.
	Summitville Mine	CO.
	White Wood Creek	SD.
LEAD/ZINC		
	Big River Mine Tailings/St.Joe Minal Corp.	MO.
	Bunker Hill Mining & Metallurgical Complex	ID.
	Cherokee County	KS.
	***Circle Smelting Corp.**	**IL.**
	Cleveland Mill	NM.
	East Helena	MT.
	Midvale Slag	UT.
	****Murry Smelter**	**UT.**
	****National Zinc Corp.**	**OK.**
	Oronogo-Duenweg Mining Belt	MO.
	Palmerton Zinc	PA.
	Tar Creek	KS.
LITHIUM	Foote Mineral Company	PA.
MERCURY	Sulphur Bank Mercury Mine	CA.
MULTIPLE-SECTORS	California Gulch	CO.
	Eagle Mine	CO.
	Iron Mountain Mine	CA.
	Richardson Flat Tailings	UT.
	***Sharon Steel Corp.(Fairmont Coke Works)**	**WV.**

	Sharon Steel Corp.(Midvale Smelter)	UT.
	Smeltertown	CO.
	Smuggler Mountain	CO.
	***Tex-Tin Corp.**	**TX.**
	****Triumph Mine Tailings Piles**	**ID.**
PHOSPHATE	Eastern Michuad Flats	ID.
	Monsanto (Soda Springs Plant)	ID.
	****Stauffer Chemical Co. (Tarpon Springs)**	**FL.**
TITANIUM	U.S. Titanium	VA.
TUNGSTEN	Li Tungsten Corporation	NY.
URANIUM, THORIUM,& VANADIUM		
	Austin Avenue Radiation Site	PA.
	Glen Ridge/Montclair/West Orange/US Radium	NJ.
	Homestake Mill	NM.
	Kerr McGee [1) Kress Creek, 2) Reed-Keppler Park, 3) Residential Area's, 4) Sewage Treatment Plant]	IL.
	Kerr McGee Chemical Corp.	ID.
	Lincoln Park	CO.
	Monticello Mill	UT.
	Monticello Rad. Contaminated Properties	UT.
	St. Louis Airport/Hazelwood Interim Storage/ Futura Coatings	MO.
	United Nuclear Corp.	NM.
	Uravan Uranium Project (Union Carbide)	CO.
	W.R. Grace/Wayne Interim Storage	NJ.
ZIRCONIUM	Teledyne Wah Clung	OR.

* Sites added as of 1996 ** Sites added as of 1994

Sites deleted from the 1995 and 1996 NPL list include the Martin Marietta, Kennecott, and Annie Creek sites. See Appendix 1 of this report for information regarding those sites.

ALUMINUM

ALCOA, Vancouver Smelter, WA

Site Description/Contaminants of Concern: This site includes an active smelter, and three waste piles containing approximately 66,000 tons of waste deposited on the north bank of the Columbia River. Contaminants of concern include cyanide, fluoride, and TCE. The site was cleaned up in 1992/3 and delisted from the NPL in 1996.

Environmental Damages and Risks: There is documented groundwater and soil contamination, though no documented effects have been found for surface water (Columbia River) due to dilution.

Cost of Remediation: Continued groundwater monitoring and testing at the site using existing wells is projected to cost $310,000 over a five year sampling period. On-site containment through the use of a HDPE cap cost approximately 1 million. Waste removal cost approximately 12 million.

Ormet Corporation, Hannibal, OH

Site Description/Contaminants of Concern: This 175-acre site is an active primary aluminum-reduction facility in operation since 1958. The site encompasses five unlined waste water ponds totaling 10 acres that are used for the disposal of wet scrubber sludge, and two spent potliner storage areas also totaling 10 acres. Sludge disposal and potliner storage practices are responsible for contamination of ground water with elevated levels of fluoride, cyanide, and sodium.

Environmental Damages and Risks: Three interceptor wells were designed to capture contaminated ground water to prevent contamination of process water and drinking water wells. Monthly sampling from the third interceptor well installed in 1982 indicates that levels of fluoride ranged from 58 to 89 ppb, and pH ranged from 8.7 to 9.0. New monitoring wells found fluoride levels as high as 460 mg/l, total cyanide as high as 110 mg/l and sodium levels as high as 3,150 mg/l. Analyses of lagoon sediments indicate effluent from the facility contains polynuclear aromatic hydrocarbons (PAHs). Sediments demonstrated acute toxicity after toxicity studies were performed.

Cost of Remediation: Two interceptor wells were installed in 1972 to collect contaminated ground water. A third well was installed in 1982. Thirty-nine monitoring wells were installed on the site in 1972 and in 1983. Remedial actions include continued monitoring, groundwater pumping, and continued injection of fresh water to control migration of contaminated ground water. No cost estimates were available. The Landfill area will be capped and a TOSCA cell constructed inside the landfill. PCB material will be excavated and placed in the TOSCA cell.

National Southwire Aluminum Co. (NSA), Hawesville, Kentucky

Site Description/Contaminants of Concern: Aluminum reduction operations began in 1969 on a 1,100 acre site in a rural section of Hancock County along the Ohio River near Hawesville, Kentucky. Two clay-lined ponds, each covering approximately seven acres, were constructed for disposal of spent pot liners from the aluminum production facility (eventually the Old North Pond) and calcium fluoride slurry from the Air Quality Control (APC) System (eventually the Old South Pond). National Southwire (NSA) closed the Old North Pond and covered it with a synthetic membrane and a top soil layer after a preliminary assessment (PA) was completed in 1986. Later, a synthetically-lined pond, designated as the New Pond, was constructed and is currently used for disposal of APC slurry. The Old South Pond was closed in 1996 (under an EPA Administrative Consent Order [AOC] for a Non-Time-Critical Removal Action) after a dewatering and installation of a synthetic membrane and top soil. A 720,000 gpd ground water extraction and treatment system was completed in 1996 under an EPA RD/RA Consent Decree under the Superfund Accelerated Cleanup Model (SACM) initiative; the plant discharges treated ground water to the Ohio River under a

Kentucky NPDES permit. Contaminants of concern in ground water, soils, and sediments include: cyanide, fluoride, arsenic, lead, and nickel.

Environmental Damages and Risks: In 1979, NSA determined that leaching was occurring beneath the Old North and South Ponds. Cyanide, which is produced during the aluminum reduction process and which is present in the spent pot liners, and fluoride form APC dust were found in ground water in the area of the disposal ponds. In 1985, NSA found cyanide in one of its three production wells. At the time the wells were providing drinking water to more than 1,000 employees. (Subsequently, NSA connected the plant to the local public drinking water system.) Other wells that draw from the Ohio River alluvial aquifer within four miles of the Site currently serve more than 20,000 people. In 1989 EPA detected significant concentrations of cyanide, fluoride, arsenic, lead, and nickel in on-site ground water and in sediments in the facility's west drainage ditch, which flows along the west border of the plant immediately west of the disposal ponds, and then into the Ohio River.

Reynolds Metals, Troutdale, Oregon

Site Description/Contaminants of Concern: The Reynolds facility is primary aluminum reduction plant where alumina from bauxite is reduced to aluminum. The facility is 1.25 miles north of the city of Troutdale, Oregon. The Columbia River forms its northern border and the Sandy River forms its eastern border. The plant was built in 1941 and was leased to Reynolds from the government in 1946. In 1949 Reynolds purchased the plant. The plant was shut down in 1991 due to economic reasons. Large quantities of wastes were produced at the Reynolds plant during the production of aluminum. Twenty-one separate wastes streams were identified by Reynolds in response to an EPA information request letter. Major hazardous substances of concern include polyaromatic hydrocarbons (PAHs), aluminum and other metals associated with bauxite, cyanide, fluoride, and polychlorinated biphenyls (PCBs) from electrical equipment.

Environmental Risks and Damages: An EPA contractor took samples from surface and subsurface soil, sediment, surface water, groundwater and an unknown waste pile. Elevated concentrations of cyanide, PAHs, many metals and fluoride were detected in various sources on-site. Elevated levels of cyanide and fluoride were detected in several on-site drinking water wells. Significant concentrations of aluminum, barium, manganese, cyanide, and fluoride were detected in the surface water samples. Concentrations of copper and cyanide in an on-site drainage ditch witch flows to an on-site lake and then Columbia River exceeded the fresh water quality criteria promulgated under the clean water act. Elevated concentrations of PAHs were detected in sediment samples taken from the ditch and lake. The same contaminants were also detected in on-site wetlands.

Date/Type/Cost of Remediation: The Reynolds Metal Company (RMC) began investigating and conducting early actions under the EPA Removal Program. The company signed a Consent Order with EPA in September 1995 to conduct an RI/FS and continue working on a number of early actions under the Removal Program. Several early actions were completed in 1996, including: 1) removal of spent potliner, 2) removal of waste material from a former chryolite waste pond, 3) cleanup of PCB contaminated soils adjacent to the casthouse, and 4) cleanup and reconstruction of the bakehouse sumps. RI/FS Work Plans addressing several source areas have been completed and investigations are underway. Reynolds is currently completing the installation of a series of deep and intermediate groundwater monitoring wells to provide information on constituent concentrations and aquifer characteristics at multiple depths beneath and downgradient of the Reynolds plant site. RMC estimates project expenditures of over $4 million to date.

ASBESTOS

Atlas Asbestos Mine, Fresno County, CA

Site Description/Contaminants Of Concern: Asbestos mining & milling operations ceased in 1979. The site includes three open pit mines, stockpiles of asbestos waste material within the mines, abandoned mill facilities, and an area of stockpiled waste in vicinity of mill facilities. The main contaminant of concern is chrysotile asbestos.

Environmental Damages and Risks: Environmental effects include air, surface water, and soil contamination. Results of air sampling indicate asbestos concentrations at all sampling stations to be higher than accepted background levels. Asbestos concentrations in surface water near Atlas mine site exceeds both the ambient water quality criterion for the protection of human health and the proposed maximum contaminant goal. Soil samples in the vicinity of Atlas Mine found large amounts of highly concentrated asbestos. The Atlas facility drains directly into the White Creek and then to a flood area along the California Aqueduct. During heavy floods the water is released in to drain inlets and asbestos is carried into the aqueduct.

Date/Type/Costs of Remediation: The selected remedy from the 2/14/91 ROD includes restricting access to the site by preventing off-road vehicle use and diverting surface water around contaminated soils. The estimated cost is $4.2 million.

Johns-Manville Coalinga Asbestos, Fresno, CA

Site Description/Contaminants of Concern: The mill operated from 1959 to mid-1974. The site covers approximately 25 acres and includes partially demolished mill buildings, an 8-acre process waste tailings pile containing 450,000 cubic yards of concentrated asbestos, and an inactive chromite mine. The main asbestos tailings pile is located in the east fork of Pine Canyon Creek. Erosion has created gullies 15 feet wide and 10 feet deep in the down slope of the tailings pile despite the presence of a small dam below the tailings pile. The main contaminant of concern is chrysotile asbestos.

Environmental Damages and Risks: Air sampling measured asbestos concentration levels up slope at 10,896 fibers/cubic meter and down slope at 9,274 fibers/cubic meter. (The generally accepted background levels are 100 fibers/cubic meter.) Asbestos concentrations in surface water exceeded both the ambient water quality criterion for the protection of human health and the proposed maximum contaminant level goal. Soils and sediments on site were also contaminated with elevated levels of asbestos.

Cost of Remediation: Phase I of the Remedial investigation was completed in March 1990, and the Feasibility Study was completed in May 1990. A ROD was signed in September 1990. The preferred remedial activity includes diverting the East Fork of Pine Canyon Creek and stabilizing the tailings pile. The estimated cost is $1.9 million.

CHROMIUM

Mouat Industries, Columbus, MT

Site Description/Contaminants of Concern: Chromium ore mining and processing operations began in the mid-1950's and ended in 1963. The site was used to process chromium ore into a high grade sodium dichromate for use as a corrosion inhibitor. Waste piles from these processes contained residual sodium dichromate as well as sodium chromate. Both total and hexavalent chromium have been found in soil, surface water, and ground water on and/or adjacent to the Mouat Industries site. The contaminant of concern is chromium found in soils at levels significantly above background.

Environmental Damages and Risks: A 1989 Preliminary Endangerment Assessment lists ground water, surface water, soil, and air as potential exposure pathways. Chromium was originally released to the soil as a result of spills and sodium dichromate leaching from the waste piles stored on-site. Infiltration and precipitation of contaminants

through soils has contaminated ground water. Ground water has transported contaminants off-site. Sampling performed in 1985 of monitoring wells down gradient of the site found concentrations of hexavalent chromium at 2.8 ppm, well above the Federal Primary Drinking Water Standard of 50 ppb. Hexavalent chromium has been found in surface-water samples down gradient from the site.

Cost of Remediation: In 1990 a chain link fence was erected around the site of the former waste pile to prevent direct contact with the contaminants. In 1993 and 1994 FMC corporation completed a removal action which addressed the soil media. About 33,000 cubic yards were treated or removed to appropriate disposal sites. The total cost was estimated to be $20 million. In 1996, an Action Memorandum and Unilateral Administrative Order were executed selecting monitoring of the groundwater plume, institutional controls, and natural attenuation as the final remedy for the site.

Shield Alloy Corp., Gloucester, New Jersey:

Site Description/Contaminants of Concern: The Shield Alloy Corp. was a producer of chromium metal, chromium oxide, specialty metals, and ferro-alloys. In 1979 the plant constructed a decontamination plant for the treatment of chromium contaminated groundwater. The groundwater extraction and treatment system was upgraded in 1989 and 1992 to provide for more effective capture and treatment of groundwater contaminated with chromium and trichloroethene. There are slag piles and low-level radioactive wastes on-site. On and off-site groundwater are contaminated with volatile organic compounds, hexavalent and total chromium.

Environmental Damages and Risks: About 3,000 people live within a 1 mile radius of the site. Ground water is contaminated with volatile organic carbons (VOC's)and chromium. On-site soils are contaminated with inorganic contaminants related to site operations, and possibly radio nuclides. The Hudson Branch Tributary of the Maurice River contains hexavalent chromium and VOC's. Other risks include drinking or direct contact with groundwater and surface water, inhaling contaminated air particles, and consuming contaminated fish from nearby surface waters.

A well-restriction area is in place downgradient of the site which restricts access to contaminated groundwater. Residents in this area have been connected to the municipal water supply.

COPPER

Anaconda Smelter, Mill Creek , MT

Site Description/Contaminants of Concern: Copper smelting by the Anaconda Copper Mining Company began in the 1880's and did not cease until 1980. This site is one of four separate but contiguous Superfund sites located in the Clark Fork River Basin, including Milltown Reservoir Sediments site, and Silver Bow Creek. The Atlantic Richfield Company (ARCO) purchased Anaconda Copper Mining Company in 1977 and is the potentially responsible party (PRP) at the site. Wastes generated at this site include: 230 million cubic yards of tailings; 30 million cubic yards of furnace slag; and 500,000 cubic yards of flue dust. The contaminants of concern at this site include arsenic, lead, copper, zinc and cadmium.

Environmental Damages and Risks: This site has documented soil, drinking water, surface water, and airborne contamination. Tens of square miles of soils have been contaminated from aerial emissions as well as millions of gallons of groundwater contaminated from wastes and soils. Investigations found that Mill Creek had the highest levels of contamination of any inhabited areas around the smelter. The town of Mill Creek had a population of 100 people. It is now uninhabited and the houses have been demolished. Anaconda (population 10,000) is one half mile west of the smelter.

Cost of Remediation: Remediation began on the Mill Creek Operable Unit with a 1987 ROD proposing the relocation of residents. The cost of relocation was $300,000. On September 17, 1991, an Action Memorandum required ARCO to conduct a Time-Critical Removal Plan (TCRP)by excavating and removing contaminated soils in the areas of 3 homes. Estimated cost of remediation to the PRP of the Mill Creek operable unit is $1.5 million.

A ROD, completed in 1991, required the treatment and disposal of all flue dust located on Smelter Hill. Remediation of the Flue Dust operable unit featured: 1)stabilizing via cement and lime approximately 316,5000 cubic yards of flue dust; and 2) placement of treated materials in an engineered repository. The estimated cost to the PRP of remediation of the Flue Dust operable unit is $54 million.

Stabilization of Red Sands adjacent to Warm Springs Creek, a repair of breaks in the levees and installation of fencing was required in certain areas of the Old Works site. Remediation of the Old Works/East Anaconda Development Area operable unit included treating soils, constructing engineered covers, constructing surface controls for runoff, upgrading or repairing levees, replacing bridges or culverts, implementing long-term monitoring and preserving historic features of the historic district where practicable. The estimated cost to the PRP is expected to be $30 million.

Waste materials including beryllium were removed from Arbiter pond and bunkers as part of an Accelerated Removals response action plan in 1992. The excavation of the waste material from two ponds and four concrete bunkers were required for remediation of the Arbiter and Beryllium operable units. The material included 160,000 cubic yards of solids, sludge and water. The total quantity hauled and placed in a repository was 275,000 cubic yards since dry materials were mixed with wet materials to stabilize them. Beryllium containing tailings were also hauled and placed in the repository. The repository was closed in 1994. The estimated cost of the removal action to the PRP is $5.3 million.

A March 1994 ROD for the Old Works/East Anaconda Development Area operational unit required remediation of recreational and commercial/industrial areas where soils and waste exceeded arsenic levels of 1,000 and 500 ppm respectively. The estimated cost of remediation to the PRP at completion is expected to be $30 million.

A Community Soils ROD completed in September 1996, selected a combination of soil removal, engineered and vegetative covers and institutional controls. Final studies are expected to be completed in 1997. An expected cost of remediation to the PRP is in excess of $8 million.

Celtor Chemical Works, Humboldt Co., CA

Site Description/Contaminants of Concern: Celtor copper and zinc milling operations operated from 1958 until the early 1960's. The site consists of the plant, a pasture used for grazing livestock, a fishing access road that is used by residents, a drainage creek, and the Trinity River. The Celtor Chemical Works Mill milled sulfide ores shipped from the Copper Bluff Mine. Contaminated areas at the site include tailings piles, ore bins, vats, an access road, and a ditch. Combined, these areas are a source of approximately 1,350 cubic yards of material highly contaminated with heavy metals. Tailings were stockpiled or presumably flushed down a gully to the Trinity River. This may have been the cause of several fish kills in the area. Contaminants of concern include arsenic, cadmium, copper, lead, mercury, silver, and zinc.

Environmental Damages and Risks: Surface water sampled up gradient and in the immediate vicinity of the site measured elevated levels of cadmium, copper, lead and zinc. Samples taken in the immediate vicinity of the site measured contaminants above both Federal Ambient Water Quality Criteria for Freshwater Aquatic Life (AWQCFAL) levels and Federal Drinking Water Standards (DWS). Native soils in the mill site area have also been contaminated by ore and tailings and were measured above the California Assessment Method (CAM) for making Total Threshold Limit Concentration (TTLC) criteria. Naturally occurring iron was the only element detected in analyses of groundwater samples. An approximate 900 people live within 3 miles of the site. The Trinity River, which supports the only fish resources for the Hoopa Indians, runs though the reservation and near the site.

Cost of Remediation: EPA conducted a Focused Feasibility Study and Interim Remedial Measure in 1983. The study prompted removal of roughly 1,400 cubic yards of contaminated materials from the site, and also discovered additional contamination at the site suggesting further remedial activities. In 1985, the RI/FS was completed, and the ROD was signed. Remediation activities occurred during 1987 and 1988. Operations and maintenance activities continued until October of 1989. The estimate for the site cleanup cost in 1989 was $4.9 million. A site closeout report was filed in 1989, with a five year review being conducted in 1993. The site is ready to be deleted from the NPL.

Commencement Bay Nearshore/TideFlats, Tacoma, WA

Site Description/Contaminants of Concern: This site began lead smelting in 1889, before copper milling and smelting operations began in 1902. Refining operations ceased in 1979, and the smelter closed in 1985. The arsenic processing plant operated until Jan. or Feb. 1986. The site encompasses the Port of Tacoma and includes 10 to 12 miles of shallow water, shoreline, and adjacent land. The site is divided into seven operable units: (I) sediment contamination; (2) on-site contamination of American Smelting and Refining Company (ASARCO) Tacoma Smelter property; (3) the Tacoma Tar Pits; (4) off-site contamination of the residential area surrounding the ASARCO Tacoma Smelter; (5) sources of sediment contamination; (6) contaminated sediments along the Ruston-Point Defiance Shoreline Waterway; and (7) demolition of the ASARCO Tacoma Smelter. (The NPL summary addresses only OU's 2,4,6, and 7.) Contaminants of concern include arsenic, antimony, cadmium, chromium, and other metals.

Environmental Damages and Risks: 1974 ambient air sampling concluded that the ASARCO Tacoma Smelter was a major source of off-site surficial soil contamination. At OU #2, potential exposure pathways include: groundwater, surface water runoff, and inhalation or ingestion of contaminated dust or soil. At OU #4, exposure pathways include inhalation or ingestion of contaminated dust or soil, contaminated building materials, and through the food chain. At OU #6, surface water, sediments, and aquatic life are the listed exposure pathways. For OU #7, contaminated building materials and contaminated particulate matter are potential exposure pathways.

Cost of Remediation: Objectives of remedial actions at the Operable units related to ASARCO include removal of contaminated or hazardous buildings and structures, demolition of the unstable smelter stack, control of ground and surface water contamination, and remediation of contaminated marine sediments. Cost remediation for OU 2 is $45 million, OU 4 is $60 million, and OU 7 is $12 million. Range of costs for remediation of OU 6 is $10-15 million.

Current Status: On June 24, 1996, a proposed Consent Decree was lodged in U.S. District Court (United States vs. Asarco Inc.), dealing with releases of hazardous substances at the Commencement Bay Nearshore/Tideflats Site. In the proposed Consent Decree, Asarco would agree to implement the remedy set forth in EPA's Record of Decision (ROD) for the smelter site dated March 24, 1995. Asarco would agree to: (1) excavate approximately 160,000 cubic yards of soil and slag contaminated above action levels; (2) dispose of the contaminated soil and demolition debris designated as hazardous waste in an on-site containment facility (OCF) which meets or exceeds regulatory standards for hazardous waste landfills; (3) cap the entire site with a low-permeability cap composed of layers of clean soils, gravel and clay; (4) demolish the remaining buildings and structures on the site; (5) replace the entire surface water drainage system; (6) armor portions of the plant site and slag peninsula shoreline; (7) continue to monitor the sediments and groundwater under an Administrative Order on Consent currently in effect; and (8) develop and implement an enforceable program of restrictions and guidelines to supplement the actual cleanup activities to ensure that the remedial action remains protective and that development activities do not impact the long-term effectiveness of the cleanup. Asarco would also reimburse the United States $3,081,510.00 for past response costs that the United States has incurred relating to the Asarco Smelter Site and would reimburse the United States for all of its future response costs at the site.

Milltown Reservoir Sediments, Milltown, MT

Site Description/Contaminants of Concern: No mining, beneficiation, or processing activities occurred at this site; however, metals mining along the Clark Fork River has impacted the Milltown Reservoir. Large volumes of river-borne sediments from upstream mining areas of Anaconda and Butte have accumulated in the reservoir created by the Milltown Darn which was constructed in 1906. These sediments have been determined to be the source of both surface and groundwater contamination. The primary contaminant of concern is arsenic.

Environmental Damages and Risks: The Milltown Reservoir is believed to contain an estimated 120 million cubic feet of sediment contaminated with heavy metals. In 1983, arsenic was discovered in four Milltown community wells at levels between 0.54 and 0.90 milligrams per liter. The Clark Fork arm of the Reservoir contains metal concentrations 5 to 17 times greater than metal concentrations in the Blackfoot Arm. Surface water sampling performed in 1989 found increases in heavy metals and TSS from upstream to downstream of the Reservoir. The site was listed on the NPL in 1983

Cost of Remediation: A ROD was signed in 1984. Remedial activities included constructing a new drinking water well in a separate aquifer, cleaning the existing water distribution system, and continuing ongoing monitoring. Capital costs are estimated to be $272,714. Operations and maintenance (O&M) costs are projected to be $4,238/year.

Silver Bow Creek, Butte, MT

Site Description/Contaminants of Concern: Metal mining, milling, and smelting operations began in the 1880's and continued through 1960 at this site. This site is another one of the four separate but contiguous Superfund sites located along the Clark Fork River. The Silver Bow Creek site encompasses over 2,000 acres and includes the cities of Butte and Walkerville, the Berkeley Pit, numerous underground mine works, the Continental Pit, Silver Bow Creek, Warm Springs Ponds, and Rocker Timber Framing and Treating Plant. Discharge from mining, smelting, wood treating, and other industrial sources for over 110 years has contaminated soils, surface water, and ground water. The site is divided into seven operable units. Contaminants of concern include arsenic and other heavy metals.

Environmental Damages and Risks: Soils at the site contaminated by elevated levels of lead, arsenic, copper, cadmium, and mercury include alluvial soils along the Silver Bow Creek floodplain, and surface soils and sediments farther removed from the streambanks. High levels of metal contamination have been detected in residential areas located near mine wastes. Federal Drinking Water Standards were exceeded for arsenic, cadmium, copper, iron, zinc, and sulfate as measured in several domestic wells.

Costs of Remediation: Remedial actions developed for each of the seven operable units attempt to control contamination associated with pond bottom sediments, surface water, mine tailings, contaminated soils and ground water. Cost estimates were provided for OUI-(Warm Springs Ponds) at $57 million + $379,000 O&M annually.

Torch Lake, Houghton Co., MI

Site Description/Contaminants of Concern: Copper milling along the shore of Torch Lake began in 1868. Processing activities continued until 1968. The site is located on the Keweenaw Peninsula of upper Michigan in an area that dominated Michigan's copper mining smelting, and milling activities for over 100 years. Approximately 200 million tons of tailings were pumped into Torch Lake, reducing its volume by 20%. The site has three operable units including: surface tailings and contents of buried drums along the shore of the lake; potentially contaminated media in and around Torch Lake; and other tailings sources. Contaminants of concern include arsenic, copper, lead and zinc. This report discussed developments with respect to Operable Unit 1(OU1) only. Rls for the remaining two OUs were not complete at the time the Site Summary Reports were written.

Environmental Damages and Risks: Sources of contamination in OU1 are tailings and associated debris, drums in

the tailings, drums in the lake, and industrial chemicals. Potential pathways for contamination include air, ground water, surface water, and sediments. Sediments are believed to be 70 feet thick in some areas, and surficial sediments contain up to 2,000 ppm of copper. Contamination of these media, including contamination of ground water from tailings in OU1, will be discussed in the Remedial Investigation for OU2. An estimated 27,000 gallons of cupric ammonium carbonate were deposited into the lake. The Michigan Department of Public Health (MDPH) issued a fish consumption advisory on Sauger and Walleye caught in Torch Lake due to an increased incidence of lesions and tumors found on these fish.
Processing water containing 2,400 times the allowable limits for copper and 100 times the limit for ammonia was dumped into the Tamarack lagoon system.

Date/Type/Costs of Remediation: Remedial actions began in 1968. A ROD was completed for operable units I and III in September of 1992. Attempts have been made to vegetate tailings deposits on lake shoreline; sewage sludge was sprayed on the tailings to promote vegetative growth; annual restocking and periodic sampling of fish has been performed; and wastewater treatment facilities have been upgraded. A ROD on operable unit II was completed in March of 1994. A "No Action" remedy was selected by the US EPA for operable unit II. No cost information was available.

U.S. Smelter and Lead Refinery, INC., Lake Co., Indiana

Site Description/Contaminants of Concern: The USS Lead facility was built in approximately 1908. Although the facility was originally built to smelt copper, it has always smelted lead. Contaminants of concern are the blast furnace slag, the lead containing dust emitted by the blast furnace stack, lead, cadmium, copper, arsenic, and zinc.

Environmental Damages and Risks: The lead containing dust has spread throughout the site and surrounding buildings. Nearby surface waters were contaminated because slag water was dumped into the wet lands. Lead particles were found downwind of the site. Approximately 4.1 million people draw drinking water from the intakes of Lake Michigan which is 15 miles downstream of the hazardous substance. Lake Michigan and other nearby canals and rivers are fishing areas. Seventy five hundred people work or attend school within two miles of the site. Two endangered species live a quarter of a mile from the site.

Current Status: The facility has a Consent Order with the Resource Conservation and Recovery Act (RCRA) program to prepare a Corrective Action Management Unit (CAMU). Site investigations will begin once all RCRA authorities have been exhausted.

GOLD AND SILVER

Carson River Mercury, Lyon and Churchill Co., NV

Site Description/Contaminants of Concern: Gold and silver processing began in the late 1880's using mercury to amalgamate the metals. The Carson River site consists of sediments in toe Carson River and hundreds of tailings piles contaminated with mercury from the amalgamation process. An estimated 7,500 tons of mercury were lost during milling processes, much of which is incorporated into uncontained mill tailings. Mercury is the contaminant of concern at this site.

Environmental Damages and Risks: The tailings pile contained concentrations of mercury at 443 ppb. Mercury was detected in three of 46 surface water samples at levels just above the 0.5 ppb detection limit. Another 4 samples obtained from the reach of Carson River measured mercury concentration levels above detection. Groundwater samples from domestic and monitoring wells from Brunswick Canyon to Lahontan Reservoir measured mercury concentrations of less than .0005 ppm. Air sampling detected mercury under temperatures exceeding 100 degrees Fahrenheit or under

windy conditions. Varying levels of mercury were measured in several different species of fish, from a maximum of 9.52 mg/kg in muscle tissue of striped bass to 23.65 mg/kg in liver tissue of the same species.

Date/Type/Costs of Remediation: An RI/FS was initiated in September 1990. EPA would like to stabilize contaminated tailings piles on-site to control mercury vapors and leaching. NDEP suggests impounding stream water before it enters the reservoir during the snow melt season to allow mercury to settle out. No information is available regarding the cost of the remedies or whether or not these remedies have been selected.

Cimarron Mining Landfill, Carizozo, NM

Site Description/Contaminants of Concern: Beginning in 1979, a cyanide process was used to extract precious metals from ore transported to the mill. The mill facility ceased operating in July 1982 after receiving a Notice of Violation from the NMEID for discharging into a non-permitted discharge pit. The Cimarron site consists of an inactive cyanidation mill that discharged contaminated liquids and stockpiled contaminated tailings and waste trench sediment at the site. Contaminants of concern at this site include cyanide, chromium, lead, iron, manganese, selenium, and other metals.

Environmental Damages and Risks: Contaminated media of most concern at the site are shallow ground water and surface soils. The area of the site most affected by elevated metals concentrations in ground water is below and down gradient of the tailings disposal area. Cyanide contaminated soils are largely found in tailings piles, sediment piles, the discharge pit, and trenches. Air sampling detected low levels of cyanide.

Date/Type/Costs of Remediation: The New Mexico Environmental Improvement Division (NMEID) began investigations at the site in 1980. An Rl/FS was conducted between 5/89 and 5/90. The remedy for the site would remediate contaminated shallow ground water and would prevent further contamination of ground water by the cinder block trenches and the discharge pit. The estimated cost for site remediation is $104,525.

Construction of the remedy for the Carrizozo portion of the site was completed in September 1992. This included stabilization and onsite disposal of lead contaminated soil and installation of a ground water treatment system. The ground water treatment system is still in operation.

Stabilization and disposal of contaminated soil at the Sierra Blanca portion of the site will be completed in Spring 1997.

Clear Creek/Central City Site, Clear Creek, CO

Site Description/Contaminants of Concern: Gold, silver, copper, lead, molybdenum, and zinc mining began in 1859. Investigations at the site focused on discharges of acid mine drainage (AMD), from the mines, and milling and mining wastes in numerous locations in the Clear Creek, West Clear Creek, and North Clear Creek drainage. Contaminants of concern for human receptors in surface water include arsenic, cadmium, chromium, lead, and manganese. Copper and zinc are additional contaminants of concern for aquatic receptors.

Environmental Damages and Risks: Surface water contamination has resulted from AMD emanating from several mine tunnels and from seepage of groundwater through tailings piles. Sediments downstream of the Argo and Big Five Tunnels, and other places show elevated levels of metals. Groundwater sampling revealed high-metals concentration exceeding human health standards. Dust and wind-blown particles originating from tailings piles have been evaluated as a potential exposure pathway.

Date/Type/Costs of Remediation: Remedial investigations began in 1985 and focused on mine-tunnel discharge treatment, tailings and waste-rock remediation, and site-wide remediation. The costs for mine-tunnel discharge remediation and for tailings and waste rock remediation are $25 million and $1.05 million, respectively. No further estimates were provided in the references.

Denver Radium (Robinson Brick), Denver, CO

Site Description/Contaminants of Concern: In 1886 The Bailey Smelter began operation on this site. In 1890 The Gold and Silver Extraction Co. established a mill and laboratory at this site to process ore. In 1902 the Colorado Zinc Co. constructed a mill on the site which operated until 1911. In 1913 The National Radium Institute began milling operations at the site which continued through 1918. The site consists of 49 separate properties combined into 11 units where radium contaminated wastes were discarded when the facility closed. A total of approximately 106,485 cubic yards of contaminated soil was left behind. The site has been divided into 11 operable units. Contaminants of concern include radium and radon.

Environmental Damages and Risks: The maximum level of radium found in soil was 5,093 pico Curies per gram (pCi/g). Soil from six properties also exhibited levels of Extraction Procedure (EP) toxicity/metals, total levels of polynuclear aromatic hydrocarbons (PAHs), and total levels of volatile organic compounds (VOCs). Air sampling measured gamma exposure and radon and radon daughter concentrations above background levels.

Date/Type/Costs of Remediation: Initial remedial investigations were initiated in 1981, and completed in 1982. Seven RODs for 10 of the 11 Operable Units were signed in 1986 and in 1987. Remedial actions include removal of approximately 149,592 tons of contaminated materials and the no-action alternative for OU 7 and portions of 6,9,& 11. The final RI/FS was completed in 1985.

Silver Mountain Mine, Loomis, WA (deleted from NPL 9/97)

Site Description/Contaminants of Concern: The Silver Mountain Mine is an inactive precious metal heap leaching site covering approximately five acres. Underground mining for silver, gold, and copper began in 1902. Activities continued off and on with the most recent being a heap leach operation. The heap leach operation was abandoned in 1981 without removal of 4,400 pounds of sodium cyanide used to treat 5,300 tons of ore. Soils, ground water and surface water have been contaminated by cyanide and arsenic. There is concern over the potential human health risk to exposure to these contaminated media. Contaminants of concern: arsenic and cyanide.

Environmental Damages and Risks: Four potential sources of contaminants were identified at the site including the leach heap, mine dump, mine drainage, and bedrock. Potential exposure pathways include: on-site soils, on-site surface water, on-site ground water in a shallow aquifer, and off-site ground water in a lake aquifer. Moderate to high values of arsenic were detected in both the mine dump and in the heap leach. Arsenic, antimony, and other heavy metals originate in the mine dump and occur in mine drainage. Arsenic and antimony also originate in the bedrock of the mine workings where ground water may act as transport.

Date/Type/Costs of Remediation: Interim remedial actions have occurred at the site, the last being in 1985. These include: treating the leachate with sodium hypochlorite; removing liquids and residue from the leachate pond; installation of a plastic liner to over the mine tailings reduce infiltration. Long-term remediation presented in the ROD was completed in 1992. Actions included consolidating and covering contaminated soils and mining wastes, fencing the site, placing a deed restriction to protect the cover, and monitoring groundwater. In 1994, future ground water monitoring was determined to be unnecessary. Cost estimates for the long-term remediation was $635,600. Actual remediation costs were $759,000.

Summitville Mine, South Fork, Co.

Site Description/Contaminants of Concern: Summitville is an abandoned gold mine that was leaking cyanide along with acid and metal-laden mine water into the headwaters of the Alamosa River. The Summitville Mine Site covers approximately 1,400 acres of Rio Grande County, about 18 miles southwest of Del Norte, high in the San Juan Mountains of southwestern Colorado. Mining has occurred there intermittently since the 1870's when gold was discovered along Wightman Fork. The first lode discovery in 1872 led to the emergence of lode mining, which progressed from open cuts to shafts to underground workings. By 1887 high grade ore declined and by 1890 the site was idle. By 1930 mining companies began to consolidate. Tunnels were used to reach previously inaccessible areas to reduce the cost of dewatering. These tunnels were the source of acid mine drainage and heavy metal contamination. In 1962, copper, gold, and silver were produced from the tunnels. Activity was limited until Galactic Resources began the Summitville project in 1984.

Environmental Risks and Damages: In 1986, six days after the operation began, cyanide leakage was discovered. Cyanide passed though both layers and penetrated into the soil at a rate of 10 ft. per year. In 1987, because of 9 system failures, there were discharges of water either directly into the Cropsy Creek or into the settling ponds on site. In 1991, Summitville had another cyanide spill on site that flowed directly to Wightman Fork. A fishkill occurred in a farm pond that obtains water from the Terrace River. Because of the historic mining area and lack of baseline data it is hard assess the background levels of contaminants. The Terrace Reservoir is fed by the Alamosa River. Water samples revealed increased levels in copper by 5 times the original level, zinc by 2-9 times, cadmium 7 times, iron 2-5 times, manganese 13 times, and aluminum 8 times. The pH dropped from 3.5 to 3.0.

Cost of Remediation: Since EPA has taken charge of the Summitville Mine site, costs have risen to $3.5 million, at an average cost of $30,000 a day. The ultimate cost of clean up is indefinite.

Whitewood Creek, Lawrence/Meade/Butte Co's., SD

Site Description/Contaminants of Concern: This site contains 25 to 37 million tons of mine tailings generated from approximately 100 years of gold mining and milling operations that occurred in the area until 1977. During the 100 years of active mining, tailings and untreated wastewater were discharged into Whitewood Creek and its floodplain. Contaminants of concern include arsenic, cadmium, copper, manganese, and other metals. Elevated levels of these contaminants have been detected in the alluvial groundwater beneath the tailings, surface water, surface soils, and vegetation.

Environmental Damages and Risks: The tailings range from 1 to 15 feet thick and 50 to 100 feet wide on both sides of Whitewood Creek along its entire 18 mile length within site boundaries. The tailings contain concentrations of arsenic up to 42,500 mg/kg and concentrations of cadmium up to 180 mg/kg. Down gradient alluvial aquifers are the only groundwater sources that exhibit elevated levels of contaminants, with levels of arsenic measured at 0.78 mg/l. Surface water contamination results from ground water seeping through the tailings and alluvium. Erosion of the tailings caused by flooding may contribute as much as 35,000 kg of arsenic to Whitewood Creek. As a result, arsenic levels in surface water vary markedly downstream from the site. Some areas of irrigated cropland are contaminated by arsenic, and residential areas located within an alluvial tailings deposit area exhibit soil contamination by arsenic.

Date/Type/Costs of Remediation: Remedial actions selected for the site include covering and/or removal of contaminated soils at existing residential properties and restricting access to tailings deposits via institutional controls. The cost is estimated to be $1,028,000 + $12,000 O&M/year for 30 years.

LEAD/ZINC

Big River Mine Tailings/St. Joe Minerals Corp.

Site Description/Contaminants of Concern: For twenty-nine years mine tailings rich with lead, cadmium, and zinc were disposed of at the 600-acre big river mine tailings area. The Big River bounds three sides of the site. Rain causes the tailings pile to discharge contaminated material into Big River. Wind erosion and airborne dust also contribute to offsite releases and increases the metals concentration of surrounding soils.

Environmental Damages and Risks: High levels of lead were detected in fish, sediments, and the surface water downstream of the site. Big River is used for fishing and for watering live stock. About 23,000 people live within 4 miles of the site. Contaminated material released from the site threatens the health of nearby residents and threatens the environment. In 1994, a stabilization of the pile was started to control the release of contamination.

Bunker Hill Mining and Metallurgical Complex, Kellogg, ID

Site Description/Contaminants of Concern: Lead smelting and silver refining occurred at this site from 1885 until 1981, when the smelter closed. A large zinc refining and smelting operation was added in 1928, and operated until the 1981 closure. The site consists of an inactive integrated mining, milling, and smelting operation. Also within the site boundaries are the inactive Page Mine, the Page tailings disposal area and numerous old mines, mill sites, and prospects. Contaminants of concern at the site include lead, zinc, cadmium, antimony, arsenic, beryllium, copper, mercury, and polychlorinated biphenyls PCB's).

Environmental Damages and Risks: Bunker Hill was added to the National Priorities List in 1983, and is one of the largest Superfund sites in the Nation. There has been contamination of soil, ground and surface waters and air from smelter operations and mining and milling. Smoke stack emissions from the smelter have contaminated the surrounding hillsides, destroying much of the vegetation. Smelter emitted metal-laden particles contained over 6 million lbs of lead, 560,000 lbs of cadmium, 860,000 lbs of zinc and 70,000 lbs of arsenic. Soils near the smelting complex have been severely contaminated by sulfur oxides and metals deposition. For over 90 years, the South Fork Coeur d'Alene River has been contaminated by mine and mill wastes, including acid mine drainage (AMD). Primary sources of ground water contamination include seepage from a large waste impoundment area, infiltration, and ground water flow through valley-wide deposits of tailings.

Date/Type/Costs of Remediation: Remedial actions began in 1986 when a soil survey was conducted in three communities. Under an emergency removal action contaminated soils were removed from 16 parks and playgrounds. More contaminated soils were removed from 210 residences in 1989, beginning a program of residential yard, commercial areas, and rights-of-way clean up that continues today. This work is now being performed by a group of PRPs working under a Consent Decree; they complete approximately 200 residential yards and other properties each year. This work is expected to have cost approximately $40 million by the time it is completed; completion is currently projected for 2000 or 2001, depending on the number of yards requiring clean up and the outcome of annual blood-lead surveys.

Gulf Chemical and Resources, the primary PRP for the smelter area performed some minor clean up of the smelter area, and planted over 1 million tree seedings on the hillsides before declaring bankruptcy. With the bankruptcy, clean up of the non-populated areas of the site became primarily a Fund-lead effort. A $5 million time critical removal action to remove smelter buildings that were a major fire/recontamination hazard began in late 1994 and was completed in May 1995. This was followed by large scale remedial action which has demolished the entire smelter complex, and continues today with contaminated soils removal and disposal.
Future work will include removal of about 1.5 million cubic yards
of mill tailings from the South Fork Coeur d'Alene River, disposal of highly contaminated tailings in the existing

impoundment area, and closure of the disposal areas with low permeability caps. Much work remains to be done to re-establish vegetation on the hillsides to limit erosion and contaminant migration within the Site. Most of this work has been paid for with Fund money, but there has been about $10 million recovered from the Gulf bankruptcy settlement, and from other PRPs.

Some demolition work at the site was performed by the Bunker Limited Partnership (BLP) environmental trust fund, which was set up as a result of the BLP bankruptcy. As BLP continues to dispose of assets, additional monies come into the fund and is used to perform more work at the Site. This fund is expected to contribute $5-7 million for Site work, and this could exceed $10 million depending on the outcome of some ongoing BLP litigation.

Discrete portions of the site are also being cleaned up by Union Pacific Railroad and Stauffer Chemical Company, under Consent Decrees entered in September 1995. Their work is expected to be completed in 1997 or 1998.

The selected remedy at the Site includes an Institution Controls Program (ICP) to ensure that protective barriers are not compromised over the long term in the many areas where significant contamination remains. This program has been established by local ordinance and regulation, and will be managed by the Panhandle Health District. A fund to support the long term operation of the ICP will be capitalized from several sources, including PRPs and appropriations by the State of Idaho.

Cherokee County - Galena Subsite, Cherokee County, KS

Site Description/Contaminants of Concern: The Cherokee County site is a mining area covering about 110 square miles. It is part of a larger area sometimes called the Tri-State Mining District, which encompasses Cherokee County in Kansas, Jasper County in Missouri, and Ottawa County in Oklahoma. One hundred years of widespread lead and zinc mining created piles of mine tailings, covering 4,000 acres in southeastern Cherokee County. The mine tailings, containing lead, zinc, and cadmium, have leached into the shallow groundwater. Runoff from the waste piles has transported contaminants into nearby streams. EPA has divided this site into six subsites that correspond to six general mining locations. Cleanup work is further along at the Galena subsite, in the east-central portion of the entire site, than at the other subsites. This 25-square-mile area has large tracts of mine and mill wastes, water-filled craters where the ground has collapsed, open mineshafts, and pits. Wastes have affected the quality of the shallow groundwater, a primary drinking source for the residents of the area, and the surface water. Several heavy metals were found in water samples from private wells. Surrounding lands are used for residences, business, light industry, farming, and grazing. Of the 22,320 people living in Cherokee County, 1,100 residents live outside the town and depend on groundwater from the contaminated aquifer for drinking supplies.

Environmental Damages and Risks: Radon gas from the mining operations has been detected in the air around the Galena subsite. Private wells in Galena contain lead, cadmium, selenium, zinc, and chromium. Acidic waters in mine shafts throughout the site, tailing piles and surface waters in the mine pits, and streams across the site contain significant concentrations of lead, zinc, and cadmium. Risks to public health include accidentally ingesting soil or mine wastes; inhaling contaminated household dust; or ingesting contaminated surface waters, foodstuffs, or groundwater. Acid mine drainage containing dissolved heavy metals contributes to the transport of heavy metals into the Spring River, Short Creek, and Shoal Creek; analysts have found contamination in fish from local surface waters. Polluted mine water also surfaces in Oklahoma's Tar Creek.

Date/Types/Costs of Remediation: The site is being addressed in six stages: immediate actions and five long-term remedial phases focusing on providing an alternate water supply, cleanup of the Treece and Baxter Springs subsites, cleanup of the Galena groundwater and surface water, and cleanup of the Galena residential soils.

EPA installed water treatment units on eight contaminated wells in Galena in 1986. EPA selected an approach for supplying an alternate source of water to Galena in 1987. Construction of two deep aquifer wells and the two water storage tanks was completed in 1992. Water line easement acquisition activities began in 1991 and were completed in 1993.

Treece Subsite: The EPA initiated investigation activities at the Treece subsite in 1988. The parties potentially responsible for contamination of this area took over the study in early 1990. This investigation explored the nature and extent of soil and water pollution at the subsite and will recommend the best strategies for final cleanup. The investigation was completed in the summer of 1994, and a remedy is expected to be selected in late 1996.

Baxter Springs Subsite: The EPA initiated an investigation at the Baxter Springs subsite in 1987. The parties potentially responsible for contamination of this area took over the study in conjunction with the Treece investigation in early 1990. This study explored the nature and extent of soil and water pollution at the subsite and will recommend the best strategies for final
cleanup. As with the Treece subsite, a remedy is scheduled for selection in late 1996.

Galena Groundwater and Surface Water: In 1989, the EPA, with the agreement of the State, selected a remedy for cleaning up the groundwater and surface water in the Galena subsite. It included removing and selectively placing mine waste below the ground surface; diverting surface streams away from the contaminants; recontouring the land surface to control runoff and erosion; and investigating deep aquifer wells. Cleanup was completed in late 1994.

Circle Smelting Corp., Beckemeyer, IL

Site Description/Contaminants of Concern: The facility is located on a 28 acre land on the eastern boundary of Beckemeyer. The facility was originally constructed in 1904 as a primary zinc smelter. In 1920, it was converted to a secondary zinc smelter and began recovering zinc from scrap metals. A Belgium retort system was used but discontinued in the late 1960's. An EI/CA has been performed by U.S. EPA characterizing the risks from in-site related lead exposure resulting in selection of capping the site as an interim remedy for the site. Three sources of contamination have been identified at the site: a metal rich slag waste pile which has been used as a source of fill for sidewalks and alleyways throughout the village, an area of contaminated soils within the stream bed of an intermittent drainage way that receives surface water run-off from the slag pile, and an area of contaminated soils which surrounds the smelter property. Contaminants of concern include zinc, cadmium, copper, lead, and nickel.

Environmental Damages and Risks: Over the years, inorganic particulates were released from the smelting retort furnaces and deposited on nearby residential and agricultural lands. The area of the contaminated soils is approximately 481 acres. In addition, analytical results document that hazardous substances have migrated from the site to Beaver Creek by the intermittent drainage way. There are approximately 5,800 feet of forested wetland frontage within 15 miles downstream of the site.

Cleveland Mill, Silver City, NM

Site Description/Contaminants of Concern: The abandoned 10 acre Cleveland Mill was used as a lead, zinc, and copper mine and mill. The site has been conducting milling operations since 1910. Between 1915 and 1945, the mill processed approximately 134,000 tons of ore. Tailings were deposited in unlined and unstabilized heaps along a small, steeply sloped valley. The site was abandoned in the 1950's. There are 9 piles of mine tailings and debris for a total of 71,000 cubic yards of material requiring remediation, including 10 acres of stream bed of the Little Walnut Creek. The creek and downstream waters are used for recreation. The piles are located at the headwaters of Little Walnut Creek, 100 yards south of the Continental Divide. Contaminants of concern include arsenic, beryllium, lead, cadmium, and zinc.

Environmental Damages and Risks: Indicator parameters were detected in wells down gradient of the site, however, no contaminants were above MCL's. Due to mine tailings runoff, pH levels as low as 2 and 3 were measured in the tributary to Little Walnut Creek. Contaminants from the mine tailings have also reached Little Walnut Creek with copper and zinc concentrations from 200 and 2,000 times above background concentrations, respectively. Elevated levels of metals were found in on-site and off-site soils during the site investigation. Although air monitoring was not

conducted, the mine tailings are believed to be a source of fugitive dust during windy weather.

Date/Type/Costs of Remediation: The RI/FS began in the fall of 1990. Excavation, Off-Site Reprocessing, Reclamation, and Beneficial Reuse and Disposal of Residual have been selected as the remedial actions for Cleveland Mill. The estimated cost is $6 million.

East Helena, East Helena, MT

Site Description/Contaminants of Concern: East Helena is an active primary lead smelter in an area encompassing approximately 80 acres. Five potential sources of contamination were identified in the November 1989 ROD including smelter air emissions, a slag pile, ore storage areas, process ponds, and process fluids. Contaminants of concern include arsenic, cadmium, copper, lead, and zinc.

Environmental Damages and Risks: Contamination of soil and surface water are primary concerns at this site. Mining leachate entering the creek upstream of the smelter has contaminated surface water and monitoring wells show arsenic at concentrations greater than 20 times the Federal drinking water MCL. Soil studies began in 1969. Blood-lead level testing of area residents began in 1975, revealing blood-lead levels twice the national average in children. Soils and sediments are heavily contaminated with arsenic and lead. There is potential for direct human contact with contaminants in the process ponds and other affected media

Date/Type/Costs of Remediation: A 1989 ROD addressing one of the five operable units describes remedial activities for the four process fluid ponds. Basic remedial activities related to these process ponds involves replacement with storage tanks or closed circuit filtration systems, excavation of contaminated soils, and smelting of contaminated sediments and soils in the smelter process. The cost is approximately $10 million.

Midvale Slag, Salt Lake County, UT

Site Description/Contaminants of Concern:
The Midvale Slag Superfund Site is located 12 miles south of Salt Lake City, Utah, within the city of Midvale, Utah. The site encompasses approximately 625 acres and is divided into two operable units. Operable Unit 1 (OU1) has been designated as the northern portion of the site, which includes the Winchester Estates Mobile Home Park and large areas of open space. Operable Unit 2 (OU2) is immediately south of OU1 and contains large piles of slag and smelter waste materials. The first smelter was constructed in 1871. Copper smelting was the first operation to be conducted, and in 1905 a lead smelter was added. In 1906, farmers in the Salt Lake Valley were concerned that the smoke emitted from all the smelting activities was the cause of their livestock and crop losses. In response, a federal judge ruled that smelters could not smelt ores that contained ten percent or more of sulfur. Thus, copper smelting was halted. Lead smelting continued, however, due to the lower sulfur content of the lead ores. In 1907, the blast furnace operating on the Midvale Slag site was redesigned to “bag” injurious sulfur and arsenic compounds, and a method was developed to recover arsenic for use as a pesticide. In 1931, a lead refinery was added to the smelter operation. This allowed for production of refined lead, gold, and silver. Cadmium was recovered from flue dust in an oxide form which was reduced to metal for marketing. Until 1928, zinc was wasted directly into the slag piles, and later an electrolytic zinc plant was added that produced market grade zinc.

The quantities of metals recovered at the Midvale Slag site between the years of 1918 through 1928 were approximately 400,000 tons of lead and significant quantities of gold, silver, zinc, arsenic, and cadmium. By 1928, the plant was smelting 250,000 tons of ores and concentrates annually. Records indicate that from 1937 through 1958, over 600 shippers had sent a total of 1,665,000 tons of ore to the Midvale Slag site mill.

Following World War II, the gradual closure of many of the mining operations that had supplied ore to the smelter at Midvale lead to the eventual closure of the smelter. In 1958, the smelter was shut down and never reopened. In 1964,

a slag screening operation was conducted by Valley Materials to produce slag material for sale. The slag was used in construction of railroad beds, road bases, fill, and uniformly sized aggregate for shot and grit blasting. The slagging operation was discontinued in the summer 1992. The contaminants of concern include arsenic, cadmium, chromium, copper, lead, silver, and zinc.

Environmental Damages and Risks:

Lead, arsenic and cadmium were sampled at maximum concentrations of 478,827; 462,957; and 44,373 ppm, respectively in the aerial extent of OU2. The ground water contains elevated levels (above MCLs) of antimony, arsenic, cadmium, selenium, and thallium.

OU1 have been covered with fill brought in as a result of the I-215 road project. Recent aerial photographs show that two-thirds of the site has been covered by fill, and the western part of the site is essentially native soils with some exposed wastes. The contaminants of concern of the slag and mixed smelter waste within OU2 includes arsenic, cadmium, chromium, copper, lead, silver, and zinc. The mixed smelter waste will be treated via solidification/stabilization technology as described in an Action Memorandum published July, 1995. Investigations are continuing to characterize the slag and the ground water to seek viable alternatives to protect human health and the environment.

Murray Smelter, Murry City, Utah

Site Description/Contaminants of Concern: Murray Smelter is an abandoned lead facility located in Murray City. Several smaller smelters were in the vicinity prior to the construction of the Murray Smelter in 1902 by the American Smelting and Refining Co. (ASARCO).

Environmental Risks and Damages: Approximately 80,000 tons of waste slag containing heavy metals have been left onsite following the close of operations in 1949. The overall extent of surface soil contamination is not currently known. Evaluation of the site considers only the slag piles and areas of soil contamination in two nearby mobile home courts. Slag materials have been documented in soil in nearly all directions from the site. The slag has been used for railroad ballast, road base, parking lot gravel, and fill in several areas surrounding the property. Contaminants emitted from smoke stacks and blowing contaminated dust is also a concern. Slag has also been found near Cottonwood Creek, where segments of the creek are used for fishing. Soil in two, residential areas have found to contain elevated levels of metals. The contaminants include antimony, arsenic, barium, cadmium, copper, lead, mercury, selenium, silver, thalium, and zinc. Arsenic and cadmium concentrations
on the residential property have been found to be above the human health screening concentrations.

National Zinc Corp., Bartlesville, Oklahoma

Site Description/Contaminants of Concern: The National Zinc Corp. (NZC) site is located on a 135-acre property at 11th and Virginia Streets in Bartlesville, Oklahoma. NZC operated a zinc smelter on this site from 1907 to 1976, when it was acquired by the Zinc Corporation of America.

Environmental Risks and Damages: The NZC had no air emission controls, allowing emissions to be deposited downwind in various areas in Bartlesville. Lead and cadmium levels in the top two feet of soil are greater than Health based levels, most within 15 miles of the facility. The extent of the area of contamination includes hundreds of residences, several schools, multiple day care centers, and many businesses.

Date/Type/Costs of the Remediation: A removal action to address contaminated soil in approximately 29 public play areas for children and 400 residential yards was conducted from 1992 to 1994 at a cost of approximately $11 million. In August 1995, the State began a remedial action to address contaminated soil. Through 1996, about 250 residential

properties have been cleaned up under the remedial action. When completed, the remedial action is expected to cost over $30 million.

Oronogo-Duenweg Mining Belt, Jasper Co.. MO

Site Description/Contaminants of Concern: Lead and zinc mining occurred in this area from the mid 1800s until the late 1970's. This site encompasses 20-square miles, contains over 7000 acres of scattered waste piles and up to seventeen smelter locations, and lies within the 2,400 square mile Tri-State (Missouri, Kansas, and Oklahoma) Mining District. Mining activities at the site involved mining crude ores and milling these ores to produce lead and zinc concentrates. Horizontal mine shafts, open pits, open vertical shafts, and tailings piles, containing an estimated 20 to 100 million tons of mining waste, remain from over 100 years of lead and zinc mining operations. Primary contaminants of concern at the site include cadmium, lead and zinc.

Environmental Damages and Risks: All contaminants of concern have been detected at elevated concentrations in ground water, surface water, sediments, and soil. Approximately 1,500 people obtain drinking water from private wells within 3 miles of the site. Ground water samples collected from private water supply wells at the site contained concentrations of lead, cadmium, zinc, and manganese that exceed EPAs health based action levels or Maximum Contamination Levels. Sediment samples collected from streams contained elevated levels of contaminants. Three surface water bodies which serve to drain area tailings piles contained elevated concentrations of contaminants. Residential yard soils in the vicinity of the smelters and mining waste piles exceed EPA action levels.

Date/Type/Costs of Remediation: EPA and PRPs have completed a remedial investigation and human health risk assessment for the mining wastes and or working on an ecological risk assessment and feasibility study. EPA and the PRPs are providing bottled water to approximately 100 homes supplied by contaminated private drinking water well, and are finalizing a feasibility study to address contaminated water supplies. EPA completed a time-critical removal action at 303 residential properties in 1996, signed a Record of Decision for residential yard soils in August, 1996. The Record of Decision specifies remediation of approximately 2500 additional residential yards. To date, EPA has spent over $5,000,000 at the site. Total remediation costs are expected to exceed $75,000,000.

Palmerton Zinc, Palmerton, PA

Site Description/Contaminants of Concern: The site consists of two primary zinc smelters that have produced zinc and other metals from 1898 through 1987. The second smelter operated from 1911 to 1980 and was the main source of air pollutants (concentrated zinc sulfide ores). A cinder waste pile from the production facilities is 2.5 miles long, 500 to 1,000 feet wide and 100 feet high, containing 28.3 million tons of waste material. Contaminants of concern include cadmium, lead, and zinc.

Environmental Damages and Risks: The site is divided into four operable units. OU1 is a defoliated 2,000 acre site on the north facing slope of Blue Mountain. Maximum levels of cadmium measured in surface soil samples are up to 2,600 times the expected background level. The source of elevated levels of zinc and cadmium in ground water is believed to be from leachate originating from the Cinder Bank pile, OU2. Surface water contamination may originate from East Plant effluent, or from ground water. Significant fish kills occurred in sampling stations in a stretch of the Aquashicola Creek that receives Cinder Bank runoff. OU3 is in the Rl/FS study phase, and OU4 will enter the Rl/FS Study stage in 1991.

Date/Type/Costs of Remediation: Remedial actions include restricting direct contact with defoliated areas and with Cinder Bank, reducing volume of run-on and run-off, reducing contamination of runoff, collecting and treating leachate, reducing windborne emissions, and reducing particulate erosion. The estimated cost of these actions is $8.4 million.

Tar Creek, Ottawa Co., OK/Cherokee Co., KS

Site Description/Contaminants of Concern: Lead and zinc were mined at the site from the 1910's until the mid 1960's. The Tar Creek site is a lead/zinc mining site encompassing approximately 40 square miles. After lead-zinc mining operations ceased, the mines flooded and began discharging acid mine drainage (AMD). The acidic drainage and the heavy metals mobilized by the AMD are constituents of concern. Numerous tailings piles consisting primarily of limestone and chert also exist on-site, and contain elevated levels of heavy metals. Lead is the primary contaminant of concern impacting human health.

Environmental Damages and Risks: Some drinking water wells producing from the underlying Roubidoux aquifer were found to be contaminated due to inadequate casings that allowed mine water to migrate into the wells. Acute surface water problems in Tar Creek exist as well, as evidenced by high mortality rate of most biota. Heavy metals increase downstream as pH decreases. Tar Creek is used for recreational purposes, including swimming. Human health risks associated with the surface water in Tar Creek are insignificant; the risks are predominantly ecological. The ingestion of lead contaminated soils by children is the main human health risk at the site.

Date/Type/Costs of Remediation: Remedial actions include well plugging to the Roubidoux aquifer, surface water diversions to prevent runoff from mine shafts, and ground-water monitoring. Cost of remediation was estimated at $4.32 million + $8,000/year for O&M. Removal actions to address lead contaminated surface soils in public play areas for children and at residences at the site began in 1995 and will be completed in 1997. The cost of removal actions is estimated to be about $8 million.

LITHIUM
Foote Mineral Company, PA

Site Description/Contamination Concern: The Foote Mineral Site is located on a 79 acre property primarily in East Whiteland Township. The Site, which ceased operation in 1991, is bordered on the north, east, and west by public roads and mixed commercial and agricultural properties, on the northwest by Conrail and on the south by an electric utility substation. Located on this Site are two quarries, a solvent burn pit, a lined equalization basin and more than 50 plant buildings and process areas. There were also three unlined settling lagoons that have been leveled and backfilled, and an area where a small amount of neutralized lithium arsenite was buried and later removed. One of the quarries now contains an estimated 256,000 cubic yards of accumulated waste slurries from the plant operations. Since 1941, operations at the site included the production of lithium chemicals and processing of a variety of ores. Other activities included processing of lithium metal, the manufacture and processing of inorganic fluxes for the metal industry, and crushing and sizing operations. Contaminants of concern include lithium, boron, chromium, VOCS and other organics.

Cyprus contends that the soil remediation was not related to any Bevill or non-Bevill mining or mineral processing wastes. Instead, Cyprus noted that the soil was contaminated by diesel fuel from a previously undetected plant site underground fuel delivery line and railhead.

Environmental Damages and Risks: The media impacted by contamination include groundwater, surface water, and on-site soils. In 1988, levels as high as 132,000 μg/l of lithium 291,000 μg/l of boron and 1,400 μg/l of chromium were measured in groundwater from on-site wells. Nearby residential wells sampled by the U.S.G.S. have exhibited levels as high as 13,000 μg/l of lithium, 20,000 μg/l of boron and 20 μg/l of chromium. Surface water sampling conducted in 1984 revealed concentrations of lithium from 300 to 800 μg/l in a nearby creek. Health effects related to exposure to certain levels of lithium, boron or chromium include: anorexia, fatigue, nausea, headaches, fever and shortness of breath, gastrointestinal affects, adverse effects on kidney and reproductive organs, skin and respiratory problems.

Date/Type/Cost of Remediation: Although it is too early in the remedial process to select a remedy, estimates of possible remedial alternatives range from $3.7 million to more than $100 million. As of 1992, Cyprus Foote Mineral Co. excavated and treated 15,000 sq. yds. of soil using a bioremedial technique. Cyprus Foote, under agreement with EPA, is expected to complete the Remedial Investigation in 1997. Cyprus Foote contends that it is also unaware of any support for EPA's contention that "estimates of possible remedial alternatives range from $3.7 million to more than $100 million" for remediation of the site. Cyprus stated in comment that while the exact source of the elevated lithium, a non-hazardous substance, levels in ground water, and other minor constituents in various media at the site, are unknown, almost all of the wastes disposed of in old limestone quarries at the site were generated from production operations that have not been undertaken for over thirty years. The Agency relied on its remediation estimates prepared by the Agency.

MERCURY

Sulphur Bank Mercury Mine, Lake CO., CA

Site Description/Contaminants of Concern: Located in Lake County, CA; this site was mined for sulphur and mercury from 1865 through 1957 and encompasses 120 acres of mine tailings, waste rock, a partially dismantled mill facility, and an open, unlined, and unstabilized mine pit covering approximately 23 acres. 1983 and 1984 samples of site wastes measured mercury concentrations ranging from 1 to 624 mg/kg. The tailings and waste rock piles are steeply sloped and line approximately 2,060 feet of shoreline to Clear Lake. Contaminants of concern include mercury and arsenic.

Environmental Damages and Risks: Biota, surface water, and sediments in the vicinity of the site have been contaminated with mercury. Arsenic was found in surface water mine discharges. The mine pit, called Herman Impoundment, has water levels several feet above the surface of Clear Lake and has overflowed into the lake during storm events, dumping acidic water with high concentrations of sulfate, sodium, chloride, boron, and ammonia into the lake. Acid mine drainage mixing with lake water forms a white clay precipitate in Clear Lake. Methyl mercury levels associated with the precipitate are approximately 10 times higher than normally found in lake water and sediments. Ground water contamination has been detected at on-site wells. Seepage from the Herman Impoundment migrates toward Clear Lake. The levels of mercury in the fish from the lake led the state to issue an advisory against eating the fish. A critical habitat for three endangered wildlife species, the peregrine falcon, the southern bald eagle, and the yellow billed cuckoo, is located less than 1/4 mile from the site.

Date/Type/Costs of Remediation: In 1992, EPA completed a removal action ($1.5 million) to cut back the shoreline waste pile from an approximate 60 to 20° slope, greatly reducing erosion of mine wastes into Clear Lake. EPA completed an RI/FS on the mine site in 1994 but was unable to finalize its proposed plan. In 1995, the seven year drought broke with heavy rains and flooding revealing a previously undiscovered groundwater acid mine drainage problem. EPA has reopened the RI/FS to address these new issues. Investigative costs to date are approximately 3 million.

MULTIPLE SECTORS

California Gulch, Leadville, CO

Site Description/Contaminants of Concern: Leadville and the surrounding 18.5 square miles are all that remains of a mining district that began in 1859 in the central Rocky Mountains of Colorado. This area is located within the Arkansa River watershed limits and was mined extensively for gold, silver, lead, zinc and copper. Mining activities ceased in 1986. The entire area is contaminated with metals. The primary source of contamination is the Yak Treatment Tunnel, one of two tunnels that drain this district. The Yak Tunnel is more than 4 miles long and discharges approximately 210 tons of metals per year into a treatment plant. Ranges of metal constituents in the Yak

Tunnel discharge, measured in ppb, include: cadmium (195-520); copper (731,730); lead (9-117); and zinc (50,100-101,000).

Environmental Damages and Risks: The California Gulch site was placed on the National Priorities List (NPL) in 1983. Yak Tunnel discharges have had the greatest impact on surface water in the area, (California Gulch and the Arkansas River). As previously mentioned, the California Gulch has received a combined total of 210 tons per year of cadmium, lead, copper, manganese, iron, and zinc, since the early 1980's. Heavy metal migration through surface water is a source of ground water and sediments contamination. California Gulch also collects run-off from several other gulches. Some of this run-off flows through local town storm drains and city streets. The Arkansas River, which receives water from the California Gulch, has been classified for fishery, public water supply, recreation, and livestock watering use.

Date/Type/Costs of Remediation: Remedial Investigation began in 1984. A ROD addressing the first OU was signed in March 1988, and implemented a remedy to decrease the discharge of contaminated water from the Yak Tunnel. The cost of remediation is $12 million in addition to $460,307 O&M/year.

Eagle Mine, Gilman, CO

Site Description/Contaminants of Concern: 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. Mining activities began in 1870 and contributed to five major sources of contamination at the site, including: acid mine water forming in the underground workings of Eagle Mine; two tailings ponds covering over 107 acres; tailings along 20 to 25 acres of pipeline corridor and in a wetlands area (Maloit Park); five roaster piles covering approximately 10 acres; and sixteen waste rock piles covering an estimated 93 acres. Contaminants of concern: antimony, arsenic, cadmium, chromium, copper, lead, manganese, nickel, silver, and zinc.

Environmental Damages and Risks: The Eagle River is the major surface water resource affected by contamination by metals including cadmium, and zinc. Over the last 100 years zinc miners have deposited about 10 million tons of mine wastes and mine tailings along the Eagle River. The mining conditions and waste formed acids which leached toxic metals into surrounding surface water and ground water. Other sources of metal contamination of sediments in the surface water are the roaster piles, Rock Creek, the old tailings/Rex Flats area, and the new tailings pond. Ground water contamination was identified in unconsolidated units adjacent to the old and new tailings ponds, and in the flooded abandoned mine workings. On-site soils are contaminated with heavy metals and the tailings ponds are sources of wind blown contamination.

Date/Type/Costs of Remediation: A remedial investigation was completed by the State of Colorado in 1985. Clean-up began in 1988 under the terms of a consent decree with the major PRP (Viacom International). This cleanup included consolidating and capping surface wastes and plugging the Eagle Mine workings. A water treatment plant was constructed in 1990. Cleanup costs exceeded $55 million. Additional remedial activities were planned such as restoring wetlands, as well as devising a pump and treat system.

Iron Mountain Mine, Redding, CA

Site Description/Contaminants of Concern: The site is a 4,400 acre area used for mining and processing gold, silver, copper, zinc, and pyrite from 1865 to 1963. Processing of copper and silver was conducted at a smelter located near the confluence of Spring Creek and the Sacramento River from 1896 to 1907. Copper and pyrite ore tailings generated from a copper flotation mill between 1914 and 1919 were disposed approximately 2 miles east of the Old Mine and Number 8 Mine. Approximately 2.6 million tons of ore were mined for gold and silver between 1929 and 1942. Tailings generated by this mining were disposed adjacent to Slickrock Creek. Other copper and zinc deposits were

mined from 1942 to 1963, and a copper-zinc flotation plant operated from 1943 to 1947. Contaminants of concern include acid mine drainage, cadmium, copper, zinc.

Environmental Damages and Risks: Acid mine drainage leaching from underground mine workings draining the massive sulfide ore body, tailings piles and other disturbed or contaminated areas on the site have caused contamination of the Spring Creek watershed. Low pH and heavy metal contamination have caused the virtual elimination of aquatic life in sections of Slick Rock Creek, Boulder Creek, and Spring Creek that receive the mining related AMD discharges. Since 1940 there have been numerous fish kills in the Sacramento River. The National Marine Fisheries Service took action to list the Winter Run Chinook Salmon as an endangered species.

Date/Type/Costs of Remediation: The Spring Creek Debris Dam was constructed in 1963 to act as a sediment basin and to regulate the AMD release to the Sacramento River. Cementation plants were constructed in 1940 and 1977 to recover copper from AMD. In 1986, a series of cleanup projects were planned to establish controls on the AMD discharges and to provide the ability to manage the IMM releases. A series of clean water diversion projects and a partial cap system were constructed to reduce rainwater contamination. In February 1989, EPA constructed an emergency lime neutralization plant to reduce metal discharges from the site by 50%. Diversion of Slickrock Creek around a large waste rock pile was completed in 1990. In 1991, diversion of clean water in Upper Spring Creek was completed, with the clean water flowing to Keswick Reservoir via Flat Creek. A remedial plan was developed in 1992 for the consolidation and capping of seven largely pyritic waste piles that were discharging AMD and actively eroding into Boulder Creek. Current costs for cleanup measures are estimated at $56,463,000.

Richardson Flat Tailings, Summit, Utah

Site Description/Contaminants of Concern: The Richardson Flat Tailings site covers approximately 160 acres in a valley 1.5 miles northeast of Park City, Utah. This site was most recently occupied by two other mining operations which left behind tailings. Park City Ventures and Noranda Mining INC. operated mining facilities on properties they leased from United Park City Mines. The constituents of concern in the tailings consist of arsenic, cadmium, copper, lead, selenium, and zinc.

Environmental Damages and Risks: A tailings pile located just west of a tailings pond on the bank of Silver Creek, has been observed discharged into an on-site diversion ditch and into Silver Creek. About 300 acres of pasture is irrigated by water from this creek. Silver Creek has been classified as a cold water fishery by the state and is bordered by wetlands. An estimated 4,500 people live within 4 miles of the site. The site is being addressed in two stages: initial actions and a long term remedial phase. The site has been fenced in and some of the tailings has been covered with top soil.

Sharon Steel Corp.(Fairmont Coke Works), Fairmont, WV

Site Description/Contaminations Concern: The 107 acre plant is located at the northeast portion of the city of Fairmont, Marion County. The facility was originally built for and operated by the Standard Oil Company in 1920 for the production of coke and the refinement of its associated by-products. Sharon Steel Corp. purchased the property in 1948 and utilized the semi-indirect process involving the combustion of coal to produce coke and its by-products. Operation ceased on May 30, 1979 as a result of Clean Water Act and Clean Air Act suits filed by EPA. A waste that was often generated is breeze, an unusable fine residual dust found in coke ovens. Contaminants of concern include cyanide and polynuclear aromatic hydrocarbons(PAHs) such as benzo(a)pyrene and benzo(a)anthracene.

Environmental Damages and Risks: Off-site migration of contaminants via surface water and the potential exposure of people who may come into direct contact with on-site materials are the primary concerns. Surface water from the site drains into an intermittent stream that joins the Monogahela River. Many communities draw drinking water from this river. Other evidence of offsite contamination involves the migration of breeze onto two adjacent residential

properties.

Sharon Steel Corp.(Midvale Smelter), Salt Lake, Utah

Site Description/Contaminations Concern: The Sharon Steel Corp. site is a former milling and smelting operation in Midvale. Sulfide concentrates of lead, copper, zinc, and other metals were extracted from the ore during milling operations. The operation accumulated 10 million tons of mine tailings on the site. Contaminants of concern are arsenic, iron, manganese, and zinc.

Environmental Damages and Risks: Nearby residents were using the windblown tailings in children's sand boxes and domestic gardens. Arsenic was found in the ground water beneath the site. About 8,000 people live within a mile of the site. A deep aquifer underlying the site is a source of drinking water for the Salt Lake City area.

Smeltertown, Chaffee Co., Colorado

Site Description/Contaminants of Concern: The Site encompasses an area of approximately 120 acres and includes three separate industrial facilities. The western region of the site was utilized from 1924 to 1953 by a series of railroad tie treating companies, the most recent being Kopper's Inc. This portion of the Site is currently used for gravel mining and processing. The central region of the Site was formerly a primary lead, copper, silver, and gold smelter operated by the Ohio and Colorado Smelting and Refining Company from 1902 to 1919. Operations ceased in 1920 and the Smelting and Refining Company from 1902 to 1919. Operations ceased in 1920 and the smelter was dismantled over the next 10 years. The eastern portion of the site is occupied by CoZinCo, Inc. CoZinCo is an operating facility that produces a zinc sulfate soil amendment/animal feed by treating metallic galvanizing wastes with sulfuric acid. The property contains elevated levels of heavy metals and creosote contaminants.

Environmental Damages and Risks: The investigations have shown that chemicals of concern (acenaphthylene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,i,h)perylene, indeno(1,2,3-cd)pyrene, pentachlorophenol, phenanthrene, aldrin, PCBs, endrin ketone, antimony, arsenic, cadmium, cobalt, copper, lead, manganese, mercury, silver, and zinc) contribute to unacceptable risk for potential future residents or current downgradient residents drinking ground water contaminated with antimony and zinc.

Smuggler Mountain, Pitkin Co., CO

Site Description/Contaminants of Concern: Silver, lead and zinc mining began in the late 1880's and early 1990's and continued, along with processing operations, through the 1960's. The site is situated within the city of Aspen and includes a 110 acre area of waste rock, tailings, and slag containing high levels of lead and cadmium. An estimated 2.4 million cubic yards of waste material was generated by years of silver, lead and zinc mining, milling and smelting operations. These wastes have been dispersed over the years due to the establishment of the reprocessing facility in the 1960's and by subsequent residential development. Contaminants of concern include lead, cadmium, and zinc as well as arsenic, barium, copper, manganese, silver and mercury. The site was placed on the NPL in May 1986. (Residents living in contaminated areas are against remediation efforts).

Environmental Damages and Risks: Soil is the primary contaminated media though contaminants have also been detected in ground and surface water. Soil sample analyses measured levels of lead over EPA's action level of 1,000

ppm. 1983 soil samples taken down slope from the tailings piles also indicated elevated levels of arsenic, barium, cadmium, copper, lead, manganese, and zinc. A geometric mean of lead in 3,300 soil samples collected in 1990 was 6,577 ppm. Surface water samples for metals fell within Federal and State standards. Development in the Aspen area has taken place directly over waste piles, and mine waste has been dozed into permanent berms of contaminated soil.

Date/Type/Costs of Remediation: There are two operable units at this site. Remedial actions for OUI include on-site repository, cleanup of residential properties and at Hunter Creek and Centennial Condos, and institutional controls. For OU2, remediation will entail mine reclamation and ground water remediation. The estimated cost is $7.2 million.

Tex-Tin Corp., Texas City, TX

Site Description/Contaminants of Concern: The Tex-Tin Corporation facility was constructed for tin smelting during World War II. The smelter produced Grade A tin ingots from 1941 to 1989. From 1989 to 1991, the facility operated as a secondary copper smelter. The site consists of two contaminated soil areas that include a portion of two inactive industrial facilities, commercial properties, and a residential neighborhood. Contaminants of concern are arsenic, cadmium, copper, lead, mercury, and zinc.

Environmental Damages and Risks: The site contains 21 ponds covering 116 acres. The ponds include 14 former acid ponds, 2 gypsum scrubber ponds, and 5 settling ponds, most containing high concentrations of inorganic chemicals. Large piles of slag contain high concentrations of copper, lead, arsenic, and copper, where two piles were found to have high levels of gamma radiation. A 0.55 acre landfill contains approximately 341,237 pounds of spent uranium/antimony catalyst. There are over 8,500 55-gallon drums containing spent catalyst material. Chemical analyses of the surface soil samples collected from residential yards indicate elevated levels of contaminants which are also found at elevated levels on Tex-Tin facility soils.

Triumph Mine Tailings Piles, Triumph, Idaho

Site Description/Contaminants of Concern: The Triumph Mine is an inactive mine located in east-central Idaho. The site consists of two large tailings piles, two milling areas, one main waste rock pile with discrete smaller piles associated with adits, and a draining adit. From 1882 until 1957, the Triumph Mine processed ore rich in silver, zinc, and lead. Processing included crushing, grinding, and flotation operations. The slurry remaining from the flotation process was pumped to two piles located in a wetland adjacent to the East Fork of the Wood River. Tailings were pumped to the upper tailing pile from 1882 to 1930, and to the lower tailing pile from 1930 to 1957.

Environmental Risks and Damages: Investigations have revealed elevated levels of heavy metals in the tailings piles, the mill processing areas, waste rock pile and draining adit. Metals including but are not limited to lead, arsenic, and zinc have migrated into residential soil, ambient air, nearby wetlands and the East Fork of the Wood River. Whether groundwater has been impacted is inconclusive to date as studies are ongoing. Some local residents who were screened for lead in the bloodstream and arsenic in urine, tested positive.

PHOSPHATE

Eastern Michaud Flats, Potacella, ID

Site Description/Contaminants of Concern: The FMC processing plant began operations in 1949 and is currently active. The site includes two facilities, FMC and Simplot, located on Eastern Michaud Flats. The FMC property has a total of 14 waste ponds, which will be going through RCRA or CERCLA closure. In addition to the ponds, the FMC facility also includes a landfill, a slag pile and a ferrosphos pile. (The only discharge is via an NPDES permit of non

contact cooling water). Simplot's facility includes two gypsum stacks, an unlined liquid gypsum pond, and three lined wastewater treatment ponds. (The volume of waste in Simplot's ponds is not discussed in references).

Environmental Damages and Risks: Sediment from unlined ponds at the FMC facility contained elevated levels of arsenic, cadmium, chloride, chromium, copper, fluoride, lead, potassium, selenium, silica, vanadium, and zinc. Contaminated sediments from these ponds are the probable source of contamination to groundwater. Groundwater is used to irrigate approximately 2,000 acres of forage crops within 3 miles of the site. All local wells were condemned in 1976 due to contamination from arsenic. In 1984, arsenic and selenium were detected in FMC's monitoring wells screened in the confined aquifer. According to the Remedial Project Manager all unlined ponds have been closed. As part of the RI/FS all media and exposure pathways were investigated including air, soil, surface water, and groundwater.

Date/Type/Costs of Remediation: A groundwater monitoring study was conducted in 1972 and 1973 that showed levels of arsenic, lead and cadmium above the Federal Primary Drinking Standards. The RI/FS will be complete by January 1997. The projected remediation costs for the site are around $15 million. This site remedy will likely include pond closures, groundwater extraction, institutional controls and site monitoring.

Monsanto (Soda Springs Plant), Soda Springs, ID

Site Description/Contaminants of Concern: This site encompasses 530 acres and includes an operating elemental phosphorus plant that produces elemental phosphorus used to manufacture phosphoric acid. Also included on-site are various waste management units including: a slag pile, effluent discharge stream, sewage evaporation ponds, effluent settling pond, coke and quartzite slurry pond, old underflow ponds, seal water pond, phossy water surge pond and on-site landfills. Contaminants of concern in soils and source piles include: arsenic, beryllium, cadmium, vanadium, and several radionuclides. Contaminants measured as detecting groundwater standards include: cadmium, fluoride, nitrate, selenium, molybdenum, and manganese.

Environmental Damages and Risks: Approximately 250 acres of soils immediately surrounding the facility and groundwater beneath it contain site-related contaminants in excess of the natural background levels. No residences are currently located within the contaminated areas around the facility. Of four hydrostratigraphic zones of ground water under the site, two basalt zones that transmit large quantities of water contain the most elevated concentrations of the contaminants of concern. Sources of groundwater contamination include the Underflow Solids Pond, the Northwest Pond and the Hydroclarifier. Cadmium levels detected at 781 ug/l significantly exceeded Primary Federal Drinking water Standards for cadmium (10 ug/l). The processed waste, previously stored in unlined ponds or impoundments, has been pinpointed as a source of contamination to ground water.
Both EPA and Monsanto agree that no ecological impacts on surrounding areas have been identified and none expected as long as conditions do not change and concentrations do not increase.

Date/Type/Costs of Remediation: PRPs developed an RI/FS work plan in 1991. An Administrative Order signed 3/91 initiated that effort. The ATSDR released a draft Preliminary Health Assessment for public comment, due July 1991. No information regarding costs of remediation was available. The EPA is currently working on the ROD selecting a remedy for the Monsanto Chemical Company site. A proposed plan calls for land and groundwater use restrictions and necessary cleanup to prevent residential exposure to contaminated soils and groundwater near the elemental phosphorus plant. The Monsanto Soda Springs Facility is currently in compliance with all appropriate environmental laws.

EPA's preferred alternative for contaminated groundwater was natural attenuation and use restrictions. For source piles and materials within the facility, no further action is required beyond Monsanto's past cleanup actions. For contaminated soils surrounding the facility, land use restrictions to prevent residential exposures were selected by EPA. EPA's preferred alternative for air, surface water and soda creek sediments is no action, with periodic monitoring. The

cost of the preferred alternative is $400,000 for the initial capital costs, up to $150,000/year for dust control, groundwater monitoring, and source/soil monitoring, for a 30-year total of up to $2,500,000. The EPA is considering a public comment period before choosing a final cleanup action for the site.

Stauffer Chemical Co., Tarpon Springs, FL

Site Description/Contaminants of Concern: Stauffer Chemical Co. is located in an industrialized area between Anclote Boulevard and the Anclote River in Tarpon Springs, about 1.6 miles east of the Gulf of Mexico. Stauffer purchased the 160 acre facility from Victor Chemical Works in 1960. From 1950 to 1981, the facility manufactured elemental phosphorus from phosphate ore.
Environmental Damages and Risks: A system of seven unlined lagoons, about 600 feet from the Anclote River received discharges of waste scrubber liquid and phosphorus water, as well as overflow from a calcium silicate slag pit. At some time, two of the lagoons were dredged, and the dredged material, composed of calcium sulfate/sulfite, calcium silicate, calcium fluoride, phosphate sand, and calcined phosphate dust, was placed in two piles approximately 40 feet from the Anclote River.

Other on site disposal activities included the dumping of furnace dust in an isolated pond and the burial of 900 drums of calcined phosphate sand consisting of 20% elemental phosphorus. Over 500,000 tons of chemical process waste were disposed of on site between 1950 and 1979. The site is underlain by a surficial aquifer composed primarily of sand and the Floridian Aquifer composed of lime stone.

Onsite monitoring wells into both aquifers are contaminated with barium, chromium, lead, vanadium, zinc, copper, and arsenic, according to EPA tests conducted in 1988 and 1989. The 1989 tests found these metals in the onsite waste piles. An estimated 8500 people in the Tarpon Springs area received drinking water from 23 public wells and three private wells located within 4 miles of the site. Because of the depth of the aquifers, all drinking water wells within 4 miles of the site are potential targets.

TITANIUM

U.S. Titanium, Nelson Co., VA

Site Description/Contaminants of Concern: Titanium dioxide pigment production began in 1931 and continued until the early 1980's. The U.S. Titanium Site encompasses roughly 175 acres of a former titanium dioxide manufacturing plant. Operations at the site from 1944 to 1971 generated approximately 80,000 cubic yards of copper as waste. This waste was stored on-site as stockpile for later sale as commercial product, but was never sold. In December 1980, the State ordered these stockpiled wastes to be buried on-site. An attempt to contain runoff from this stockpiled waste prior to burial included installation of a temporary copper as leachate collection system. Leachate was found to contain high concentrations of toxic metals, including arsenic and cadmium. Surface waters indicated high sulfate concentrations and low pH. Metals, sulfate, and high acidity contaminate the ground water.

Environmental Damages and Risks: Highest metals concentrations in soils measured at the site occurred in samples collected from the copper as pile, which revealed very high levels of iron. Generally, metal levels tended to be on the higher end of the normal range in uncontaminated soils. Soils, surface water and ground water have low pH, or high acidity, as determined from several surface and ground water samples from the site. High acidity results in mobilization of metals in water. Several metals were in violation of established water-quality criteria. Ferrous sulfate is highly acidic, and storm run off from the site waste piles contributed to the six major fish kills in the Piney and Tye Rivers.

Costs of Remediation: A sedimentation pond was installed to address water quality problems from the site. As mentioned earlier, a temporary copper as leachate collection system was designed. The goal of remedial action is to control risks posed by acidic discharge. The total cost was estimated to be $5.9 million.

TUNGSTEN

Li Tungsten Corporation, NY.

Site Description/Contaminants of Concern: The site covers 26 acres in Long Island, New York along the north bank of the Glen Cove Creek. From the early 1940's to 1985 tungsten ores and concentrates were imported mainly from China, South America, and Canada, and were smelted for production of tungsten carbide powder, tungsten wire, and welding rods. There is about 10,000 cubic yards of ore residuals still on-site. On the site exists 3 concrete oil recovery sumps, 2 unlined settling ponds referred to as mud holes, and a lined settling pond known as a mud pond. Storage and manufacturing buildings are also on site. Contaminants of concern are VOC's, heavy metals, and fuel oil constituents, and radioactive materials.

Environmental Damages and Risks: Major sources of contamination include: chemical waste piles; tanks both inside and outside of buildings; radioactive wastes and slag stored inside buildings; and other disposal areas such as the surface impoundments, including the fuel impoundment. Because waste piles are uncovered, there is potential for particulate contaminants to migrate freely. The pits don't have impermeable covers to prevent infiltration of storm water. Media impacted by contaminants are soil, ground water, and surface water. Samples of surface water reveal high concentrations of calcium (499,000 ug/l), magnesium (175,000 ug/l), potassium (49,000 ug/l), and sodium (136,000 ug/l).

Costs of Remediation: Nine remedial actions to be undertaken by GCDC were identified in the Administrative Consent Order EPA filed. The interim actions required by the order, and the actions voluntarily initiated by GCDC were completed between 7/21/89 and 4/4/90. The actual cost has been estimated to be approximately $1.5 million.

URANIUM, THORIUM, VANADIUM

Austin Avenue Radiation Site, Delaware Co., Pennsylvania

Site Description/Contaminants of Concern: The disposal of radioactive tailings generated by the W.L. Cummings Radium Processing Co. resulted in 31 different properties being contaminated with radium, thorium, and radon.

Environmental Damages and Risks: The Austin Avenue Radiation Site consists of 31 contaminated properties located in Landsdowne Borough, East Landsdowne Borough, Upper Darby Township, Aldan Borough, and Darby Borough. Radium tailings resulting from the plant's operation were mixed with materials used to construct buildings. Radium, radon, thorium and asbestos are present in buildings and other structures located on contaminated properties. Risks to human health include direct contact with or ingestion of contaminated solids.

Glen Ridge, Montclair/West Orange, and U.S. Radium, NJ

Site Description/Contaminants of Concern: Beginning in 1917, radium was extracted from carnotite ores at the US Radium site. This practice ceased in 1926, when this form of processing was no longer profitable. The Montclair/West Orange and Glen Ridge NPL sites are noncontiguous sites contaminated with radioactive waste suspected to have originated from the U.S. Radium site, a former radium processing plant. The U.S. Radium site consists of the processing facility area, adjacent properties, and a number of potential satellite properties that may have been associated with radium extraction, production, or application. The Montclair study area covers approximately 100 acres and includes 366 properties. The West Orange study area covers about 20 acres, and 75 properties. The Glen Ridge site includes 306 properties.

Environmental Damages and Risks: Soil samples obtained from the U.S. Radium site measured high levels of

radium-226, radon-222, and its decay products, and radon progeny, that increased with depth. All three study areas contained "hot spots" of radioactive contamination with levels of radium ranging from 1 to 4,545 pCi/g. Radioactive decay of radium 226 into radon gas is the leading cause of increased levels of radon gas in residential property basements. Elevated levels of radionuclides were found in sediments in storm sewers, however, levels measured in the ground water did not exceed the drinking water limit of 5 pCi/1.

Date/Type/Costs of Remediation: Remediation of the U.S. Radium facility site has been initiated by evacuating and fencing off the area. The entire remediation plan will provide clean-up of soils at several hundred contaminated properties, over a 10 year period, at an estimated cost of $253 million.

Homestake Mill, Cibola, NM

Site Description/Contaminants of Concern: Uranium processing began at this site in 1958 and continued to operate until June 1990, when it was placed on "standby" status. The site consists of a uranium beneficiation mill and two tailings embankments containing 17 million cubic yards, and covering approximately 175 acres. The mill tailings are composed of uranium depleted fine and coarse sand and slimes. The site has three Operable Units (OU's): 1) tailings seepage of contaminated aquifers, (remediation being conducted jointly by EPA and NRC); 2) long term tailings stabilization, surface reclamation, and site closure (remediation being conducted by NRC); 3) radon in neighboring subdivisions (no action ROD due to indoor radon not connected to tailings pile). The contaminant of concern for OU 3 was radon.

Environmental Damages and Risks: Environmental concerns at the site involve potential or actual releases of hazardous substances to air, ground water, and soil. However, no relationship was found between indoor radon levels and proximity of residents to the mill. Contaminated soil at the site was located within Homestake's restricted area and cleaned up prior to March 1989. The 1990 sampling of monitoring wells measured uranium and thorium concentrations that exceeded 100 and 230 ppm, respectively.

Date/Type/Costs of Remediation: Remediation at OU1 involved Homestake providing an alternative water supply to nearby residences for immediate relief and reverse gradient injection of fresh water to drive contaminated shallow aquifer inside Homestake's premises, away from the residential areas south of the mill site. OU2 is being addressed by NRC under Mill tailings regulations, and will concentrate on long-term stabilization of the tailings and closure of the tailings-disposal area. By 1996 the large tailings area has been covered with a low permeability barrier. The RI addressed OU3 and determined that the uranium mill and tailings embankment did not contribute significant radon levels. No alternatives were addressed. Total cost of all remedial effort is $ 25 million. Homestake is bearing the cost of the remedy.

Kerr McGee [1) Kress Creek, 2) Reed-Keppler Park, 3) Residential Areas, 4) Sewage Treatment Plant], West Chicago, IL

Site Description/Contaminants of Concern: Thorium processing at the Kerr McGee facility began in the 1930's and ended in the mid 1970's. These four sites were affected by wastes generated at the former Kerr-McGee thorium processing plant. (The Kerr McGee facility is not an NPL site.) The facility generated wastes such as radioactive monazite ore, tailings, and unspecified process wastes. The four sites have sources of contamination such as destination of plant runoff, process wastes used as fill, and wind-blown dust.

Environmental Damages and Risks: Contamination of soils was found at all 4 sites, and contaminated sediments were found at the Kress Creek Site. Sampling found exposures to gamma radiation exceeding background levels at all 4

sites. U.S. EPA is currently reviewing data collected during the Remedial Investigation Phase at all 4 sites.

Date/Type/Costs of Remediation: In 1976, some contaminated material was removed from a tennis court to a fenced area at Reed-Keppler Park. In 1985, and in 1986 Kerr McGee voluntarily removed material from the Sewage Treatment Plant to the Kerr McGee plant area, and voluntarily removed contaminated material from more than 100 residential properties. In 1994, U.S. EPA issued an Unilateral Order to Kerr-McGee to conduct a non-time-critical removal action at the Residential Areas Site; U.S. EPA estimated the cleanup to cost between $22 - $119 million, depending on the number of contaminated properties determined to require cleanup. Kerr-McGee began the Residential Areas cleanup in 1995, and it is estimated the cleanup will continue through 1999. In 1996, U.S. EPA issued an Unilateral Order to Kerr-McGee to conduct a time-critical removal action at the Reed-Keppler Park Site. Kerr-McGee will begin the cleanup in 1997 at an estimated cost of $38 million. This effort is expected to continue through 1998. U.S. EPA has not yet made cleanup decisions for the Kress Creek and Sewage Treatment Plant Sites.

Kerr-McGee Chemical Corp., Soda Springs, ID

Site Description/Contaminants of Concern: Kermac Nuclear Fuels Corporation purchased approximately 50 acres of land in 1961 and constructed a vanadium pentoxide facility on the property in 1963. In 1964, Kermac merged with Kerr-McGee Corporation. An additional 103 acres were purchased in 1971, and another 174 acres were purchased in 1992. Kerr-McGee uses limestone and ferrophosphorous ore as raw materials to produce vanadium. The site includes an active vanadium pentoxide production facility, a three tailings ponds, a solvent extraction pond and scrubber pond, two stockpiles, and two limestone settling ponds, with minor changes occurring over time. A 1988 Site Inspection found unlined waste ponds containing hazardous substances were leaking 350 gallons per minute into the ground water. Contaminants of concern in ground water are molybdenum, vanadium, manganese, arsenic, tributylphosphate, and total petroleum hydrocarbons.

Environmental Damages and Risks: The shallow aquifer is contaminated with hazardous substances released by the Kerr- McGee facility. Degradation of ground water quality downgradient of the site was observed. Concern existed for adverse impacts to irrigation and industrial water supply sources, as well human health risks associated with the potential future use of ground water as a drinking water source.

Date/Type/Costs of Remediation: Remedial action alternatives were evaluated for treatment options and source control. A 1995 Record of Decision identified elimination of uncontrolled liquid discharges to ground water, with company-selected process changes, ground water monitoring, excavation of buried calcine tailings and pond sediments, and deed restrictions to address contaminated ground water. Reuse of stockpiled roaster rejects material was also a component of the remedial action. Costs for the remedial actions are estimated at $2,200,000. Remedial design activities at the site are underway.

Lincoln Park, Cannon City, CO

Site Description/Contaminants of Concern: Uranium ore was processed at the Lincoln Park Site from 1958 until 1986. The site operator (Cotter Corporation) has an approved license and is planning to resume milling operations in 1997. The site covers approximately 6 square miles and consists of two inactive mills, a partially reclaimed tailings pond, an inactive tailings pond, and the residential community of Lincoln Park. Sources of contamination include: uranium ore stockpiles; tailings leachate impacting surface and groundwater resources; contaminated soils; and previously degraded groundwater. Potential contaminants of concern include radium-226, nickel, molybdenum, cobalt, arsenic, zinc, lead, and cadmium.

Environmental Damages and Risks: Soils and underlying bedrock in the 65 acre old tailings ponds area have been contaminated with uranium, molybdenum, radium-226, and heavy metals. Both on-site and off-site soils have also

been contaminated by the milling operations. Air transport of wind-dispersed particles from the main and secondary impoundments, old tailings pond area, ore stockpile and ore handling areas, and from the yellowcake dryer, represent the major mechanism for off-site soils contamination. Ground water contamination has been found beneath the old tailings. Surface water pathways for solutes from the site have been identified.

Date/Type/Costs of Remediation: On-site remediation began in 1988 following entry of the Consent Decree. The 1988 Remedial Action Plan includes comprehensive actions such as installation of a leak collection system to intercept impoundment run-off, removal of contaminated soils, minimizing air transport of particles from impoundments, and construction of a hydrologic barrier to remedy to prevent off-site migration of contaminated groundwater. Cost estimates for the remedy are not available.

Monticello Mi11 Site, San Juan Co., UT

Site Description/Contaminants of Concern: Uranium and vanadium milling operations were active at this site from 1942 until 1960. The Monticello Mill Tailings Site and the Monticello Vicinity Properties are estimated to contain between 2.4 and 2.6 million cubic yards of contaminated tailings, soils and mill site debris. The former mill site and tailings impoundment area encompasses a 78 acre site adjacent Montezuma Creek. The mill site was decommissioned in the early 1960's. An estimated 2.1 million cubic yards of tailings and contaminated soils are located in the 68 acre tailings impoundment area, and an additional 100,000 cubic yards are located in the former mill area. Properties adjacent the former mill site are estimated to contain an additional 300,000 cubic yards of contaminated material. Tailings and contaminated soils contain elevated levels of both radioactive and non-radioactive contaminants of concern including: products of the uranium 238-decay cycle, arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, vanadium, and zinc. The site has been separated into three Operable Units. OUl consists of the mill tailings, 0U2 encompasses the peripheral properties, and 0U3 focuses on contaminated ground and surface water.

Environmental Damages and Risks: The site includes four tailings impoundments. Tailings began to migrate as dunes soon after operations ceased and the tailings ponds dried up. Erosion of the tailings by water became a problem. Surface soil within Monticello has been contaminated by tailings, ore residue, tailings-pond overflow, emissions from the roaster stack, and erosion of tailings piles by wind and water. Ground water monitoring from 1984 to the present have recorded elevated levels of contaminants in the alluvial aquifer several miles down gradient of the mill site with radium detected at 44 pCi/l, uranium at 12.8 mg/l and arsenic at 0.19 mg/l. Tailings-pond seeps and ground water leachate from the alluvial aquifer discharged to Montezuma Creek have occurred since the mill site began operations in the early 1940's. Surface water sampling from 1994 to the present indicate that contaminants continue to enter the stream from ground water discharge from the tailings piles. Since 1993 surface run-off from the mill site has been contained and routed to a pond for treatment prior to release to Montezuma Creek. Air monitoring indicates that radon emissions over each of the four tailings piles exceeds EPA standards.

Date/Type/Costs of Remediation: The selected remedy for OUl is excavation of the contaminated tailings, soils and debris and containment in a repository presently being constructed approximately one mile south of the former mill site. The clean up of the site has a total estimated cost of approximately $200 million. The 414 contaminated vicinity properties and peripheral properties are being cleaned up at a cost of approximately $18 million. The repository, with a capacity of 2.6 million cubic yards, has been constructed and it is anticipated that tailings placement will begin in the summer of 1997 and be completed in late 1998 or early 1999. Clean up of the peripheral properties and the vicinity properties is anticipated to be completed in late 1998. An RI/FS for 0U3 is presently under preparation with a ROD expected in early 1999. If treatment of surface and ground water is required it is projected that treatment would begin in the year 2000.

Monticello Rad. Contaminated Properties, San Juan Co., UT

Site Description/Contaminants of Concern: This site consists of 425 private and community properties within the town of Monticello, UT. The properties have been contaminated with radioactive mill wastes from ore processing operations near the city. Uranium production occurred in Monticello from the early 1940's until 1960, when the plant was closed and dismantled. Contaminated dust from the mill tailings piles has blown into the city. Also, tailings from the mill site have been used as construction material and backfill, and as a sand mix in concrete. Approximately 135,000 tons of tailings were removed from the tailings ponds and used in local residential construction projects. The primary contaminants of concern include uranium, thorium-230, radium 226, and radon 222.

Environmental Damages and Risks: Human health risks associated with exposure to the contaminants are external whole-body gamma exposure, and ingestion of wind-blown tailings and dust. Of the 2,200 people living in Monticello, an estimated 400 residents have been contaminated with radiation as a result of exposure to the mill wastes. Maximum levels of contaminants detected in area soils include: radium at 23,000 pCi/g; and uranium 238 at 24,000 pCi/g.

Date/Type/Costs of Remediation: DOE began clean-up of the properties in 1984, and to date an estimated 395 out of 425 properties have been cleaned. A ROD was signed in 1989, selecting a remedy that consisted of excavation, removal, and relocation of uranium mill tailings to the east tailings pile at the Monticello Mill site. The estimated cost was $60,000 per property, for 114 properties. An additional 106 properties have been added to the remediation list in April 1991. Cleanup of the vicinity properties is expected to be completed in 1997.

St. Louis Airport/Hazelwood Interim Storage/Futura Coatings, St. Louis, MO

Site Description/Contaminants of Concern: The St. Louis site is comprised of numerous properties located in two distinct areas: the Mallinckrodt Chemical Plant in downtown St. Louis; and properties on or near the Lambert International Airport. From 1942 to 1957, the St. Louis Downtown Site (SLDS) was used for separation of uranium ores. These processing activities, conducted under Manhattan Engineering District and Atomic Energy Commission contracts, contaminated properties and buildings with uranium, radium, and thorium. The transfer of uranium-bearing process residues from SLDS to properties near the Airport resulted in contamination of the Latty Avenue Properties, the St. Louis Airport Site (SLAPS), and numerous vicinity properties that are located along former haul routes. Currently, about 65,000 cubic yards of this contaminated material is stored in piles at the Hazelwood Interim Storage Site (HISS) on Latty Avenue.

These radioactively contaminated sites are managed by the U.S. Department of Energy (DOE) within its Formerly Utilized Sites Remedial Action Program (FUSRAP). St. Louis FUSRAP properties in the NPL include the SLAPS, the HISS, and the Futura Coatings property located adjacent to the HISS.

Approximately 900,000 cubic yards of in-situ soil exceed DOE's unrestricted release (residential) guidelines for residual radioactivity in soil. Contaminant distribution is such that 90% of the radioactivity is contained within 10% of the volume. The primary contaminants of concern include uranium, thorium, and radium.

Environmental Damages and Risks: Historic management practices resulted in contamination of subsurface soils, adjacent properties, haul route properties, and creek sediments. Ongoing monitoring and maintenance of properties by the DOE helps minimize further migration of contaminants. Risk assessment has shown that risks tot the general public with existing controls in place and under current land uses are not significant; however, potential risks under hypothetical exposure scenarios that involve direct contact with the waste materials are significant.

Date/Type/Costs of Remediation: Numerous removal actions have been performed including building dismantlement at the downtown site, and excavation and remote disposal of contaminated soils on residential and commercial properties near the airport site at a cost of approximately $30 million. DOE is scheduled to propose a plan for comprehensive remedial action in summer '97. EPA anticipates that the proposed remedy will involve remote disposal of significant volumes of contaminated materials, and in-place management of lesser contaminated soils in a manner

consistent with anticipated future land use. The remedy is likely to cost between $300 and $600 million.

United Nuclear Corp., Gallup, NM

Site Description/Contaminants of Concern: The United Nuclear Corp. Churchrock Site is an inactive uranium mill and tailings-disposal site that contains approximately 3.5 million tons of acidic tailings in a 100-acre tailings impoundment. Contaminated tailings seepage has impacted ground water. In July 1979, a dam in the tailings disposal area breached releasing 93 million gallons of tailings to the Rio Puerco River. Complex ground water flow patterns exist at this site due to flow in the shallow Southwest Alluvium to the southwest, and the flow in the bedrock (zone 1 and zone 3) to the northeast. Fractures and fissures are also present in the bedrock. Contaminants of concern include: arsenic, cadmium, lead, molybdenum, cobalt, manganese, chromium, and radionuclides.

Environmental Damages and Risks: A dam breach in July 1979 caused release of about 93 million gallons of tailing and pond water. However the dam breach was not the reason the site was listed on the NPL. Seepage from the tailings disposal area contaminated groundwater that was created as a result of up gradient mine water discharge in to the Pipeline Arroyo. 37 billion gallons of mine water discharge between 1967 and 1986 saturated the shallow formations near the Pipeline arroyo. Tailings disposal, resulting from milling operations (1977 to 1982), caused acidic waters from the tailings pile to seep into the shallow formations, which were previously saturated by 37 billion gallons of the mine water discharge. The contamination of the mine water saturated zone prompted EPA to propose UNC to the NPL. Mine water discharge stopped in 1986, and the water level under the tailings pond and surrounding areas has been dropping since 1986 and especially after the pump and treat remedy started after 1989. 1985 levels of contaminants measured in an alluvial plume included: nitrate (> 300 mg/l);sulfate (> 8000 mg/l); selenium (0.05 mg/l); manganese (16 mg/l); molybdenum (5.0 mg/l); cadmium (0.125 mg/l). Arsenic was found in on-site Zone 1 and 3 wells up to 2.5 mg/l, above the 0.5 mg/l drinking water standard. Gross alpha levels above 15 pCi/l were found throughout the site and in all aquifers of concern. Human health risks associated with 1985 levels of arsenic and radionuclides are increased cancer risks.

Date/Type/Costs of Remediation: The 1979 release of tailings and pond water was "cleaned up" by UNC. Attempts to neutralize the tailings were conducted between 1979 and 1982. Contaminated ground water is being removed by pumping and evaporation as prescribed in a 1989 Record Of Decision (ROD). UNC has been pursuing remedial actions to address source control and on-site surface reclamation pursuant to a 1989 Remedial Action Plan (RAP). Source control measures i.e. low permeability covers and reclamation have been completed and the three tailings cells have been covered by the end of 1993. The cost of the ground water remediation effort is estimated at $17 million over a 10 year period.

Uravan Uranium Project (Union Carbide), Uravan, CO

Site Description/Contaminants of Concern: Radium milling and extraction operations began in 1915. The plant was expanded to include vanadium recovery in 1935 and began this process in 1936. It operated as a uranium facility in the late 1940's. In 1984 Union Carbide formed a subsidiary, Umetco, which now owns and operates the facility. The Court ordered Consent Decree was signed in late 1986. During the course of its operations, the mill generated and disposed of millions of cubic yards of liquid and solid wastes containing radioactive materials, metals and inorganics. There is uncontrolled release of radon from the tailings piles, seepage of contaminated liquids into soils and ground water, and concern over the risk of large waste areas and their potential impacts to public health and environment.

Environmental Damages and Risks: Ground water contamination is evident at various areas at the site. Soil contamination exhibits an inverse relationship to distance from the mill. Aluminum and silver concentrations in surface water downstream from the site were found to be above Colorado Surface Water Standards. Contaminated soils are also believed to be entering the aquatic system and increasing contaminant load. Radon gas emanates from the eroding tailings piles. Uravan is one of the more complex radiation sites in the country, with heavy metals, residual salts, and

radionuclide contamination of ground water and surface water.

Date/Type/Costs Of Remediation: Ground water is being remediated through pump and evaporation. Two million cubic yards of contaminated materials have been removed and stabilized in repositories. No surface water impacts were measured at the site during 1994. The remediation is designed as a zero discharge activity. As of October, 1995, radon emissions meet EPA and NRC standards. Current expenditures to date are more than $40 million. Removal of all contaminated solids, placement of these solids in secure repositories, and stabilization of tailings piles is estimated to cost approximately $470 million.

EPA 5-Year Report: "The remedial effort appears to be effective in reducing or eliminating contaminant releases. [and] the Rap-specified remedial effort appears to be protective of human health and the environment."

W.R. Grace/Wayne Interim Storage, Wayne, N.J.

Site Description/Contaminants of Concern: Beginning in 1948, thorium and rare earths were extracted from monozite ore, until 1971. The W.R. Grace site consists of 6.5 acres containing approximately 100,000 cubic yards of waste. 70,000 cubic yards of the waste containing almost 76 tons of thorium, was buried on-site. Another 38,500 cubic yards (CY) of waste from past removal actions was stored in an on-site pile. Current actions have removed 15,000 CY with the remainder scheduled for removal in 1999. After process operations ceased in 1971, the facility was licensed for storage of thorium-containing waste. In 1975, the storage license for radioactive materials was terminated by the NRC following decommissioning of the facility, and the property was released without radiological restriction (the only stipulation was that the property deed state that radioactive materials were buried on the property). Contaminants of concern include thorium and its decay products, radium-226, uranium and its decay products, and radon. This site is included in DOE's Formerly Utilized Site Remedial Action Plan.

Environmental Damages and Risks: Elevated levels of radiation were detected in 1981 and 1982 aerial surveys. Off-site contamination of soil and sediments with thorium, radium and uranium was found during 1982 and 1983 radiological surveys.

Date/Type/Costs of Remediation: From 1985 to 1987 waste was removed from nearby properties to an on-site storage pile. This pile is currently being shipped off-site for disposal. The cost of removal from this site and two other DOE FUSRAP sites in N.J. is estimated to be $210 million.

ZIRCONIUM

Teledyne Wah Clung, Albany, OR

Site Description/Contaminants of Concern: This is an active site that has been manufacturing primary and mill product zirconium and hafnium for approximately 30 years. The process generates wastes such as radioactive chlorinator residues, ignitable MIBK still bottoms, magnesium chlorides, smokehouse residues and slag wastes. The site consists of two areas, the Plant site and the Farm site, encompassing a total of roughly 225 acres. TWCA has been cited for numerous NPDES permit violations and was cited in 1986 for violations of State hazardous waste management rules.

Environmental Damages and Risks: Ground water sampling indicated levels of heavy metals that exceeded Federal Primary Drinking Water Standards. Maximum concentrations for chloride, iron, manganese, sulfate, and TDS exceeded Federal Secondary Drinking Water Standards. Low levels of volatile and semi-volatile organic compounds are found in surface waters on and around the site. Results of sediment sampling performed in 1989 as part of the remedial investigation is not yet available to the public, however, TWCA used the sludge from wastewater treatment processes as a soil amendment on the Farm site. Air monitoring generally indicates that air emissions are considered

an unimportant pathway for radionuclide transport.

Date/Type/Costs of Remediation: A ROD for OU1 was finalized in 1989 to expedite removal and solidification of the sludge and transport to an off-site solid waste disposal site at an estimated cost of $10.7 million.

Appendix 1

Mining Sites deleted from the NPL

Martin Marietta Aluminum Co., The Dalles, OR
deleted July 5, 1996

Site Description/Contaminants of Concern: The site contains a 15-acre landfill containing approximately 200,000 cubic yards of waste, including asbestos, metallic wastes, and 5,000 tons of spent cathode-waste materials containing cyanide, polynuclear aromatic hydrocarbons (PAHs) and arsenic. In addition, approximately 64,670 cubic yards of cathode-waste material was deposited at the unloading area and at the old cathode-waste management area. There are four scrubber sludge ponds over 14.8 acres containing contaminated sludge and subsoil. Primary co39ntaminants of concern: volatile organic compounds (VOCs), including trichloroethylene (TCE), PAHs, and inorganics such as asbestos, cyanide, arsenic, and other metals.

Environmental Damages and Risks: The major sources of contamination at the site include impacts to ground water, surface water, soil and air. The ground water system consists of 4 different aquifers contaminated with varying levels of total and free cyanide, fluoride, sodium, and sulfate. Major surface water resources in the area include the Columbia River and its tributaries. Prior to construction of a runoff interception network, leachate from the landfill discharged into the alluvial aquifer. Of seven surface water ponds on site, four scrubber sludge ponds are no longer in use, though they continue to intersect the water table, and the Recycle Pond and Lined Pond are no longer in use as part of the plant's production operation. (The Recycle Pond continues to discharge into the Columbia under NPDES). PAHs are found in soils and sediments.

Cost of Remediation: Cyanide compounds were detected in ground water in the spring of 1983. The Rl/FS was completed in June 1988. Remedial action included excavating the cathode-waste material and placing it in a landfill, covering the two remaining uncovered sludge ponds with soil, plugging nearby production wells, collecting and treating leachate, and groundwater monitoring. Cost: $6,707,400 + operation and maintenance costs.

Kennecott Sites

In January 1994, EPA proposed to list the Kennecott Sites on the NPL, 59 Fed. Reg. 2568 (1/18/94). This proposal then became subject to public comment and review. Since that time, EPA has entered into a Memorandum of Understanding (MOU) with Kennecott whereby EPA will not finalize the listing of the Kennecott Sites so long as Kennecott continues certain cleanup activities listed in the MOU. Kennecott is currently in compliance with the MOU and EPA has not listed the Kennecott Sites on the NPL.

The Agency recieved a number of comments questioning the extent of environmental damage at the Kennecott sites. These sites involve both mineral processing and extraction/beneficiation activities. The extent of contamination at the kennecott site is not in dispute. The Court at 801 F. Supp. 553 (September 3, 1992) clearly notes the extent of groundwater contamination at the site.

Kennecott noted in comment that under the MOU, KUCC agreed to complete certain removal and remedial activities, including a historic site assessment, for 161 sites identified by EPA. These historical sites are included within, but do not represent the full list of sites contained in the "Site Background Document." Upon agreement of the parties to the MOU, the sites were prioritized in three categories. KUCC completed its review and research of over 40 Priority 1 sites and submitted a report to EPA dated August 27, 1996. KUCC is in the process of completing its assessment and review of the Priority 2 sites. This year, KUCC expects to submit the Priority 2 response document along with a response to EPA questions generated by the 1996 submittal. The results of the historic site assessments provide information in addition to that contained in the January 1996 EPA Site Background Document. Significant information contained in numerous other reports and documents also are not necessarily reflected in the Site Background Document or the Damage Cases Report [As noted in Kennecott's April 23, 1996 comments to the proposed rulemaking, Attachment E, (Exhibit 7), Kennecott submitted over 43 volumes of comments and supporting documents in response to EPA's January 18, 1994 proposed listing. Kennecott also has provided to EPA Region VIII, multitudes of documents in response to several CERCLA Section 104(e) requests. All of this information is now available to the Agency for review.

Kennecott (North Zone), Magna, Utah

Site Description/Contaminants of Concern: The Kennecott (North Zone) site is located near the south shore of the Great Salt lake. Since around 1900, the area have been used for a wide variety of mineral processing by many different companies. Magna, the nearest town, has a population of approximately 17,800 people and is located south of the large Kennecott tailings pond. The primary metal currently produced is copper. Contaminants in the various sources include arsenic, chromium, copper, lead, selenium, and zinc.

Environmental Risks and Damages: Analysis of ground water monitoring wells have found high levels of arsenic and selenium. The exact source of the contamination has not been identified. Two separate plumes are suspected: one which originates in the smelter/acid plant area and the other near the refinery. The groundwater is a suspected source of contamination found in wetlands downgradient of the smelter and refinery. An ecological risk assessment is currently in progress to determine what the significance of this might be. Another contamination is located in refinery evaporation ponds. Attempts have been made to remove contamination from the ponds, but two layers, 40 and 60 feet below the surface, are still contaminated.

Kennecott (South Zone), Copperton, Utah

Site Description/Contaminants of Concern: The South Zone comprises approximately 150 square miles in southwest Salt Lake County, west of Salt Lake City, Utah. Mining in the area began in 1860s, with the copper being the primary metal produced. Various mining companies have operated in the district over the years, including Anaconda Co. and Kennecott Copper Corp.. Kennecott sent much of the mineral processing waste and copper ore from these operations north to the Kennnecott (North Zone). Tailings waste produced in the South Zone is shipped to the North Zone slurry and Rail. The South Zone includes wastes associated with extracting and concentrating copper ore.

Environmental Risks and Damages: The Southwest Salt Lake County Groundwater is considered a public health hazard by the Agency for Toxic Substances and Disease Registry (ATSDR) because high sulfate concentrations (above 500 ppm) in the drinking water aquifer may be ingested by a few people still using private drinking water wells within the path of the groundwater contaminant plumes. The three predominant mining-related sources for the South Zone groundwater contamination are the Large Bingham Reservoir (and possibly Bingham Canyon underflow), Lark mines, and the South Jordan Evaporation Ponds. Soils in residential areas of Bingham Creek located within the City of West Jordan are also contaminated with metals such as lead and arsenic. The sources of the soil contamination are primarily lead tailings from other previous lead mining operations and copper tailings from Kennecott's copper mining operations. Analysis of soil samples from the residential areas determined the average contamination level of 110 ppm lead and 11 ppm arsenic.

Cost of Remediation: According to Kennecott, the comprehensive cleanup activities have cost approximately $150 million to date, with another expected $39 million in 1996. Kennecott states that 25 million tons of mining wastes have been relocated or permanently disposed of.

References:

- Document sent to Michael H. Shapiro from Kennecott Utah Copper Corporation, dated April 23, 1996, regarding inaccuracies in certain EPA background documents used in support of Land Ban Restrictions Rulemaking.

- Document sent to Michael H. Shapiro from EPA Region VIII, dated May 7, 1996, containing Region VIII responses to Kennecott Utah Copper Corporation's concerns regarding inaccuracies in certain EPA background documents used in support of Land Ban Restrictions Rulemaking.

Annie Creek Mine Tailings, Lawrence Co., South Dakota

Site Description/Contamination of Concern: The Annie Creek Mine is located in the Black Hills National Forest. Gold ore was processed here for 9 years and tailings were disposed of on site. Contaminants of concern are arsenic, aluminum, cobalt, iron, manganese, mercury, nickel, selenium, silver, vanadium and zinc.

Environmental Damages and Risks: High concentrations of arsenic were discovered in the Annie Creek water and sediment and in the Spearfish Creek. Both Annie Creek and Spearfish Creek are used for the spawning and the fishing of trout.

Cleanup Completed: The cleanup of he Annie Creek Mine Tailings was completed by Wharf Resources in August of 1994.

NOTE: Todays rule only affects newly identified mineral processing wastes. Many comments were submitted to the Agency which address the separate issue of whether the Agency should or should not reevaluate the Bevill exclusion. This technical background document does support todays rule. It presents information on mineral processing sites placed on the NPL as of January, 1996. Comments and responses in this section therefore only address concerns noted by comments as they relate to mineral processing sites on the NPL. The Agency will address the issue of the reevaluation of Bevill at a later date.

Comm 1104, 1089, 1029 Many commenters noted that the report does not support the rule since damages noted are related to practices no longer used by industry.

Response: The cases noted in the report are relevant because they illustrate the range of environmental damages mineral processing wastes have caused. The Agency finds that many of the mineral processing wastes that caused damages in the past are still generated and still pose threats if mismanaged.

It should be noted that at mineral processing NPL sites, slag was generated in large quantities by smelters, for example the Anaconda Smelter and the Commencement Bay/ASARCO Smelter. As with waste rock at mines, slag was disposed where convenient, with little or no attention to long-term management. Some slag wastes are the focus of Superfund cleanups. The same type of slag is currently being generated at active smelters. While most of these new slags are exempt from RCRA Subtitle C, the operators are attempting to dispose of them in a more environmentally controlled fashion, such as in engineered impoundments or co-mingling with tailings.

Old and new smelters also generate enormous quantities of flue dust, as well as emissions containing high levels of arsenic and sulfur dioxide. Sulfuric acid plants and arsenic recovery technologies were often added to smelters over the years, which reduced later impacts of emissions, as did taller stacks, which allow dispersal of pollutants over wider areas and consequent reduction in local impacts. Other air pollution control devices, often installed because of local damages, were able to capture much of the flue dust. The Anaconda Smelter site, which ceased operations in 1980, was an integrated facility that includes 185 million cubic yards of tailings, 27 million cubic yards of granulated slag and 0.25 million cubic yards of uncontained flue dust that cover an area over 6,000 acres. In addition to smelting, operations at the site included a copper refining plant that produced cathode copper using an ammonia leach process and a beryllium oxide pilot plant. At the Anaconda Smelter site, for example, captured flue dust was disposed on land, where it now constitutes part of a major operable unit that requires substantial cleanup. State-of-the-art smelters are recycling this flue dust to make more product. The Agency acknowledges that this recycling is driven not only by economics, but by increased regulatory requirements (i.e., Clean Air Act).

Comm 1041 Commenter noted that the Cherokee county Kansas, Foote Mineral NPL cases do not support restricting the placement of mineral processing secondary materials on the land.

Response: The Cherokee case does relate to extraction/beneficiation wastes while the Foote case does involve land disposal of some mineral processing wastes. The Foote Mineral case shows that mineral processing wastes have caused environmental problems in the past. The commenter indicated that cases in the report did not support the virgin Bevill feedstock option . The Agency is not adopting in todays rule the virgin Bevill feedstock option.

Comm 1041 noted that while Cyprus Foote did excavate and treat soil at the site in 1992 using bioremediation, EPA conveniently forgets to mention that the soil remediation was not related to any Bevill or non-Bevill mining or mineral processing wastes. Instead, the soil was contaminated by diesel fuel from a previously undetected plant site underground fuel delivery line and railhead. EPA disingenuously implies that this work had something to do with mining or mineral processing wastes, and that Subtitle C regulation under RCRA could have prevented this contamination, which is just plain false.

Cyprus Foote is also unaware of any support for EPA's contention that "estimates of possible remedial alternatives range from $3.7 million to more than $100 million" for remediation of the site. While the exact source of the elevated lithium, a non-hazardous substance, levels in ground water, and other minor constituents in various media at the site, are unknown, almost all of the wastes disposed of in old limestone quarries at the site were generated from production operations that have not been undertaken for over thirty years. Finally, the lithium production operations at the Frazer facility were not generally extraction or beneficiation operations. They are therefore irrelevant to any reexamination of the Bevill status of extraction or beneficiation wastes. All processing wastes that may have been generated at Frazer already have been classified as non-Bevill mineral processing wastes.

Response: The text of the report has been amended to note Cyprus's objections to the characterization of damages at the site. The Agency does not agree that this case should not be used. Foote chemical was a mineral processing facility. The Agency further concludes that lithium metals appear to have contaminated the site.

Comm 1029 The comprehensiveness and efficacy of the existing Nevada regulatory programs are reflected in the absence of "problem sites" in the State. As EPA's own Background Documents attest, of the 60-odd mining and mineral processing sites on the Superfund National Priorities List, only one (Carson River Mercury) is located in Nevada, and that site is a historic site where operations occurred long before the advent of the existing State regulations. See Mining and Mineral Processing Sites on the NPL,

Response: This report did not asses the efficiency or effectiveness of any state program. Readers can not simply assume that a state has a well run regulatory program as long as no sites are listed on the NPL in that state.

Comm 1048 The NPL document does not support USEPA's proposals to regulate the storage and handling of mineral processing secondary materials prior to reuse or to regulate the use of secondary materials as an alternate feedstock to mineral beneficiation and mineral processing units because the document presents no information which demonstrates that alternative feedstocks have contributed to the quantities of hazardous constituents found at mining and mineral processing sites; and the document presents no information which demonstrates that co-processing of nonhazardous alternative feedstocks in a unit generating Bevill waste have caused or contributed to any alleged problem.

Response: The Agency prepared this report to illustrate the types of environmental damages caused by mining and mineral processing sites. The NPL sites related to mineral processing clearly illustrate the types of environmental damages caused by the improper management of mineral processing wastes. These wastes, such as flue dusts and slags are still generated, and the Agency acknowledges that some historic disposal practices no longer are permitted. Never the less, it is important for the Agency to present data on how these wastes can continue to cause environmental problems years after their placement on the land. As noted earlier, todays rule does not adopt the virgin Bevill feedstock or significantly affected options.

Comm 1054 The Commenter notes that EPA Region VIII, Utah Department of Environmental Quality and KUCC entered into a Memorandum of Understanding (MOU) in September 1995. [A copy of this MOU was submitted to EPA as Attachment B to Kennecott's comments dated April 24, 1996, January 25, 1996 LDR -Supplemental Proposal to Phase IV.] The MOU essentially defers EPA's efforts to list the Kennecott South and the Kennecott North Zone sites on the CERCLA NPL. Under the MOU, KUCC agreed to complete certain removal and remedial activities, including a historic site assessment, for 161 sites identified by EPA. These historical sites are included within, but do not represent the full list of sites contained in the "Site Background Document." Upon agreement of the parties to the MOU, the sites were prioritized in three categories. KUCC completed its review and

research of over 40 Priority 1 sites and submitted a report to EPA dated August 27, 1996. KUCC is in the process of completing its assessment and review of the Priority 2 sites. This year, KUCC expects to submit the Priority 2 response document along with a response to EPA questions generated by the 1996 submittal. The results of the historic site assessments provide information in addition to that contained in the January 1996 EPA Site Background Document. Significant information contained in numerous other reports and documents also are not necessarily reflected in the Site Background Document or the Damage Cases Report [As noted in Kennecott's April 23, 1996 comments to the proposed rulemaking, Attachment E, (Exhibit 7), Kennecott submitted over 43 volumes of comments and supporting documents in response to EPA's January 18, 1994 proposed listing. Kennecott also has provided to EPA Region VIII, multitudes of documents in response to several CERCLA Section 104(e) requests. All of this information or more is available to the Agency for its review. Consequently, it is arbitrary and capricious for EPA to rely only on the Site Background Document without considering all the information available in the CERCLA record for the Kennecott sites.

Response; The report has been amended to reflect the fact hat Kennecott has provided the information noted in its comments. The Agency still contends that contamination at the site resulted from historic and current activities. Such information is relevant to the Agency's position that improper management of mineral processing waste have caused environmental problems.

Comm 1054 Although some contamination at the North End of KUCC's facilities may be attributed to newly identified hazardous mineral processing wastes, the contaminants identified by EPA (e.g., flue dust, acid plant blowdown, process water) are not conclusively known to be the cause of groundwater contamination at the North End. KUCC is currently conducting a removal action for contaminated soils and wastewater treatment plant sludges. (See, North Facilities Soils/Wastewater Treatment Plant Sludge Ponds (NFS/WWTP) Administrative Order on Consent, SSID #4B, Docket No. CERCLA-VIII-95-04.) The removal activities require KUCC to characterize potential areas of contamination at the site, but the characterization program is phased over the course of the project and has not been completed. Additionally, a remedial investigation and feasibility study for the groundwater contamination underlying the North End is planned for the purpose of determining the sources of groundwater contamination and development of remedial alternatives. The work plan for the remedial investigation was only recently approved by EPA [FN 15 Verbal approval was received from Dr. Eva Hoffman, EPA Region VIII, June 9, 1997.] and issued as a final work plan dated June 16, 1997. Until this work is completed, it seems obvious that EPA cannot determine the causes of contamination and rely on its determination in this rulemaking as it seeks to do here.

Response: KUCC admits that contamination at the North end may be attributed to mineral processing wastes. While KUCC continues to conduct evaluation of the exact sources of contamination, OSW evaluation of data currently available shows strong likelihood that some combination of flue dusts, sludges, and acid plant blowdown are contributing to contamination at the site. While the remedial investigation is ongoing, no definitive conclusions can be reached, however the status of that investigation does not restrict the Agency from making conclusions based on data available at this time.

Comm 87, 1054 Kennecott notes that the Agency has concluded that prior to 1990, many facilities and specific waste streams associated with mining and mineral processing operations were not subject to the rigorous controls of RCRA Subtitle C. For example, long-term land storage of flue dust at KUCC was essentially terminated

when stored flue dust was sent for disposal at USPCI prior to the September 1991 date when it became regulated as a newly identified mineral processing waste. See Kennecott Utah Copper Corporation, Estoric Sites Response to EPA, August 27, 1996, Site 75 -Flue Dust Disposal Area (Exhibit 2). Additionally, as demolition and cleanup projects have taken place, historic spills of flue dust have been removed and disposed as appropriate at off-site permitted facilities. Id. at Site 76 (Exhibit 3).

Another example of a historic practice that ceased before 1990 is the use of the refinery electrolyte purification (EP) pond. Although suspected as a primary source of selenium contamination to groundwater, the use of the unlined EP ponds for the storage of spent electrolyte bleed solution was terminated in 1974. Sludges from the pond were removed in 1972 and again in 1982 when the area was backfilled and revegetated. Id. at Site 77 (Exhibit 4). Current operations recycle the electrolyte bleed solution. Historic Site Response at Site 99 (Exhibit 5). The refinery itself was modernized in 1993-1994 as part of KUCC's modernization project and remaining contamination is being addressed as part of the North Facility Soils Removal Action. Id. EPA's Site Background document notes that an inspection by the Utah Department of Environmental Quality (UDEQ) identified contamination under the floor of the refinery tank house, but UDEQ delayed requiring a groundwater permit for the facility, since it was to be reconstructed and the problem areas replaced with acid resistant materials. Site Background Document at 93-94. UDEQ ultimately determined that the new facilities did not require a groundwater permit. Historic Site Response at Site 99 (Exhibit 5).

Response: The Agency acknowledges that certain waste practices have changed at their Bingham Canyon. The report has been amended to reflect the fact that the North and South units were not listed on the NPL. Evaluation of information regarding waste disposal and their related environmental impacts are relevant to todays rule since this site provides insight into the range of wastes generated in the past and how wastes are currently disposed and how they were managed in the past. The Agency acknowledges that Kennecott has spent approximately $150 million as of 1995, with another $39 million expected to be spent on such efforts in 1996. Kennecott has relocated or permanently disposed of approximately 25 million tons of mining or mineral processing wastes. Kennecott has completed cleanup of roughly half of the sites originally identified by regulatory agencies..

Comm 1034 There is no evidence in the background documents, or elsewhere in the docket, that past practices described in the document *Mining and Mineral Processing Sites on the NPL* continue today-even at currently operating sites that are on the NPL. Of the sites in that document where Asarco has been identified as a PRP, only one continues operations today. As contrasted with past practices, Bevill wastes are currently subject to a wide array of management standards designed to protect human health and the environment. Furthermore, **Bevill** wastes are not unregulated, but are subject to a variety of federal, state, and local laws. Finally, EPA has misrepresented the growth of "new" mining and Mineral processing sites on the NPL. Almost all of the mining and mineral processing sites on the NPL had been identified on CERCLIS by 1985 and, relative to all other sites, the number of mining and mineral processing sites on the NPL has not grown significantly **since** 1985. The growth of mining and mineral processing sites on the NPL reflects the growth of the NPL as a whole, not any unique increase in risks posed by mining and mineral processing sites and certainly not due to problems arising from current materials management practices.

Response: As noted earlier, the Agency finds that at least half of the sites noted on the NPL are either active or

were
closed between 1970 and 1990. The Agency therefore concludes that evidence of environmental damages from such sites reflect current waste management practices. The Agency acknowledges that most mining and mineral processing sites were identified by the Agency in the mid 1980s. It should be pointed out that Kennecott north and south were not added to the NPL because alternative regulatory agreements were reached.

Comm 67 -Mining Sites on the National Priority List: In its attempt to support the need for stringent regulation of processes used for the continuous recovery of metals at primary production facilities, the Report cites three case histories of copper facilities that are listed on the National Priority List (NPL). The facts presented in these case histories bear no similarity to the issues at hand in this rulemaking.
The Anaconda smelter operated for many decades prior to the advent of any environmental regulations. The activities that have resulted in environmental harm would not be allowed under today's regulatory programs, and EPA cannot justify the need for additional regulations based on the impacts of totally unregulated historic activities.
The Tex-Tin site is a secondary facility; it would not be subject to the regulations proposed in this rulemaking. As a
secondary facility, Tex-Tin accepted various waste materials as feedstock that would never be processed by primary facilities. Inclusion of the Torch Lake site is totally inappropriate. 'The description of the causes of damage at the site include mill tailings and drums of chemicals, but M mineral processing activities or wastes are even mentioned in the Report.

Response: The Anaconda and Palmerton cases are relevant to todays rule since it illustrates how long environmental
damages may be if mineral processing wastes are not properly managed. The case studies of Torch lake and Texas Tin are included because they were extraction/benefciation sites and may be used by the Agency when it determines if a reevaluation of Bevill is warranted.

Comm 58 The Commneter objected to inclusion of Asarco Globe, Anaconda, Asarco East Helena, and Palmerton cases noted in this report. The commenter noted that all of these cases involve sites were damages relate solely to historic practices.

Response: The Agency acknowledges that the Anaconda, and Palmerton sites have been closed for some time. Both
sites were either closed or demolished in 1980. As the Agency has noted several times, the purpose of noting historic sites is to present how mineral processing wastes cause long term environmental damages when they are improperly managed. Asarco East Helena is an operating facility which has been recently become part of a Consent

Decree under the Clean Water Act and Resource Conservation and Recovery Act (see 63 FR 8473 February 19, 1998).