11-3-1998

EPA Superfund Record of Decision: Kennecott South Zone Site

Environmental Protection Agency

PB99-964401
EPA541-R99-034
1999

EPA Superfund
Record of Decision:

Kennecott South Zone Site
OUs 1, 4, 5, 10 & Portions of 11 & 17
Copperton, UT
11/3/1998

RECORD OF DECISION

KENNECOTT SOUTH ZONE SITE

Operable Units 1, 4, 5, 10, portions of 11, and 17
Bingham Creek and Bingham Canyon Area

November, 1998

U. S. Environmental Protection Agency
999 18th Street, Suite 500
Denver, Colorado 80202

I. THE DECLARATION

A. SITE NAME AND LOCATION:

This decision document covers all or portions of six (6) operable units which are part of the Kennecott South Zone Site proposed for inclusion on the National Priorities List. Included are Bingham Creek (Operable Unit 1), Large Bingham Reservoir (Operable Unit 4), Anaconda/ARCO/Copperton Tailings (Operable Unit 5), Copperton Soils (Operable Unit 10), portions of Bingham Canyon Historic Facilities (Operable Unit 11), and Bastian Sink (Operable Unit 17). The sites are located in unincorporated Salt Lake County, Utah, the City of West Jordan, and the City of South Jordan, Utah.

B. STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action (no action) for the Bingham Creek, Large Bingham Reservoir, Anaconda/ARCO/Copperton Tailings, Copperton Soils, portions of Bingham Canyon Historic Facilities and Bastian Sink Operable Units of the Kennecott South Zone located in Salt Lake County, which was chosen in accordance with CERCLA, as amended by SARA, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for this site.

The State of Utah concurs with the selected remedy.

C. DESCRIPTION OF THE RATIONALE FOR NO ACTION

EPA has determined that no further action is required at these operable units. For Bingham Creek, Large Bingham Reservoir, and Anaconda/ARCO Copperton Tailings, previous response actions have eliminated the risks at these sites. For Lower Bingham Creek, Copperton Soils, portions of Bingham Canyon Historic Facilities and Bastian Sink, no action is appropriate due to lack of risk for current and proposed land uses.

D. DECLARATION STATEMENT

EPA has determined that no further action is required at these operable units in order to protect human health and the environment. Several cleanup actions were completed under Removal authorities and these have eliminated the need to conduct additional remedial actions. Because, at some locations, wastes have been left in place, a five year review will be necessary.

Max H. Dodson
Assistant Regional Administrator
Ecosystems Protection and Remediation
U. S. Environmental Protection Agency, Region VIII

11/3/98
Date

State Concurrence:

Dianne R. Nielson
Executive Director
Utah Department of Environmental Quality

Date

II. DECISION SUMMARY

A. SITE NAME, LOCATION, AND DESCRIPTION

This decision document covers all of or portions of six (6) operable units which are part of the Kennecott South Zone Site proposed for inclusion on the National Priorities List. Each of these operable units are described individually.

1. Bingham Creek (Operable Unit 1)

a. Bingham Creek Channel: The Bingham Creek Channel consists of the current and historic channel course of Bingham Creek from the Large Bingham Reservoir in the foothills of the Oquirrh Mountains on the west to the Brookside Mobile Home Park in the City of West Jordan on the east, a distance of about 13 miles. The creek course at the Large Bingham Reservoir is located along the western side of unincorporated Salt Lake County near the town of Copperton, then travels easterly through the Cities of South Jordan and West Jordan.

The channel transects an eastward, gently-sloping alluvial plain that extends from the foot of the Oquirrh Mountains front to the Jordan River. The elevation ranges from 5300 feet (ASL) at the Large Bingham Reservoir to 4300 feet at the confluence of the creek with the Jordan River.

The upper part of the creek channel is located on private land used for farming, mining, and industrial purposes. Portions of the lower part of the creek channel are located on public lands used for open space and recreation, but is bounded by suburban residential, commercial and industrial development. Other portions of the creek channel are located on privately owned residential property. In some cases, the creek has been rerouted in man-made ditches, channels, and culverts with suburban development occurring on the historic channel.

Bingham Creek is an intermittent, losing stream that flows only during peak runoff periods or during major storm events. The channel course, over time, has meandered and overflowed during flood events that have been caused by natural and human-caused events. Historically, the creek has abandoned old channels and formed new channels spreading contaminated alluvial and waste materials across broad areas. The principal aquifer under the creek is recharged along the foothills of the Oquirrh Mountains and discharges downgradient at the Jordan River. Groundwater (Operable Unit 2) is not being addressed in this decision document.

b. Bingham Creek Residential Soils

The Bingham Creek Residential Soils area consists of certain residential development areas in the floodplain of Bingham Creek. Located in the cities of South Jordan and West Jordan, numerous residences were built on the floodplain or over historic channels. Since most of the historic flow of the creek was diverted by early farmers and ranchers, some creek-borne contaminants were also found near irrigation ditches. Neighborhoods affected include Jordan View Estates, Meadow Green, Fahnian Ranchettes, Vista West, Sugar Factory, and Brookside. Approximately 125 individual residences were addressed as part of three prior removal actions. Most of these residences were located within 2 blocks of the creek channel.

c. Lower Bingham Creek

Lower Bingham Creek is the section of the creek between the Brookside Mobile Home Park on the west and the creek's confluence with the Jordan River on the east a distance of about a mile. This section is located in the historic Jordan River floodplain and is relatively flat. The creek courses through industrial and agricultural lands here. On the west, the creek is buried in a culvert underneath a light industrial park with associated parking lots. From the industrial park on 1300 W. the creek flows through agricultural and ranch land to an asphalt plant. The land between the asphalt plant and the Jordan River is used for agriculture (currently, alfalfa). The creek in this section is a man-made ditch. The nearest residences are about 2 blocks away. There is a small flow in the creek through this section originating with some springs at the Brookside Mobile Home Park and overflows from an irrigation canal near the Jordan River. There is a Brownfields proposal to use a portion of this land as a recreational corridor with bike paths and trails.

2. Large Bingham Reservoir (Operable Unit 4)

The Large Bingham Reservoir is located just to the south of the town of Copperton at the mouth of Bingham Canyon in the Bingham Creek channel. It was built in 1965 by Kennecott Utah Copper Corp. (hereinafter referred to as Kennecott) to impound Bingham Creek waters and leachate waters from Kennecott mining operations for recovery of metals and industrial process water. The original reservoir was unlined and, located in the recharge area for the principal aquifer, it has been shown to be a major source of groundwater contamination.

The old reservoir was retired and a new one replaced it. The new reservoir is lined and is also used for storage of stormwater and process water by Kennecott.

The land use is industrial/mining. The nearest residential community is Copperton, about ½ mile to the north. The area is fenced and is not accessible to the general public.

3. Anaconda Tailings (Operable Unit 5)

a. Anaconda Tailings

The Anaconda Tailings, also known as Anaconda (ARCO) Tailings, Copperton Tailings, ARCO Copperton Tailings and Utah-Apex Tailings, consists of approximately 3.5 million tons of lead, arsenic, zinc, and silver-bearing, fine-grained sediments covering 41 acres along the south side of Bingham Creek in the north one-half of Section 16, Township 3 South, Range 2 West. It is located adjacent to Bingham Creek. Erosion, seepage and tailwaters from the tailings created contamination along Bingham Creek, Bastian Ditch, and into Bastian Sink, and near-by agricultural lands. The land use is industrial/mining and since remediation occurred, is used for open space. The nearest residential neighborhood is Copperton, about 3/4 mile away. The site is fenced and is not accessible to the general public.

b. Bastian Ditch

The Bastian Ditch had its origins in the 1880's when water was diverted from Bingham Creek near the Oquirrh foothills to the Bastian Sink vicinity. The ditch carried water as far south as Copper Creek. The Ditch originates in the vicinity of the Anaconda Tailings and roughly follows Utah Highway 111 southward. It was used by farmers to convey water from Bingham Creek and later the Anaconda Tailings Impoundment to their fields. A recent study of aerial photographs indicates the ditch system continued southward nearly to Butterfield Creek. Subsequent sampling showed scattered elevated lead values in the southern extension of the ditch system. The current land use is industrial and agricultural. The nearest residential neighborhood is Copperton, 3/4 mile away (at northern end of the ditch). The ditch, where it exists, is not in use.

4. Copperton Soils (Operable Unit 10)

The town of Copperton is located at the mouth of Bingham Canyon adjacent to Bingham Creek on the south side of town. The eastern end of the town was built on an historic tailings deposit, particularly the residences along Copperton Circle. The land use is residential. Lands just to the east of Copperton Circle are industrial/mining land use.

5. Portions of Bingham Canyon Historic Facilities (Operable Unit 11)

Bingham Canyon is located on the east flank of the Oquirrh Mountains. Mining of mineral resources in Bingham Canyon and it tributaries began in 1863. Open pit mining of copper ores began in 1903 on the headwaters of the canyon. Today, Bingham Canyon Mine open pit is about 2 ½ miles across and over ½ mile deep and is surrounded on the east, south, and north sides by waste rock dumps. Older mining and milling facilities which have been documented in historic literature have been buried by the waste rock dumps or mined away by nearly 100 years of open pit operations.

The area where most of the historic mining operations existed is still occupied by an active mining operation and is zoned industrial/mining. Activities include mineral exploration, blasting in the pit, hauling of ores and waste rock by trucks and rail, and maintenance of the facilities. A visitor center is located near the top edge of the pit, but the access is through the Lark Gate. Kennecott owns all the water rights in the watershed (including stormwater runoff, snow melt and leach waters) and uses them for industrial processing. The mine is fenced and is not accessible by the general public. The nearest residences to the Bingham Canyon Mine are located in the town of Copperton adjacent to the Bingham Canyon Gate. Current operational facilities, including, but not limited to, the Bingham Canyon Mine, the Bingham Canyon Mine Waste Rock Dumps, the Kennecott Precipitation Plant, and the Copperton Yards are not included in this decision document. The footprint of the former Proler operation is not included. Groundwater issues associated with the mine are also not included in this decision document.

6. Bastian Sink (Operable Unit 17)

The Bastian Sink is located in the south central portion of Section 15 and the north central portion of Section 22, Township 3 South, Range 2 West. It measures 3,000 feet by 1,200 feet at its maximum extremities, totaling approximately 60 acres. It is a topographic low just to the south and east of the Trans Jordan Landfill on State Highway 111. Bastian Sink received waters diverted from Bingham Creek and the Anaconda Tailings Pond via the Bastian Ditch. The water was used to irrigate farmland in the area. The water flowing in the Ditch contained considerable tailings sediments probably derived from flow through the tailings pond.

The current land use is agricultural, but has been zoned for industrial land use. The nearest residence is in Copperton, approximately 2.5 miles to the west. The area is fenced and is not accessible to the general public.

B. SITE HISTORY AND ENFORCEMENT ACTIVITIES

1. Bingham Creek (Operable Unit 1)

The Bingham Creek Channel is located downstream from the West Mountain (Bingham) Mining District on the east flank of the Oquirrh Mountains where mining activities began in 1863. Bingham Creek originates in Bingham Canyon within the borders of the mining district and trends easterly to the Jordan River. The distance of Bingham Creek from the Large Bingham Reservoir, located near the mouth of Bingham Canyon, to the Jordan River is about 13 miles. During the early days of mining, wastes from mining and mineral processing (mine dumps, mill tailings, and smelter slag) were dumped directly into Bingham Creek or stored adjacent to the creek where they were subject to erosion and transport to the creek. The mining wastes contained elevated levels of lead, arsenic, and other heavy metals. Over the years, especially during flood events, these mining and processing wastes washed downstream where they were deposited in the creek channels and floodplain. The land through which Bingham Creek trends was originally farm land, but with the growth of the Salt Lake City suburbs, several residential neighborhoods were built along the creek, on floodplains, and over historical creek channels.

Three removal actions in accordance with Action Memoranda dated, May 1991, January 1993, and June 1995, were performed by EPA, ARCO and Kennecott to address the problems associated with mining wastes in the channel of Bingham Creek and in the neighborhoods built on the Bingham Creek floodplain.

a. Bingham Creek Channel

On February 18, 1993, EPA issued a Unilateral Administrative Order (UAO) for Bingham Creek Phase II to ARCO (Atlantic Richfield Company) and Kennecott, Docket No. CERCLA-VIII-93-10. This addressed the contaminated tailings removal in the Bingham Creek channel as outlined in the Action Memorandum dated January 28, 1993. Lead values up to 30,000 mg/kg were found. The removal extended from the Kennecott Large Bingham Reservoir dam to the downstream side of the Brookside Trailer Park, a channel distance of approximately nine miles. The work was conducted by ARCO and Kennecott under the supervision of EPA and UDEQ. In general, wastes in the creek channel containing over 2,000 mg/kg lead were removed down to three feet or deeper, any remaining contamination was capped, and the creek bed was then recontoured. The excavated wastes were hauled either to the Kennecott Bluewater Repository or to the Anaconda Tailings.

In the process of cleaning up the creek channel, a number of road crossings and utility corridors were encountered and cleaned up: West Valley Highway

Crossing, Kern River Gas Transmission Co Pipeline Crossing (under provisions of Administrative Order on Consent, CERCLA VIII 92-01), 3200 West Street Crossing, and Salt Lake County Water Conservancy District Water Pipeline Crossing. A number of historic facilities and waste storage locations were also encountered and cleaned up: Tailwater Ditches, Bingham Flats, Evaporation Ponds Canals, Cemetery Pond, Mixed Tails, Robbe Cells, McGregor Precipitation Plant,

New York and Utah Mill, Revere Smelter, Holy Cross Hospital Grounds [now Paracelsus Jordan Valley Hospital], and the Redwood Road Pond.

The Cities of West Jordan and South Jordan have agreed to supervise long term management of the site using existing authorities for land use planning, zoning, and building permits.

b. Bingham Creek Residential Soils:

During Bingham Creek Phase I, in 1991, surface soils contaminated with mining wastes were excavated and removed from 50 residential properties in West Jordan which were located within the historic flood plain of Bingham Creek in accordance with the Action Memorandum dated May 1991. Lead values up to 12,000 mg/kg were found in the soils. Soils with lead concentrations exceeding 2,500 mg/kg were removed and replaced with clean fill. EPA conducted the removal in conjunction with Kennecott. Kennecott participated by constructing a mine waste repository (Bluewater Repository) and providing hauling services from the site to the repository. Their participation was done under the provisions of an Administrative Order On Consent, Docket No. CERCLA-VIII-91-11, dated May 20, 1991. Kennecott also paid EPA a portion of the costs associated with this action.

Bingham Creek Phase III occurred in 1995-1997 and addressed 75 residential properties in accordance with the Action Memorandum dated June 1995. It provided for the removal of soils which had concentrations in the soil exceeding 1,100 mg/kg lead and/or 100 mg/kg arsenic. Removal depths in both actions were as much as 18 inches which was then replaced with clean soil. The removal took place in areas which were determined to provide a pathway for exposure to residents. In Phase III, the work was conducted by ARCO under the provisions of Unilateral Order CERCLA VIII-95-19 dated July 21, 1995, and amended October 31, 1995. The work was conducted under supervision of EPA and UDEQ. The contaminated materials were hauled to the Anaconda Tailings.

The Cities of West Jordan and South Jordan have agreed to perform long term management of the site using existing authorities for land use planning, zoning, and building permits.

c. Lower Bingham Creek

It is known that mining wastes washed all the way from Bingham Canyon to the Jordan River. UDEQ, Kennecott, and EPA have all confirmed that elevated lead and arsenic are found along the creek channel. This area, located in the Jordan River floodplain, is used for agriculture, ranching, and industry. There are no plans to develop this area for residential use. Therefore, the data concerning the location of mining waste contamination were transferred to the City of West Jordan who will manage this area in the future through land use planning, zoning, and building permit authorities. The city has received a Brownfields Grant to design a long-term plan for this and nearby areas.

2. Large Bingham Reservoir (Operable Unit 4)

In 1965, Kennecott constructed a reservoir on Bingham Creek just to the south of the town of Copperton in the channel and floodplain of Bingham Creek at the mouth of Bingham Canyon. At the time of construction, the area had been used as a tailings impoundment by Utah Copper, Kennecott's predecessor. The unlined reservoir had a capacity of approximately 500 million gallons and received flow from (1) groundwater which was pumped from the Bingham Canyon alluvium upstream of the reservoir, (2) stormwater from Bingham Canyon and the mine waste dumps, (3) a concentrator, and (4) acidic leachate waters from the Bingham Mine Waste Dumps during emergency overflow conditions. Groundwater monitoring downstream of the reservoir and water balance calculations revealed that the reservoir was leaking into the underlying principal aquifer at the rate of approximately 1180 gal/min. The water was highly acidic, and contained very high concentrations of metals and sulfate.

The original reservoir was retired from service in 1991. The water was drained, and the sludges, tailings, and underlying soils excavated. Approximately 20 - 30 feet of materials were removed from the reservoir area. The sludges were mixed with alluvium high in calcium carbonate, placed along the main waste rock dumps behind the leachate collection system, and buried by waste rock when this portion of the dump slope was relaxed. Kennecott then regraded the excavated area and constructed a new reservoir in the same location. The new reservoir has three basins. The first basin is used as a debris collection basin and is lined with concrete to allow access for maintenance. The second and third basins are lined with two layers of HDPE with a leak detection system between the layers. The performance of this reservoir is monitored through a Utah Groundwater Permit (UGW 350006).

Adjacent to the Large Bingham Reservoir to the north is the Small Bingham Reservoir. The original Small Bingham Reservoir was also constructed in 1965 as a mine waste treatment facility and a sewage lagoon for the town of Copperton. The original reservoir was lined with clay. In 1990, Kennecott took the reservoir out of service, excavated some of the materials, and installed a new reservoir equipped with clay, geotextile, and HDPE liners with a leak detection system. The performance of this reservoir is monitored through a Utah Groundwater Permit (UGW 350004).

EPA and Kennecott entered into Administrative Order on Consent CERCLA VIII 92-10 on June 23, 1992 under which Kennecott performed the removal action at the Large Bingham Reservoir.

3. Anaconda Tailings (Operable Unit 5)

a. Anaconda Tailings Impoundment

The Anaconda Tailings is located immediately south of Bingham Creek near the Kennecott Large Bingham Reservoir. The Tailings Site was originally a tailings pond constructed in 1914 to trap the tailings produced by the Utah Apex and Bingham New Haven Mills upstream in Bingham Canyon. Tailings were sluiced to the site via flumes. The pond allowed most of the tailings to settle out. The water, containing acids, heavy metals, and residual tailings, was then sent back to Bingham Creek or used by farmers for irrigation.

EPA issued a Unilateral Administrative Order (CERCLA VIII 93-06) with an effective date of January 25, 1993, to ARCO requiring ARCO to conduct an Engineering Evaluation/Cost Analysis (EE/CA) and complete a removal action at the Anaconda Tailings Site.

The Anaconda Tailings Removal Action, which occurred from 1993 to 1997, consolidated the lead tailings from a 96-acre parcel to the western end of the site where they were capped with a HDPE liner, clay, and soils. Also included in the capped area were the soils excavated from ARCO projects along Bingham Creek during Phases II and III. Run-off and run-on controls were installed to prevent water from entering the site, and to prevent erosion of the cap into Bingham Creek during storm events. The facility was designed to withstand a 100-year storm event.

ARCO has agreed to perform long-term maintenance of the capped repository. In addition, Salt Lake County has agreed to use its authorities in land use planning, zoning, and building permits to insure that the cap integrity is not compromised.

b. Bastian Ditch

The Bastian Ditch was constructed in the 1880's to convey irrigation waters from Bingham Creek to ranch and farm land south of the creek. The ditch captured tailings that entered the creek upstream of the diversion. When Utah Apex constructed their tailings impoundment in 1914, the farmers also used the tailwaters for irrigation. Historical records indicate that the tailwaters were not free of contamination. Remnants of the ditch could be seen along the south side of the Anaconda Tailings and on Kennecott lands south of the Anaconda Tailings.

The tailings deposited in the Bastian Ditch were removed by Kennecott and ARCO on their respective lands. ARCO placed these tailings in the main ARCO tailings capped repository. Kennecott hauled the tailings from their sections of the ditch to the Bluewater Repository.

ARCO performed its cleanup of the Bastian Ditch under the provisions of Unilateral Administrative Order CERCLA VIII 93-06. Kennecott performed its cleanup under the provisions of Administrative Order on Consent CERCLA VIII 98-09 under which Kennecott agreed to perform response actions at several areas including a portion of the Bastian Ditch.

4. Copperton Soils (Operable Unit 10)

Historical photographs reveal that the eastern end of the town of Copperton was built on a tailings deposit. The tailings may have come from the experimental Utah Copper mill built in 1903, but this is not known for certain. EPA investigated the area in 1994, and determined that this section of town had, in fact, been built on mine wastes, but the concentrations of hazardous substances were low and well beneath action levels for residential property. EPA determined that no action was required.

5. Bingham Canyon Historic Facilities (Operable Unit 11)

Mineral resources were discovered in Bingham Canyon in 1863. It was not long before the canyon and its tributaries were covered with small mining, milling, and processing operations. The ores near the surface contained gold, silver, lead, zinc, and copper. A wide variety of mineral processing techniques were used by the mills depending on the requirements of the specific ore. Typically, wastes were simply dumped directly into the creek or impounded along the banks of the creek.

In 1903, Utah Copper began open pit operations in the Canyon and bought the mining claims as their pit operations grew. Today, most, but not all, of these historic sites have been subsumed by the pit itself or buried under the Bingham Canyon Mine waste rock dumps.

In 1993, EPA began compiling a list of the facilities known to have operated in the canyon. In 1995, Kennecott began to characterize the sites by describing the locations, what was known about the operations there, and where their wastes were located. If the site was accessible (not buried by waste rock or subsumed by the pit), Kennecott collected samples to determine what hazardous substances were left by these operations. This activity was performed under the provisions of the Kennecott/EPA/UDEQ Memorandum of Understanding signed in September, 1995. The results of the characterization of historic facilities are in three reports called On-Site Environmental Assessments. EPA and UDEQ used the results of this study to determine if cleanups were needed.

EPA and UDEQ concluded that each facility in Bingham Canyon fell into one of several broad categories: (1) facilities whose footprints no longer exist because they have been mined away by the growing Bingham Pit; (2) facilities whose footprints have been buried by waste rock from the Bingham Mine or have been buried underneath a current operating facility; (3) facilities which could be characterized but any contamination found was consistent with the current land use and did not require cleanup; (4) facilities which were characterized and required cleanup; (5) facilities which were found not to have operated and therefore produced no wastes; (6) facilities which were located in areas which were cleaned up during CERCLA and non-CERCLA cleanups; and (7) current facilities.

Facilities whose footprints no longer exist because they have been mined away as the pit grew are:

Utah Apex Mill
Rogers Mill #1 and #2
Boston Consolidated Mill
Stewart #2 Mill
Columbia Copper Mill
Jordan Mill
Spanish Mill
Telegraph Mill
Silver Shield Mill
Bingham Gold
Utah Concentrator
Utah Mill
Brooks Mill
Durrant Mill
Eagan and Bates Mill
What Cheer Mill

Murphy Mill
Boston Launder (exact location unknown)
Apex Yard Launder
Ohio Copper Launder
Copper Center Gulch Launder
Main Canyon Launder (exact location unknown)
A Pit Launder (exact location unknown)
Drain Tunnel Launder (exact location unknown)
Ingersoll Gulch Launder
Starless Launder
Copper Placer Launder
Utah Smelter
Winnamuck Smelter

Several of the historic sites were buried by the Bingham Mine Waste Rock Dumps or current facilities. At these sites, any wastes left by these operations were buried and no longer accessible for sampling or remediation:

Lead Mine Mill
Utah Copper Mill
Winnamuck Mill
Markham Mill
Walls Mill
Shawmut Mill
Highland Boy Mill
Bingham-New Haven Copper and Gold Mill
Last Chance Mill
New England Gold and Copper Mill
Stewart Mill
Bemis Mill
West Mountain Mining Co. Mill
Bingham Mining and Milling
Utah Consolidated Gold Mill
Heaston Concentrator Jigs
Massasoit Mill
Bingham New England Mill
Tiewaukee Dump Launder
McGuires Gulch Launder
Galena Gulch Launder
Winnamuck Precipitation Plant
Cuprum Yard Plant

Watsons Jig
Darrenugue Jig (mobile facility)
Verona Uranium

The footprint of a few sites was available for characterization, but the concentrations of hazardous substances were sufficiently low to present little threat at their land use. These sites included:

Copperton Dumps
Yampa Smelter

In one case, a facility was found that needed cleanup. This facility, operated by Proler to process cans for use in precipitation plants, has not been fully cleaned up and is therefore excluded from this decision document.

One site, the Zinc Concentrator, was investigated and no wastes were found at the site. It was later learned that the mill facility had been built but never operated.

Several facilities on the comprehensive facility list were cleaned up as a part of the Bingham Creek Channel cleanup or decommissioned by the Utah Division of Radiation Control. The facilities required no further action. These facilities were:

Robbe Cells
McGregor Plant
New York and Utah Mill
Revere Smelter
Mixed Tailings
Yellow Cake Plant

Although the mining and ore processing facilities which are still currently active may have hazardous substances at their locations, these were not systematically characterized and are therefore excluded from this decision document. This category includes, but is not limited to, the following facilities in Bingham Canyon:

Bingham Canyon Open Pit Mine
Bingham Canyon Mine Waste Rock Dumps
Barneys Canyon Gold Mine
Copperton Concentrator
Kennecott Precipitation Plant
Truck and rail maintenance shops
Dry Fork Electrowining facility
East-side Collection System

Dry Fork Collection System
Bingham Canyon Collection System

Information about the status of each of these historic facilities has been forwarded to Salt Lake County who has agreed to use its land use planning, zoning, and building permit authorities to manage the Bingham Canyon historic sites area in the future.

6. Bastian Sink (Operable Unit 17)

The Bastian Sink contains elevated levels of lead and arsenic due to receiving irrigation waters from Bingham Creek and tail waters from the Anaconda Tailings. Water was conveyed to the area by the Bastian Ditch. There are estimates of 800,000 cubic yards of lead and arsenic contaminated sediments in the Bastian Sink area. This area was characterized by ARCO under the provisions of the Unilateral Administrative Order for Anaconda Tailings. Approximately 22% of the area was found to have elevated lead and arsenic above residential action levels.

Because the current land use of this area is agriculture, and the zoning is industrial, the lead and arsenic do not pose a significant current risk. There are no future plans to develop this site for residential purposes. The City of South Jordan has agreed to provide long term management of the site using its land use planning, zoning, and building permit authorities.

C. HIGHLIGHTS OF COMMUNITY PARTICIPATION

The Administrative Record original documents are housed in the EPA Region VIII Superfund Records Center, and an information repository is available at UDEQ. EPA and UDEQ also established and maintained a local information repository. Originally, the repository was at the West Jordan Library until it exceeded the storage capacity of the library. Then it was relocated to West Jordan City Hall.

A site-wide community relations plan was completed in 1991 by UDEQ.

Residents were kept informed via public meetings, neighborhood meetings, individual meetings with impacted homeowners, availability sessions where the residents could receive information concerning blood leads and soil concentrations, letters, and fact sheets. In addition EPA and UDEQ responded to requests for information on real estate and other related issues via phone, fax, and mail. The proposed plan indicating EPA's and UDEQ's preferred approach for this area was mailed to all residents impacted by the various actions, as well as public officials, and the media.

EPA and UDEQ worked closely with the Cities of West Jordan and South Jordan and Salt Lake County to develop protocols for long-term protection of the remedies using existing local ordinances covering land use planning, zoning, and building permits. Alternative approaches were discussed and documented.

EPA and UDEQ established a site wide Risk Assessment Task Force to provide a forum by which national and local experts could discuss risk assessment issues and propose studies to resolve the issues. Citizens of Bingham Creek neighborhoods contributed home grown vegetables to aid in these studies. One farmer participated in a study of the uptake of lead and arsenic in wheat grains. Prior to setting a final action level for residential properties, affected residents were invited to a meeting to discuss several issues, including land use and uncertainties in risk calculations. Several approaches were proposed by EPA and UDEQ. The property owners evaluated their options and indicated which approach they preferred. The final action level for residential properties incorporated their recommendations.

EPA and UDEQ briefed city, county, state legislative, and congressional officials as requested.

A public meeting regarding the Proposed Plan with EPA's and UDEQ's preferred alternative (No further action) was held on May 13, 1998, at West Jordan City Hall. A responsiveness summary to the comments received is provided in Section III.

D. SCOPE AND ROLE OF OPERABLE UNIT WITHIN SITE STRATEGY

The Kennecott South Zone Site, proposed for the National Priorities List, is composed of approximately 13 Operable Units which encompass geographical areas or media-specific issues. This Record of Decision covers 6 Operable Units (or portions thereof) within the Kennecott South Zone Site.

1. Bingham Creek (Operable Unit 1) includes surface soil contamination within the channel and flood plain of Bingham Creek;

2. Large Bingham Reservoir (Operable Unit 4) includes the Large Bingham Reservoir and Small Bingham Reservoir located at the mouth of Bingham Canyon;

3. Anaconda Tailings (Operable Unit 5) includes the surface and near surface contamination from an historic tailings impoundment of Utah Apex Mill, located upstream in Bingham Canyon and the Bastian Ditch;

4. Copperton Soils (Operable Unit 10) which includes surface soil contamination on the east side of the community of Copperton;

5. Bingham Canyon Historic Facilities (Operable Unit 11) which includes historic milling and smelting facilities located in Bingham Canyon; and

6. Bastian Sink (Operable Unit 17) includes the Bastian Sink which received tailwaters from the Anaconda Tailings Site.

Groundwater underneath these areas (Operable Unit 2) will be addressed in a separate action. Surface contamination, surface impoundments, and other waste piles at other geographical locations in the Kennecott South Zone have been addressed in separate actions, including, for example, Butterfield Canyon, Lark, and the South Jordan Evaporation Ponds.

Also not addressed in this Record of Decision are current mining facilities including, but not limited to, the Bingham Mine, the Bingham Mine Waste Rock Dumps (Eastside, Westside, Dry Forks, etc.), Copperton Precipitation Plant, Copperton Concentrator, and current truck and rail facilities.

The Denver and Rio Grande/Southern Pacific/Union Pacific railroad right of way between Midvale and Bingham Canyon is specifically excluded from this decision document. A separate action may be needed, particularly if this line is abandoned.

The former Proler facility located to the east of the Copperton Cemetery on the banks of Bingham Creek channel is also excluded from this decision document. A separate action may be needed at this site.

The selected remedy for the Bingham Creek and Canyon facilities (OUs 1, 4, 5, 10, 11, and 17 or portions thereof) of the overall Kennecott South Zone is "no further action" because the risks to human health and the environment have been eliminated through previous removal actions, land use/building permit controls, and/or the wastes are inaccessible and do not pose a risk to human health or the environment.

E. SITE CHARACTERISTICS

1. Known or suspected sources:

Bingham Creek originates in the Oquirrh Mountains where mineral resources were discovered in 1863. At first, the minerals were retrieved by digging underground shafts and tunnels. Later, open pit mining techniques were developed and used. The waste rock generated from the sinking of the tunnels or open pit excavations was disposed of near the portal or edge of each mine. Although some mining companies shipped their ores outside the canyon for further processing, others built mineral processing facilities near their mines. Wastes from the processing, mill tailings and smelter slag were disposed of into the creek itself where they were washed downstream. Wastes were also placed in piles or impoundments along the banks of the creek where they, too, were subject to erosion and redeposition downstream. Because of the small particle sizes, mill tailings were particularly prone to erosion and movement downstream.

a. Mills

The following table gives details about the mills which were known to have operated in Bingham Canyon or its tributaries:

HISTORIC MILLS IN BINGHAM CANYON

Name	Years of Operation	Processes Used	Ore Processed	Volume of Wastes produced*	Current Status
Lead Mine Mill	1882-1896	grinding, smelting	Pb/Au/Ag	46,667 tons	Buried by current Kennecott Precipitation Plant
Utah Copper Company Mill	1904-1910	grinding, gravity separation	Cu	1.4 million tons	Partially buried by waste rock
Winnamuck Mill	1877-1913	grinding, gravity separation, cyanide leaching	Pb/Au/Ag	122,500 tons	Buried by waste rock and rail lines
Markham Mill	1893-1917	Milling	Pb	76,000 tons	Buried by waste rock
Walls Mill	1874-1911	Grinding, gravity separation	Pb/Ag/Au	116,667 tons	Buried by waste rock
Shawmut Mill	1900-1902, 1906-1907	Grinding, gravity separation	Pb/Ag/Au	8333 tons	Buried by waste rock

Utah Apex Mill	1907-1939	Grinding, gravity separation, oil flotation	Pb/Zn	1.421 million tons	Subsumed by the pit
Rogers Mill	1891-1903	Grinding, gravity separation	Pb/Au/Ag/Cu	42,000 tons	Subsumed by the pit
Boston Consolidated Mill	1906-1910	Milling	Cu	49,739 tons	Subsumed by the pit
Stewart #2 Mill	1879-1893	Grinding, amalgam-ation, cyanide leaching	Au	41,667 tons	Subsumed by the pit
Highland Boy Mill	1895-1898	Grinding, cyanide leach	Cu/Au	20,900 tons	Buried by waste rock
Bingham New Haven	1909-1925	Grinding, flotation	Cu/Zn	45,000 tons	Buried by waste rock
Columbia Copper Mill	1901-1904	Grinding	Cu	ore capacity = 120 tons/day	Subsumed by the pit
Last Chance Mill	1882-1910	Milling	Pb/Zn/Ag	36,000 tons	Buried by waste rock
New England Gold and Copper Mill	1904-1913	Grinding, gravity separation	Ag/Au/Pb/Cu	ore capacity = 50 tons/day	Subsumed by the pit or buried by waste rock
Jordan Mill	1879-1900	Grinding, gravity separation, amalgam-ation, cyanide	Ag/Au/Pb	61,364 tons	Subsumed by the pit.
Stewart Mill	1878-1895	Grinding, amalgam-ation, cyanide	Pb/Zn/Au	68,571 tons	Subsumed by pit, or buried by dumps

Spanish Mill	1874-1901	Grinding, gravity separation, cyanide	Pb/Zn/Au/Ag	63,333 tons	Subsumed by the pit
Telegraph Mill	1876-1914	Grinding, cyanide	Pb/Au/Ag	91,200 tons	Subsumed by the pit
Bemis Mill	1898-1905	Grinding, gravity separation	Cu	ore capacity = 120 tons/day	Buried by the 6190 truck shops
West Mountain Mining Concentrator	1890-?				Buried by waste rock
Silver Shield Mill	1910-1913			ore capacity = 60 tons/day	Subsumed by the pit
Bingham Mining and Milling Co	1890-?			ore capacity = 100 tons/day	Subsumed by the pit or buried by waste rock
Utah Consolidated Gold Mine Mill	1897-1905	grinding, cyanide leach	Au/Ag/Cu	ore capacity = 100 tons/day	Buried by waste rock
Bingham Gold Mining Co	1895-1896	Cyanide leaching	Au		Subsumed by the pit
Utah concentrator	1874-1876	Milling	Pb/Au/Ag	600 tons	Subsumed by the pit
Heaston Concentrator Jigs	1896-1910	Milling	Pb/Au/Ag	4127 tons	Buried by waste rock
Massasoit Mill	1893-1911		Pb	ore capacity = 200 tons/day	Buried by waste rock
Utah Mill	1874-1876	Milling	Pb/Au/Ag	600 tons	Subsumed by the pit

Brooks Mill	1899 - 1900	Milling	Pb/Au/Ag	4167 tons	Subsumed by the pit
Durrant Mill	1877-1879	Grinding, Amalgam-ation	Pb/Au/Ag	4167 tons	Subsumed by the pit
Eagan and Bates Mill	1877-1879	Grinding	Pb/Ag/Au	16,667 tons	Subsumed by the pit
Bingham New England Mill	1905-1913	Milling	Pb/Ag/Au	48,000 tons	Subsumed by the pit or buried by waste rock
What Cheer Mill	1874-1875	Grinding	Pb		Subsumed by the pit
Murphy Mill	1874	Grinding, gravity separation			Subsumed by the pit
CW Watson Jig	1880	gravity separation	Au		Buried by waste rock
Darrenugue Jig	1906	gravity separation	Au/Cu		Mobile facility, Buried by waste rock
NY and Utah Mill	1878-1881	roast, leach	Au/Ag		Cleaned up during BC Phase II

* Kennecott estimates based tonnages of ore milled and/or mill capacity and years of operation

b. Smelters

The following smelters were known to have operated in or near Bingham Canyon: Utah Smelter, Winnamuck Smelter, Revere Smelter, and Yampa Smelter.

HISTORIC SMELTERS

Site Name	Years of Operation	Ore processed	Process used	Current status
Utah Smelter	1871-1873	Pb/Ag/Au capacity = 45 tons/day	smelting, blast furnaces	subsumed by the Bingham Pit
Winnamuck Smelter	1867-1870	Pb/Ag capacity = 30 tons/day	smelting, cupola and blast furnaces	Buried by waste rock
Revere Smelter	1880-1881	Ag/Pb	roasting and cyanide leaching	Cleaned up as part of the Bingham Creek Phase II action
Yampa Smelter	1903 - 1910	Cu capacity = 1000 tons/day	roasting, reverberatory and blast furnaces, converting	Buried by waste rock

c. Precipitation launders

Precipitation launders also operated in the canyon. Once it was discovered that copper in solution from mine wastes could be recovered by reaction with scrap iron, many devices were installed in the canyon to precipitate the copper. Most were built and operated during the period 1913 - 1925. Many of the precipitation plants obtained the iron needed from Hewletts Cannery in Salt Lake City and later from a source in California. There are some uncertainties as to the exact location of many of these sites in the Bingham Canyon area. In 1926, the total shipments for wet precipitation from all sources amounted to 3.79 million pounds and the gross copper content amounted to 1.989 million pounds.

Waters from acid mine drainage were treated to recover the copper and the spent waters were discharged into Bingham Creek. The treatment served only to remove copper, not other metals. Two secondary uranium recovery plants took minewaters previously stripped of their copper to recover uranium. These spent waters were also discharged to Bingham Creek.

PRECIPITATION LAUNDERS

Name	Years of Operation	Process	Product	Current Status
Boston Mine	1913 -?	Precipitation launder using scrap iron	Cu	location unknown
Apex Yard	1916 - ?	Precipitation launder using scrap iron	Cu	subsumed by pit
Ohio Copper Mine	1920s-1937	Precipitation launder using scrap iron	Cu	The launder was in the shaft of the mine, the discharge was sent to Mascotte Tunnel at Lark. The mine has been subsumed by the pit. (Mascotte Tunnel discharges are not addressed in this decision document.)
Ute Copper Tiewaukee Dump	1925-1927	Precipitation launder using scrap iron	Cu	Buried by waste rock
McGuires Gulch	1919-1927?	Precipitation launder using scrap iron	Cu	Buried by waste rock
Galena Gulch	1922 - 1927?	Precipitation launder using scrap iron	Cu	The upper portion of the gulch is buried by waste rock; the lower portion has been subsumed by the pit.

Copper Center Gulch	1921-1927?	Precipitation launder using scrap iron	Cu	Subsumed by the pit
Main Canyon	1922- 1929?	Precipitation launder using scrap iron	Cu	Location unknown
A Pit	1923 - 1929?	Precipitation launder using scrap iron	Cu	subsumed by the pit
Drain Tunnel	1923- 1929?	Precipitation launder using scrap iron	Cu	Location unknown
Ingersoll Gulch	1922 - 1929?	Precipitation launder using scrap iron	Cu	Subsumed by the pit
Starless	?	Precipitation launder using scrap iron	Cu	Subsumed by the pit
McGregor Plant	1933-1936	Precipitation cells using scrap iron	Cu	Buried by a later operation called Robbe Cells, area was cleaned up during Bingham Creek Phase II.
Robbe Cells	1936-1958	Precipitation cells using scrap iron	Cu	Cleaned up during Bingham Creek Phase II.
Winnamuck		Precipitation launder using scrap iron	Cu	Buried by waste rock
Copper Placer	1892 - ?	Treated waters from the Starless Mine	Cu	Subsumed by Bingham Pit

Cuprum Yard	1927-?	Precipitation plant using scrap iron	Cu	One portion has been subsumed by the pit; the other portion is buried by waste rock
Verona Uranium Mill	1969-1973	Ion exchange, solvent extraction	Uranium oxide	Plant decommissioned in 1983, site now mostly buried by waste rock
Yellow Cake Plant	1960s - 1989	Ion exchange	Uranium oxide	cleaned up in 1995

d. Minor sources

The pattern of distribution indicates that mining wastes from these upstream sources were the prime contributors of lead and arsenic to the channel and floodplain of Bingham Creek. Minor airborne sources could contribute small amounts of these metals, including use of lead arsenate pesticides, fallout from use of leaded fuels, and fallout from smelters not located in Bingham Canyon.

e. Sources specific to Anaconda Tailings

The sources of the contamination at Anaconda Tailings, the Bastian Ditch and the Bastian Sink are the Utah Apex Mill, the Bingham-New Haven Mill , their successors and other mills upstream of the Utah Apex Mill's flume. The Anaconda Tailings was formerly a tailings impoundment designed to contain the tailings from the Utah Apex and Bingham-New Haven Mills and coincidentally also the tailings of all of the mills upstream of the Utah Apex Mill's flume. After passing through the impoundment, waters from the mills were discharged back to Bingham Creek, or diverted via the Bastian Ditch southward for irrigation use purposes. Historic records suggest that the tailwaters, even after passing through the impoundment settling basins were still contaminated with tailings. The Bastian Sink, a topographic low near Bingham Creek, was apparently used as a catchment basin for tailwater overflows.

2. Groundwater:

The lead and arsenic present in tailings deposited downstream from Bingham Canyon is generally not very leachable. Although the principal aquifer underneath this area is contaminated with sulfates, acid, and metals, the source of the groundwater contamination is related to leakages of acid leachates produced by oxidation of metallic sulfides. Metal sulfides are still present at depth in the Anaconda Tailings. For this reason, the Anaconda Tailings were capped with HDPE, clay and soils to prevent water and oxygen from penetrating into the sulfides. Without water and oxygen, the production of acid leachates is prevented and the wastes do not mobilize to groundwater.

The contaminants of concern and principal threats at the Large Bingham Reservoir include lead and arsenic, but also highly acidic waters and a variety of other metals. The acidic waters were produced through oxidation of pyritic minerals in waste rock dumps. In later years, Kennecott collected most of the waters for copper recovery. Excess waters were stored in the Large Bingham Reservoir. These waters leaked through the sides of the Large Bingham Reservoir into the groundwater producing an acidic plume of groundwater elevated in acid, sulfates and metals. The original reservoir was taken out of service in 1991 and replaced with a lined facility.

The groundwater contamination is being addressed in a separate action.

3. Contaminants of concern

The contaminants of concern and principal threats at Bingham Creek, Anaconda Tailings, Bastian Sink, Copperton Soils, and Bingham Canyon were lead and arsenic, both of which are components of mill tailings and smelter emissions. The majority of contamination was in the form of various metallic salts found in soils at varying depths along the Bingham Creek drainage as it departs Kennecott property and travels east to the Jordan River that courses north to the Great Salt Lake. These metals have been detected in groundwater along with acid and sulfate, and surface water and plants have also been shown to contain lesser amounts of the metal contaminants. The metals were present in soils at potentially toxic concentrations, were mobile in the surface soils from mostly surface water erosion, but also from minor airborne transport, and posed both non-cancer and cancer risks. The risk-driver was soil-lead, which primarily poses adverse risks to normal neurologic development in young children when over-exposure occurs. Lead and arsenic also have some (quite uncertain) carcinogenic potential, but the risks of these adverse cancer effects are relatively low and would be addressed (to less than 10E-4 to 10E-6) by the remediation of the relatively greater neurologic risks posed by excess exposures to soil-lead; this confidence is due to repeated findings of statistically significant correlations of arsenic levels with lead levels, where arsenic was present at about 4% the level of lead in soils.

4. Volumes and concentrations of contaminants, extent of contamination.

Specific details about the site characteristics for each area are given below:

AREA	ACTION	LAND USE	ACTION LEVEL	DEPTH OF EXCAVATION
Bingham Creek Phase I (OU 1) (Residential soils)	Removal of contaminated surface soils	residential	2500 ppm Pb in soils (interim)	Maximum 12 - 18 inches, tapering upward near trees or buildings
Bingham Creek Phase 2 (OU1) (Channel)	Removal or capping of contaminated soils, sediments, tailings	recreational, open space, industrial, residential	2000 ppm Pb in soils (final)	Maximum 3 feet required. Actual depths sometimes exceeded 20 feet
Bingham Creek Phase 3 (OU1) (Residential soils)	Removal of contaminated surface soils	residential	1100 ppm in soils (final)	Maximum 18 inches.
Lower Bingham Creek (OU1)	no action taken	Current land use is industrial and agricultural. Future land use is the same, also recreational and open space.	No action level	No excavation
Large Bingham Reservoir (OU4)	Removal of contaminated sludges, tailings, and subsoil, new reservoir constructed with triple lining with leak detection	Industrial/mining	no action level, 1000 ppm lead was used as guide	20-30 feet excavated
Anaconda Tailings (OU5)	Consolidation of tailings into a capped repository	Industrial	2000 ppm Pb in tailings	Height of tailings in the repository was 40 feet.

Bastian Ditch (OU5)	Removal of contaminated ditch sediments	Industrial/open space	2000 ppm Pb in sediments	Maximum 3 feet
Copperton Soils (OU 10)	No action taken	Residential	No action level, 1100 ppm lead used as guide	No excavation needed, highest lead value was less than 300 ppm
Historic Bingham Canyon Facilities (OU 11, portions)	No action taken	Industrial/mining	No action level	No excavation, historic sites are largely inaccessible.
Bastian Sink (OU 17)	No action taken	Current land use is agricultural. Future land use is agricultural, open space, recreation or municipal waste disposal	No action level	No excavation

For those areas which required cleanup, site characteristics of the areas prior to the cleanup are summarized below:

AREA	Contaminated area	Volumes removed or addressed	Maximum Pb	Maximum As
Bingham Creek Phase 1 (OU1)	52 residences	74,000 cy	17,000 ppm	
Bingham Creek Phase 2 (OU1)	9 linear miles of creek channel	1,048,000 cy	41,600 ppm	630 ppm
Bingham Creek Phase 3 (OU1)	84 residences	100,000 cy	16,000 ppm	
Large Bingham Reservoir (OU4)	80 acres	2,660,000 cy	3,150 ppm	471 ppm

Anaconda Tails (OU5)	96 acres	~1,530,000 cy	31,800 ppm	2,230 ppm
Bastian Ditch (Kennecott) (OU5)	1/4 linear mile	5,850 cy	28,000 ppm	1,100 ppm
Bastian Ditch (ARCO) (OU5)	1 linear mile	39,000 cy	20,307 ppm	

Site characteristics of the areas where no action was needed are given below:

AREA	Contaminated area	Approximate volume	Lead distribution	Land Use
Lower Bingham Creek (portion of OU1)	~23 acres	36,600 cy	Surface: 34% above 2000 ppm lead median - 1400 ppm average - 1801 ppm	agricultural and industrial
Copperton Soils (OU 10)	none	none	All lead values were lower than 253 ppm lead, significantly lower than the Bingham Creek final action level of 1100 ppm lead	residential
Historic Bingham Canyon facilities (OU11)	original locations spread over an 11,000 acre area	Original production records indicate in excess of 3,814,000 tons	unknown - original wastes are inaccessible for study	industrial/mining

Bastian Sink (OU 17)	~30 acres	48,400 cy	Surface: 22% above 2000 ppm median = 897 ppm average = 1347 ppm Depth = 1 foot or less	agricultural

5. Migration pathways.

At mills, the ore is crushed and ground into small particle sizes and the economic minerals are separated out via flotation, leaching, or gravity separation. The non-economic particles are typically slurried to the nearest water body or tailings pond. The particle sizes are of a range easily transported by water. The tailings were washed downstream and then were deposited in the floodplain downstream as the waters receded. At some locations, the layer of tailings was thin; in other locations near the channel, the tailings could be 20 feet thick. Agricultural practices along the creek mixed the tailings into the soils. Residential neighborhoods were built on the Bingham Creek floodplain. Because of the small size of the tailings particles, resuspension and remobilization during flood events or rainstorms was a distinct possibility. Although the upper portions of the creek passes through industrial and agricultural land, the channel in these areas was cleaned up also because of the possibility that these wastes could move into downstream neighborhoods.

F. SUMMARY OF SITE RISKS

1. Data and Studies used for estimating risk.

Parties involved with this site generated some of the most comprehensive, efficient, and cost-beneficial data associated with a Superfund risk evaluation. Risk managers recognized the value of early and focused involvement of stakeholders and risk assessors, and initial working committees were established that proved quite successful: (1) the Risk Assessment Task Force; and (2) the Ecological Technical Assistance Group. Members had relevant scientific expertise, avoided excessive legal and policy biases, and fully represented science issues for the involved parties. Local, regional, and national experts participated in these committees.

The Risk Assessment Task Force recommended that the following studies and data collection be performed to be used in EPA decisions at these sites:
(1) nature and extent of contamination; (2) fate and transport of the contaminants from their source areas to where they were ultimately found; (3) geochemical speciation of the metal salts; (4) determination of the bioavailability of lead and arsenic using the juvenile

swine model; (5) garden vegetable uptake of co-located metals (both greenhouse and in-situ studies were performed); (6) an extensive blood lead and urine arsenic study of exposed, potentially exposed, and background children living in the area along with appropriate statistics; (7) a study of the soil/household dust relationship in the area; (8) statistics involving exposure frequency and duration at the site; and (9) a comparison of several model predictions with actual distributions.

The IEUBK (Integrated Exposure Uptake Biokinetic) Model was used with the site specific data to develop a PRG (Preliminary Remediation Goal) of 1100 - 1300 ppm lead in soil. The model predicted that this concentration range of lead in soil would yield <5% of exposed children with 10 ug/dL or greater blood lead levels. EPA's risk management goal dictates that cleanups should result in <5% of exposed children with blood lead exceeding 10 ug/dL. The exact concentration of lead in soils and/or dust at any site will vary depending on site specific conditions. In the case of Bingham Creek, the soils contained lead species such as lead phosphates which were less bioavailable in the juvenile swine studies than assumed by the default value in the model. RMEs (Reasonable Maximum Exposures) and Central Tendency Analyses were used in the model calculations. Model results also revealed that the major exposure pathway for young children at the site was soil ingestion, largely resulting from mouthing behavior. Lead was not detectable in the municipal water supply and ingestion of lead from homegrown vegetables was also a minor pathway. For more detail, refer to the Bingham Creek Phase III Endangerment Assessment.

The PRG range of 1100 ppm - 1300 ppm of lead in soils was presented to a delegation of Bingham Creek residents. The reasons for the uncertainties were explained (bioavailability uncertainty, soil/dust variability, etc.). The residents preferred the more conservative value given the uncertainty. Residents were also asked if action levels for different land uses should be developed. They indicated that all of the land be considered residential since the vacant and industrial lands were surrounded by residential property. They did not want the residential character of their neighborhoods to change.

The results of these studies, models, and public input were used to set a final action level of 1100 ppm lead in soils for residential land use. Vacant lands within the residential neighborhoods were considered to be residential. Vacant lands outside the residential area were evaluated on the basis of their current and future land use. The 2000 ppm lead level previously used in the removals at open space, recreational, and industrial lands at this site was considered to be sufficiently protective for these land uses. A preliminary calculation performed recently with newer information and models confirms that this level is protective for these land uses.

Arsenic was also identified as a contaminant of concern at these sites. EPA discovered that there was a strong relationship between the lead concentrations and the arsenic concentrations in the soils with arsenic levels about 4% of the lead concentrations.

A few urine arsenic samples from the juvenile swine study (used primarily for lead bioavailability) provided an estimate of arsenic bioavailability. Based on this and other site specific conditions, a PRG (Preliminary Remediation Goal) of 100 ppm arsenic was calculated. Again, the acceptable risk range for potential carcinogens in the National Contingency Plan is 10E-4 to 10E-6. The action level set for arsenic at the Bingham Creek residential sites was 100 ppm arsenic which is below the 10E-4 risk level. The actual cleanup achieved levels significantly lower than this because the risk driver was lead. Note that 4% of the lead action level of 1100 ppm Pb is 44 ppm arsenic. Other contaminants (e.g. cadmium) were present at low levels below any risk-based concentrations in soils.

2. Environmental Evaluation

The majority of this site had land uses that provided relatively little habitat for wildlife where meaningful contact with hazardous contaminants would occur. Thus, a qualitative ecological risk evaluation was performed by the EPA Region VIII site toxicologist in the Phase III Endangerment Assessment. Because the Bingham Creek Phase I and Phase III areas and land-use were largely residential with limited opportunities for exposure to wildlife, there were no specific sampling or monitoring on ecological receptors. Kennecott did conduct a site-wide ecological risk assessment for those areas of the larger Kennecott South Zone and North Zone which had substantial wildlife habitat. Although those studies included both phytotoxicity and uptake estimations, the information is not relevant to the portion of the site included in this decision document. Although wildlife occasionally visit the area, the land is not primarily wildlife habitat. The area is located in suburban cities near Salt Lake City. Bingham Creek is normally dry except following storm events. The creek serves mainly as a drainage ditch and does not support aquatic life. Aquatic impacts in the Jordan River are possible following storm events or floods. The Jordan River is not covered in this decision document and impacts there were not evaluated. Thus, EPA concludes that there are no actual or threatened releases from these OUs that pose a present or potential future threat to the environment within the coverage of this document.

3. Rationale for the no action decision

The no action decision for the OUs covered in this decision document is based on four considerations: (1) at some OUs, the removal actions were designed to achieve final remedial cleanup goals; (2) at one OU, initial studies revealed that the concentrations of contaminants were not high enough to pose a risk to health; (3) in several locations, the land use was not residential currently or anticipated to be residential and there is little exposure; or (4) at one OU, the waste locations were not accessible to the public or workers.

There were three OUs at which removal actions were designed to accomplish both short term and long term remediation goals. This was done primarily to avoid the need for remobilization and thus reduce costs. At Bingham Creek (OU 1), before initiation of the last removal action, there were extensive risk assessment and risk management activities to determine a final action level of 1100 ppm lead. The work included excavation of contaminated soils down to a maximum of 18 inches, replacement with clean soils, and revegetation. The purpose of this action was to break the exposure pathway to young children playing in their yards. The affected cities agreed voluntarily to use their land use and building permit authorities to prevent disturbance of any underlying contamination. In addition, contamination remaining in Bingham Creek channel itself was removed down to a depth of at least 3 feet, with remaining material capped under clean fill. This was done not only to protect occasional visitors from direct contact with the wastes, but also prevent downstream migration of the materials into residential neighborhoods during storm conditions. A major goal of this project was to prevent any possible recontamination of residential soils in the watershed. A final action level of 2000 ppm lead was based on a recreational and open space land use. At Large Bingham Reservoir (OU4), all contaminated sludges, tailings, and underlying soils were removed from the site. The reservoir was then reconstructed using a triple lining system with leak detection. In addition to the leak detection system, downgradient monitoring wells were also installed. The continued integrity of the reservoir is covered under a state groundwater permit which requires any leaks to be repaired. The primary goal of this project was to prevent any future contamination of groundwater associated with this reservoir. At Anaconda Tailings (ARCO Copperton Tailings, OU5), the tailings ponds were capped with clay, geotextile liners, and soil to prevent infiltration of meteoric water into the tailings. In addition the exterior of the capped repository was armored with rip rap, with runoff and run on controls. The design of this remedy was to prevent any direct contact with the waste by visitors, workers, and wildlife, to prevent any future migration of contaminants to groundwater and to prevent any off-site migration associated with a 100-year storm event. Maintenance of the facility is provided by the property owner, and Salt Lake County is using its land use and building controls authorities to prevent disturbance of the repository. At these areas, no further action is needed because the exposure pathways and potential future exposure pathways have been virtually eliminated.

At one operable unit, Copperton Soils (OU 10), a residential area, studies revealed that the concentrations of contaminants were not sufficiently elevated to pose a risk to children. The highest lead contamination found in soils at this site was 253 ppm lead, well beneath any level of concern.

At two locations, Lower Bingham Creek (a small portion of OU 1), and Bastian Sink (OU 17), the land use is agricultural. For several reasons (unrelated to contamination) these two areas are not attractive for future residential development. No action was needed at these locations because exposure is very low and limited to episodic visits by adults. In addition, average lead values for these areas are beneath 2000 ppm lead, the action level used for recreation and open space areas of the Bingham Creek channel.

At one OU, Bingham Canyon Historic Facilities (OU 11), most of the facilities are inaccessible to workers and visitors. This is in an area of active mining operations and the older historic facilities have either been mined away by the open pit or have been buried by waste rock from the newer mining activities. If wastes still exist in these locations, they are not accessible and there are no exposure pathways. Where wastes remain at concentrations of concern, they were specifically excluded from this no action decision document.

4. Previous actions taken at the site to reduce unacceptable risks.

Previous response actions were taken in order to reduce or eliminate risks at the site. No action was taken at certain areas where there was little risk, based on present and future anticipated land use. The objectives of the response actions are described below:

AREA	NATURE OF RESPONSE	RATIONALE
Bingham Creek Phase 1 (OU1)	1. Removal of surface soils in Bingham Creek residential areas and neighborhood parks with lead exceeding 2500 ppm down to a maximum depth of 18 inches. This was an interim emergency response.	1. A. Prevent exposures of children to unacceptable levels of lead via inadvertent ingestion of soils by children sticking dirty toys or hands into their mouths. Note: this interim action was taken to remove the most contaminated soils while scientific studies were launched to determine the final action level. B. Prevent exposure of children and adults to lead via ingestion of homegrown produce grown in contaminated soils.
	2. Aid the city in development of special conditions for building in this area and provide the city with details of waste locations.	2. Prevent recontamination of surface soils during construction of new buildings at the site.

Bingham Creek Phase 2 (OU1)	1. Removal of surface soils in Bingham Creek channel with lead exceeding 2000 ppm down to a depth of 3 feet. This was an emergency response, but also designed to be a final action. 2. Erosion controls added to protect the remedy. 3. Aid city in the development of building permit conditions and provide details of waste locations.	1. A. Prevent exposures of children to unacceptable levels of lead via inadvertent ingestion of soils due to children putting dirty hands or toys into their mouths. This area has some recreational use by people in nearby residential neighborhoods. B. Prevent mobilization of contaminated soils into downstream neighborhoods during storm events. 2. Protect the cap from erosion during storm events. 3. Prevent exposures due to additional development along the channel.
Bingham Creek Phase 3 (OU1)	1. Removal of surface soils in Bingham Creek residential areas and neighborhood parks with lead exceeding 1100 ppm down to a maximum depth of 18 inches. This was a final response. All properties originally slated for Bingham Creek Phase 1 but not remediated due to access refusal were also remediated. There were no access refusals during this final phase. 2. Aid city in the development of special conditions for building in this area to the city and provide details of waste locations	1. A. Prevent exposures of children to unacceptable levels of lead via inadvertent ingestion of soils by children sticking dirty toys or hands into their mouths. B. Prevent exposure of children and adults to lead via ingestion of homegrown produce grown in contaminated soils. 2. Prevent recontamination of surface soils during construction of new buildings at the site.

Lower Bingham Creek (portion of OU 1)	No action taken. Data on waste locations were provided to the city for possible use in redevelopment planning for the area.	The location is in the Jordan River floodplain and is currently agricultural and industrial. This is a Brownfields Site. There is no current risk due to the land use. The city is developing a master plan for this area to ensure that any future development does not increase exposure to the waste.
Large Bingham Reservoir (OU4)	Water drained from reservoir and sludges, tailings, and contaminated subsoils were removed. A new facility was built using a triple lined system (clay and two HDPE liners with a leak detection between the two HDPE layers). On-going monitoring of leaks is required under provisions of a state groundwater permit.	This action was taken to eliminate a source of groundwater contamination and to prevent a recurrence of leaks to groundwater.
Anaconda Tailings (OU5)	1. Tailings were consolidated into one area of the site and capped with HDPE, clay, and soil. The action level was 2000 ppm lead. 2. Rip-rap protects the upgradient sides of the cap. 3. Run-on and run-off controls were installed surrounding the cap.	1. A. Capping of the waste prevents direct exposure of the wastes to humans and wildlife thus minimizing risk. B. Capping of the waste with impervious liners prevents groundwater contamination and potential health impacts to downgradient well owners. 2. Reduces the potential for migration of the waste downstream during flood events. 3. Protects the cap from erosion during rain events.

Bastian Ditch (portion of OU5)	1. All of the tailings were removed from the ditch on ARCO property and on Kennecott property downgradient to the Randolph Peterson Gate. The action level was 2000 ppm (industrial land use)	1. A. Prevent direct exposure of the wastes to humans and wildlife. B. Prevents recontamination of previously cleaned up sites downgradient of the ditch.
Copperton Soils (OU 10)	No action taken	Although historic tailings were located toward the east side of Copperton, no action was needed because the concentrations of lead were well beneath any health concern.
Historic Bingham Canyon Facilities (OU 11) (except those specifically excluded from this decision)	No action taken	Wastes remaining in Bingham Canyon by historic facilities are no longer accessible, and present no risk to human health or the environment. The wastes are either subsumed by the pit (mined away), buried by the current Kennecott waste rock dumps, or buried by current Kennecott support facilities. The migration potential for wastes at these sites is low. Note: the total wastes produced at these historic facilities is on the order of 3.8 million tons. The current waste rock dump which buries these sites is about 3.5 billion tons. Wastes from historic sites, if buried, represent 0.1% of the total waste at the site.

Bastian Sink (OU 17)	No action was taken. The data will be provided to the owners and the county for use if the land use changes in the future.	There is no current risk at the site because the land use is agricultural. Ideas for future land use include continued agricultural use, expansion of the nearby Trans Jordan Landfill, industrial use and open space. There are no plans to use this area for residential purposes due to its location near waste storage and disposal facilities. Special conditions on building permits will prevent exposures if the land use should change in the future. Unlike Bingham Creek, the migration potential is low.

5. Five Year Review Issues:

Several of the areas covered in this Record of Decision are subject to the 5-year review process because there are wastes left in place. The issues for consideration are as follows:

AREA	5-YEAR REVIEW ISSUES
Bingham Creek (OU1)	Wastes are left on a few properties. The wastes exist underneath a soil cap. Construction activities on these properties with wastes may require special conditions in building permits administered by the cities. Is this concept continuing to work? Have residents installed gardens in inappropriate locations? Are further institutional controls needed for this? Are erosion controls in the creek channel working? Has land use changed in lower Bingham Creek?
Anaconda Tailings (OU5)	Wastes are left in place underneath a cap composed of HDPE, clay and soil and are protected by runoff and run-on controls. This property is not suitable for development. Does the cap remain protective?
Bastian Ditch (portion of OU5)	Most of the wastes have been removed to repositories. The only wastes remaining are under State Hwy 111 under road base and asphalt. Do these conditions still remain?

Bastian Sink (OU17)	Wastes exist at the surface on about 30 acres of the 145 acres surveyed; most of the wastes are confined to the top foot. Current land use is agricultural. Special conditions in building permits administered by the county are required for any change in land use. Has the land use changed? Is it compatible with the pattern of existing contamination?

G. DESCRIPTION OF NO ACTION ALTERNATIVE

EPA has determined that no further action is required at these operable units. For Bingham Creek, Anaconda Tailings, Bastian Ditch and Large Bingham Reservoir, previous response actions have eliminated the risks at these sites. For Bastian Sink, Copperton Soils, Lower Bingham Creek and portions of Bingham Canyon Historic Facilities, no action is appropriate due to lack of risk associated with current land uses.

H. EXPLANATION OF SIGNIFICANT CHANGES

The selected remedy documented in this Record of Decision is the same as the preferred alternative presented in the Proposed Plan. There were no significant changes.

III. RESPONSIVENESS SUMMARY

INTRODUCTION:

The Proposed Plan explaining EPA's and UDEQ's preferred remedy for these portions of the Kennecott South Zone was mailed to affected residents, public officials and media on May 1, 1998. An advertisement concerning the public meeting and the public comment period was carried by the Salt Lake Tribune and Deseret News on May 6, 1998. The public meeting was held on May 13, 1998, at West Jordan City Hall. Comments on EPA's and UDEQ's Proposed Plan could be given orally at the public meeting or by writing to EPA. The public comment period started on May 5, 1998, and closed on June 5, 1998.

ORAL COMMENTS DURING THE PUBLIC MEETING:

The public meeting agenda had four parts: (1) Introductions of EPA, BOR, UDEQ, City of West Jordan, and Kennecott staff; (2) slide show and summary of cleanup activities and the proposed alternative; (3) questions from the audience; and (4) the formal receipt of oral comments.

There were no oral comments made during the formal comment section of the public meeting.

WRITTEN COMMENTS SUBMITTED TO EPA:

One written comment was received by EPA during the public comment period.

COMMENTER: James L. Warlaumont, Esq.
Appel and Warlaumont
1100 Boston Building
9 Exchange Place
Salt Lake City, UT 84111

(Attorney for four families in Abeyta, et al. vs. ARCO, et al. Civil Case #960901485CV)

DATE: June 5, 1998, received by EPA June 8, 1998

Mr. Warlaumont submitted some sampling data associated with JV-8 (3065 W 8600 S, West Jordan), JV-10 (Candido Abeyta's former property, address not given), and JV-14 (2947 W 8600 S, West Jordan).

He pointed out that the results indicate that "there are still many areas on these properties where concentrations of minerals exceed the levels described on page 7 of the flyer [Proposed Plan]." Page 7 refers to a final cleanup level of 1100 mg/kg lead in soil.

He requested that this information "be considered as part of the final remedy selection process".

EPA RESPONSE:

The goal of the Bingham Creek residential Soil cleanup activities was to prevent the exposure of residents and their children to unsafe amounts of lead and arsenic. EPA focused on the top 6 inches of residential yards as the area where people were most likely to be exposed to the contaminants in the soil. In designated garden areas, EPA focused on the top 18 inches to allow for tilling of the soil. The specific goal of this cleanup was to bring the average concentration within each exposure unit to beneath the action level of 1100 ppm lead in the surface soils. The use of averages allowed EPA and the individual property owners some flexibility in the design of the cleanup protocol for each property.

A complete removal of surface contamination requires removal of all trees, shrubs, flowerbeds, fences and structures. Because the objective was to achieve the average concentration within the yard, the homeowner could choose to save trees, shrubbery, decorative walls, and other structures. EPA prepared detailed design drawings of the yards which depicted all structures, tress, gardens, etc., in the yard. No construction work was begun on any property until the homeowner and EPA agreed on which plants and structures would be saved and which would be replaced. The drawings were altered to reflect these decision. The final designs were approved in writing by each homeowner prior to implementation of the work.

In order to save the plants and structures designated by the homeowners, EPA often had to use hand tools to carefully remove contaminated soils from around these items. However, it was not possible to remove all the contamination without risking either killing the plants or undermining the retained structures. Therefore, it was anticipated that some higher levels of contamination would exist around those plants and structures although the average soil concentration in the total yard would be at safe levels.

The new sampling data submitted to EPA indicates several spots where the concentrations exceeded EPA's action level. This is not necessarily inconsistent with the cleanup objectives if these samples were collected in the areas where the homeowners requested that the trees or walls be saved. The maps showing sampling locations submitted along with the Commenter's data did not show the location of these trees or walls. Therefore, EPA requested additional information from the Commenter concerning the exact location of the samples relative to these plants and/or structures. On July 24, 1998, the Commenter answered that the locations of these structures or plants relative to the sampling locations were not available.

The scale of the property maps and sampling locations submitted by the Commenter did not permit a precise comparison of EPA's design drawings to these maps, but some rough approximations could be made. EPA then evaluated the data submitted to determine whether these results were consistent with (1) the goal of the removal action and (2) the specific individual designs.

The goal of the removal action was to cut off the exposure route to the residents. While EPA removed up to 18 inches in some locations, only 6 inches is needed to cut off the exposure route, particularly in sodded lawn areas. The Commenter's data containing sampling results from 0-6 inches, 6-12 inches, 12-18 inches, and 18-24 inches. In presenting the statistics for these data, the Commenter then presented tables in which the results from all depths were used. When this technique is used, all of the yards had lead values in excess of EPA's final action level of 1100 ppm lead. However, EPA did not address any soils at the 18-24 inch depth and in some yards did not address soils beneath 12 inches. When the Commenter's data from the crucial top 6 inches alone are averaged, the story is different. In the top 6 inches, JV-8 contained an average of 761 ppm lead; JV-10 contained an average of 49 ppm lead; and JV-14 contained an average of 1557 ppm lead. Only in the yard of JV-14 did the top 6 inches of soil apparently average above the 1100 final action level. This assumes that representative sampling was conducted by the Commenter. Further examination of the sampling map of JV-14 revealed that many of the commenter's samples appeared to have been collected at or near plants or structures retained at the owner's request. When these samples were deleted from the data set, the average lead level at JV-14 dropped to 201 ppm lead.

In a more detailed examination, of the 10 sample locations at JV-8, two yielded samples above action levels at the surface. Both of these two locations were near or at plants and structures retained at the owner's request. Of the 8 sample locations at JV-10, none of the samples exceeded action levels at the surface. Of the 10 sample locations at JV-14, five yielded samples above the action levels at the surface. All five of these locations were near or at plants and structures retained at the owner's request. EPA concludes that the overall goal of the removal action to prevent exposure of the residents to unsafe levels of lead was achieved.

Next, EPA examined the Commenter's data to see if the results were consistent with the original designs for these properties. In general, the original design for these properties called for removal of the top 12 inches and replacement with clean soils. For JV-8, of the 10 samples, five contained lead levels above the action level. Two of the five were near plants retained at the owner's request; the other three were underneath gravel and road base. These results are consistent with the design. For JV-10, of the 8 samples, five contained lead levels above the action level. Of these five, one was near a plant retained at the owner's request; one was underneath a gravel driveway; and two were close to or underneath the owner's house. One sample was located, according to the Commenter's map, in a garden area. This garden is not shown at all on the original detailed design drawings and must have been installed by the property owner following the removal action. Furthermore, the original design drawing shows a third shed located on JV-10, and the current drawing from the commenter shows that the shallow samples were collected in the vicinity of the shed that is no longer present. Also, soil from the crawl space on JV-10 was removed to allow placement of a thin concrete cover (shot-crete). It is EPA's understanding from the discussions with the original owner, that the owner removed some of the concrete cover that EPA installed in the crawl space. For JV-14, of the 10 samples, nine contained lead levels above the action level in the top 12 inches. Of these nine samples, seven were collected at or near plants retained at the owner's request; and the other two were near structures also retained at the owner's request.

EPA concludes that the sampling data submitted by the Commenter are consistent with the original designs for these properties. It is clear that the garden at JV-10 was installed sometime after the removal action was done because it is not shown on the original design. Because EPA anticipated that in garden areas, the residents might till the ground, EPA excavated these areas down to 18 inches and took care to note these areas on the design drawings. The situation is complicated by the fact that property ownership has changed since the original remediation and that a structure appears to have been removed and may have exposed some soil that could not be accessed during the removal action. It is not clear whether the old property owner installed the garden with full knowledge or new property owner installed the garden without this knowledge. An attempt was made to clarify this situation by a visit to this property. No garden area could be found. No action was taken.

Although these types of situations are inevitable, it is EPA's view that any disturbance of the remedy is the ultimate responsibility of the homeowner. It may be necessary for a homeowner to dig through the clean fill and bring up contaminated soils; however, it is also the responsibility of the owner to replace the lead contaminated soil and clean cover or remove the newly exposed contaminated soil to the locally permitted solid waste landfill. It is also the owners' responsibility to inform any new owner that contamination does exist underneath the fill. In this case, the homeowner should contact EPA or UDEQ to ascertain what he can do to protect his family from the contamination caused by the disturbance of the remedy. In this case, the contamination is beneath 6 inches, but root vegetables may penetrate into the contaminated zone and require washing before ingestion.

EPA is making one addition in the decision document based on this comment. EPA will recommend that during the 5 year review EPA determine if installation of gardens in inappropriate places is a common occurrence and worthy of development of additional institutional controls.