ADMINISTRATIVE RECORD

ORIGINAL
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RECORD OF DECISION

MILL CREEK, MONTANA

ANACONDA SMELTER SUPERFUND SITE

FIRST OPERABLE UNIT

ROD Revisions
Roll out D.W. ARARs for

VOLUME I

OCTOBER 1987

EPA

RECORD OF DECISION

MILL CREEK, MONTANA

ANACONDA SMELTER SUPERFUND SITE

FIRST OPERABLE UNIT

OCTOBER 1987

Prepared by:
U.S. EPA
Region VIII
Montana Office

EPA

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STATEMENT OF PURPOSE

The purpose of this record of decision (ROD) is to select a remedial action for the community of Hill Creek, Montana. Hill Creek, Montana is an operable unit of the Anaconda Smelter National Priorities List (NPL) site. The Anaconda Smelter Site was placed on the NPL in September 1983. Hill Creek is located in southern Deerlodge County, southwestern Montana, approximately 25 miles west-northwest of Butte, Montana, 1.5 miles east of Anaconda, Montana and is immediately adjacent to the Anaconda Smelter.

Environmental and biologic testing show that the community of Hill Creek, Montana is the most contaminated inhabited area around the Anaconda Smelter NPL site. Hill Creek residents are constantly exposed to several media contaminated by arsenic, cadmium, and lead. Consequently, human health concerns in Hill Creek are EPA's highest priority for the Anaconda Smelter site. EPA has concluded that the contamination in the Hill Creek area poses an imminent and substantial endangerment to the health of individuals residing there. Exposure of children to ingestible forms of arsenic dust and cadmium, soil, and water in the Hill Creek community would likely result in elevated cancer risks. Exposure to cadmium and lead in soil and dust also can lead to adverse toxic affects on human health. The primary purpose of the selected remedy for Hill Creek is to provide adequate permanent protection for the health of current residents in Hill Creek, Montana and interim protection of future short-term visitors in the area. This record of decision document describes the selected first operable unit, interim remedial action for this site of permanent relocation with temporary site stabilization. This remedy was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of

1986 (SARA), and the National Contingency Plan. The State of Montana and the Federal Emergency Management Agency (FEMA) have concurred on the selected remedy of permanent relocation of Hill Creek residents with temporary site stabilization.

STATEMENT OF BASIS

This decision is based upon the administrative record which has been compiled for the Hill Creek Operable Unit, including the following documents:

- Final Remedial Investigation Report, Hill Creek Operable Unit, Anaconda Smelter Site, September 1987. Prepared by the Atlantic Richfield Company for U.S. EPA, Region 8.
- Final Feasibility Study Report, Hill Creek Operable Unit, Anaconda Smelter Site, September 1987. Prepared by the Atlantic Richfield Company for U.S. EPA, Region 8.
- Final Revised Endangerment Assessment: Hill Creek, Montana (Anaconda Smelter Site) September 1987. Prepared by Clement Associates, Inc. for U.S. EPA, Region 8.
- Summary of Remedial Alternatives Selection (attached hereto).
- Responsiveness Summary (attached hereto).
- Other reports, documents, correspondence, etc. included in the Administrative Record (see attached index).

DESCRIPTION OF SELECTED REMEDY

The remedy for Hill Creek, Montana selected by EPA is the interim first operable unit remedy of permanent relocation of all Hill Creek residents. Following relocation of all residents, the area will be temporarily stabilized. The contaminated soils in Hill Creek will be addressed as part of the remedy for the Anaconda Smelter NPL site. The contaminated debris from the relocation or demolition activities will be consolidated and temporarily stored with similar debris on Smelter Hill. Final disposition of these materials will be addressed as part of the final remedy for the Anaconda Smelter NPL site. Areas disturbed by the relocation/demolition

activities will be regraded and revegetated. Operation and maintenance requirements for the selected alternative will include monitoring and maintenance of the vegetative cover used to stabilize disturbed areas and installation and maintenance of a fence around the perimeter of the site. Short term institutional controls to control access and land use will also be implemented.

The selected interim remedy provides adequate protection of the health of current residents of Hill Creek. This alternative is the most cost effective alternative considered and would result in the lowest estimate of excess risk to public health. This remedy is also environmentally preferable to all other remedies and is necessary because of the potential for recontamination of the Hill Creek area from wind blown dust from surrounding areas contaminated with arsenic cadmium, and lead. A "cleanup" remedy at this time would therefore not be reliable over the long term. The selected remedy complies with all applicable or relevant and appropriate Federal and State requirements addressing the interim remedy of permanent relocation and temporary site stabilization. CERCLA sub-paragraph 121(d)(4)(a) allows the selection of a remedy that does not attain a level or standard of control at least equivalent to all legally applicable or relevant and appropriate Federal and State standards, requirements, criteria, or limitations if the remedial action selected is only part of a total remedial action that will attain such level or standard of control when completed. The Record of Decisions for subsequent operable unit(s) addressing Hill Creek will select applicable or relevant and appropriate requirements associated with permanent remedies. The evaluation and identification of such requirements in Remedial Investigation/Feasibility Studies do not represent final EPA determinations.

In accordance with Section 121(b) of CERCLA, alternative permanent solutions and alternative treatment technologies were evaluated (deep tilling, soil leaching, etc.). Review indicated that these treatment technologies did not adequately reduce surface contaminant levels below

public health concerns. However, further testing is needed to evaluate other technologies. Innovative technologies and permanent remedies will be fully evaluated in RI/FS work for the final remedy at the Anaconda Smelter NPL site.

The Anaconda Smelter Superfund site consists of the Anaconda Old Works and Anaconda (Washoe) Smelter sites, the Arbiter Plant, numerous waste piles and waste ponds, various demolition dumps, and associated areas contaminated by aerial deposition of smelter stack emissions. The total Superfund site area covers several tens of square miles. Several operable units have been designated (40 CFR Sub-section 300.68(c)) based on similarities in the nature of the contamination, the location of the contaminated media and the ability of areas to be remediated under similar time frames. The Hill Creek Operable Unit is the first operable unit at the Anaconda Smelter site which has received focused attention over the past year owing to the highest documented level of environmental contamination of all communities in the area, the demonstrated exposure of Hill Creek children to smelter contaminants, and the associated risks to human health.

As previously stated, the purpose of the Hill Creek interim remedy is to provide adequate permanent protection for the health of current residents in Hill Creek, Montana and interim protection of the health of future short-term visitors in the area. Some environmental concerns will be addressed within the limits of the selected remedy. For example, fugitive dust will be minimized during house demolition and site revegetation efforts. However, regional contamination problems which may remain in Hill Creek after implementation of the interim remedy will be addressed under separate operable units. The final remedy for soils and ground water will be determined following the RI/FS reports for these remaining operable units.

As required by Section 121(d)(2) of CERCLA and 40 CFR Section 300.68, the final remedy will attain or exceed applicable or relevant and appropriate

Federal and State public health and environmental standards and will effectively minimize the release of hazardous substances into the environment so they do not migrate to cause substantial danger to present or future public health and the environment (40 CFR 300.68(a)(1).

DECLARATIONS

Consistent with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and the National Contingency Plan for oil and hazardous substances (40 CFR Part 300), I have determined that the selected first operable unit interim remedy at the Anaconda Smelter site, Mill Creek, Montana operable unit:

- Provides adequate permanent protection for the health of current Mill Creek residents and adequate interim protection for the health of short-term visitors to the area.
- Complies with all applicable or relevant and appropriate State and Federal requirements pertaining to the interim remedy of permanent relocation and temporary site stabilization.
- For the purpose of the interim first operable unit for Mill Creek, the RI/FS adequately evaluated permanent treatment and alternative treatment technologies for the purposes of SARA. The statutory preference for treatment that reduces toxicity, mobility, or volume will also be fully addressed in RI/FS work for later operable units.
- Is consistent with CERCLA requirements governing remedial action (sub-paragraph 121(d)(4)(a), provided the remedial action selected is part of a total remedial plan that will achieve a set level or standard of control when completed;
- Is cost effective; and
- Will be consistent with the final remedy for the Anaconda Smelter site.

This remedy is more cost effective than and environmentally preferable to the transportation, storage, treatment, destruction, or secure disposition off-site of the hazardous substances (Section 101(24) of CERCLA). The

State of Montana has been consulted and concurs with the approved remedy. In addition, the action will require minimal future operation and maintenance activities to ensure the continued effectiveness of the remedy. These activities will be considered part of the approved action. EPA has not reached agreement with the responsible party at the site to implement the selected remedy; however, the responsible party has reached an agreement with several residents to purchase their property and continues to negotiate with the 8 remaining families in the community. See attached confidential enforcement analysis.

James J. Scherer
Regional Administrator
EPA Region VIII

October 2, 1987
Date

Attachments

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

This part of the Record of Decision (ROD), summarizes the information EPA used and the evaluations conducted to support the selection of the interim remedy for Mill Creek, Montana. In addition to the summary text, Attachments I, II, III, and IV provide EPA's: Responsiveness Summary, Statement of Findings for Floodplains and Wetlands, Confidential Enforcement Analysis, and Administrative Record Index, respectively. This information collectively is EPA's record of decision supporting the selection of permanent relocation with temporary site stabilization as the interim remedy for Mill Creek, Montana.

I. SITE LOCATION AND DESCRIPTION

The unincorporated community of Mill Creek is located in southwestern Montana at the southern end of Deer Lodge Valley approximately 25 miles west-northwest of Butte, Montana and about 1.5 miles east of Anaconda, Montana (Figure 1). The study area is located immediately adjacent to the Anaconda Smelter.

Mill Creek (also known as Silica), Montana is located immediately adjacent to the Anaconda Smelter site. The community covers an area of 160 acres, 70 of which are owned by the Anaconda Minerals Company (AMC). Most of the surrounding lands are owned by AMC (Figure 2).

The principal ground water bearing structure in the immediate vicinity of the site is a shallow alluvial aquifer consisting of characteristically coarse grained fan and floodplain deposits that are moderatly permeable and hydraulically connected with surface streams. The study area is in the Mill Creek drainage, a tributary of Silver Bow Creek, which flows directly through the Warm Springs tailing pond complex.

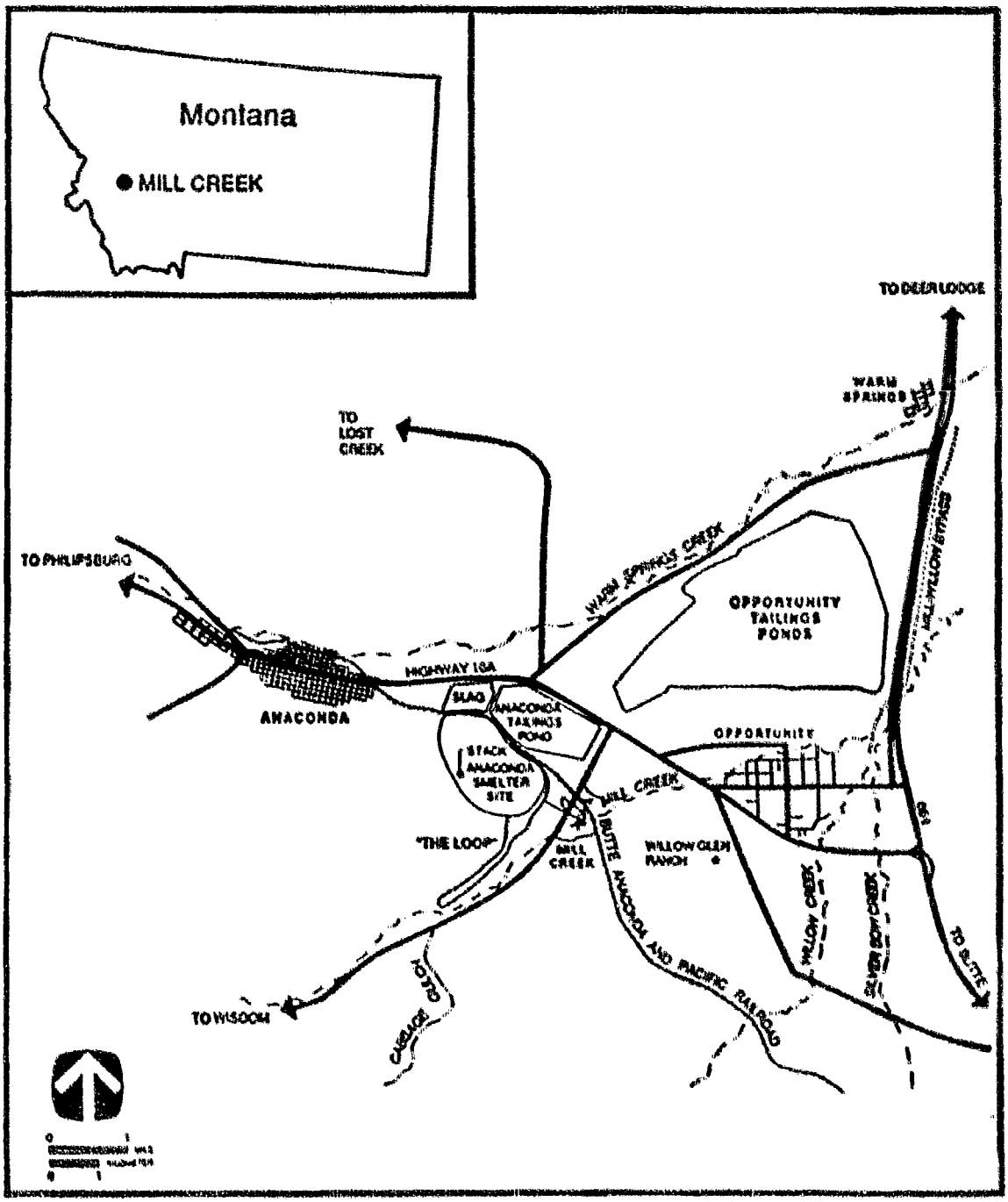

Figure 1. Location of Mill Creek and surrounding communities.

II. SITE HISTORY AND CURRENT SITE STATUS

A. Site History

Residents moved into the Hill Creek area due to its close proximity to the Anaconda Smelter site. The first filing on record for land in the Hill Creek area was in 1902. By 1916-1917, a large part of the Hill Creek area contained tents, log houses, and shacks. By 1918, a schoolhouse was moved to the Hill Creek community. Eventually, the community was divided into the Hillview lots, as shown in Figure 2.

The Anaconda Smelter was operated for nearly a century beginning in 1884 and ceasing in 1980. The smelter was initia'ly operated by the Anaconda Copper Company (later renamed the Anaconda Company), and its predecessors in interest. The Anaconda Company merged with the Atlantic Richfield Corporation (ARCO) in 1977. ARCO operated the smelter from 1977 to 1980 and continues to own the former smelter site and surrounding areas near Hill Creek through its Anaconda Minerals Company operating unit.

Ore and concentrates were processed in the Old Works, Arbiter, and Washoe Works at various times between 1884 and 1980. Ore processing to anode copper produced wastes that have spread over more than 6,000 acres and contain elevated concentrations of arsenic, cadmium, copper, lead, and zinc. ARCO has estimated that the wastes include about 185 million cu. yds. of tailings, 27 million cu. yds. of granulated slag, and 0.25 million cu. yd. of flue dust. Locations of waste piles of these materials in relation to the community of Hill Creek are shown on Figure 3.

The Anaconda Smelter site was listed on the National Priorities List (NPL) on September 8, 1983 (48 Federal Register 40658). Contamination of the community of Hill Creek was identified as a problem during the Phase I remedial investigation. The community has been contaminated from over 100 years of smelter emissions, fugitive emissions of flue dust located at the smelter, and continued fugitive emissions from adjacent highly contaminated

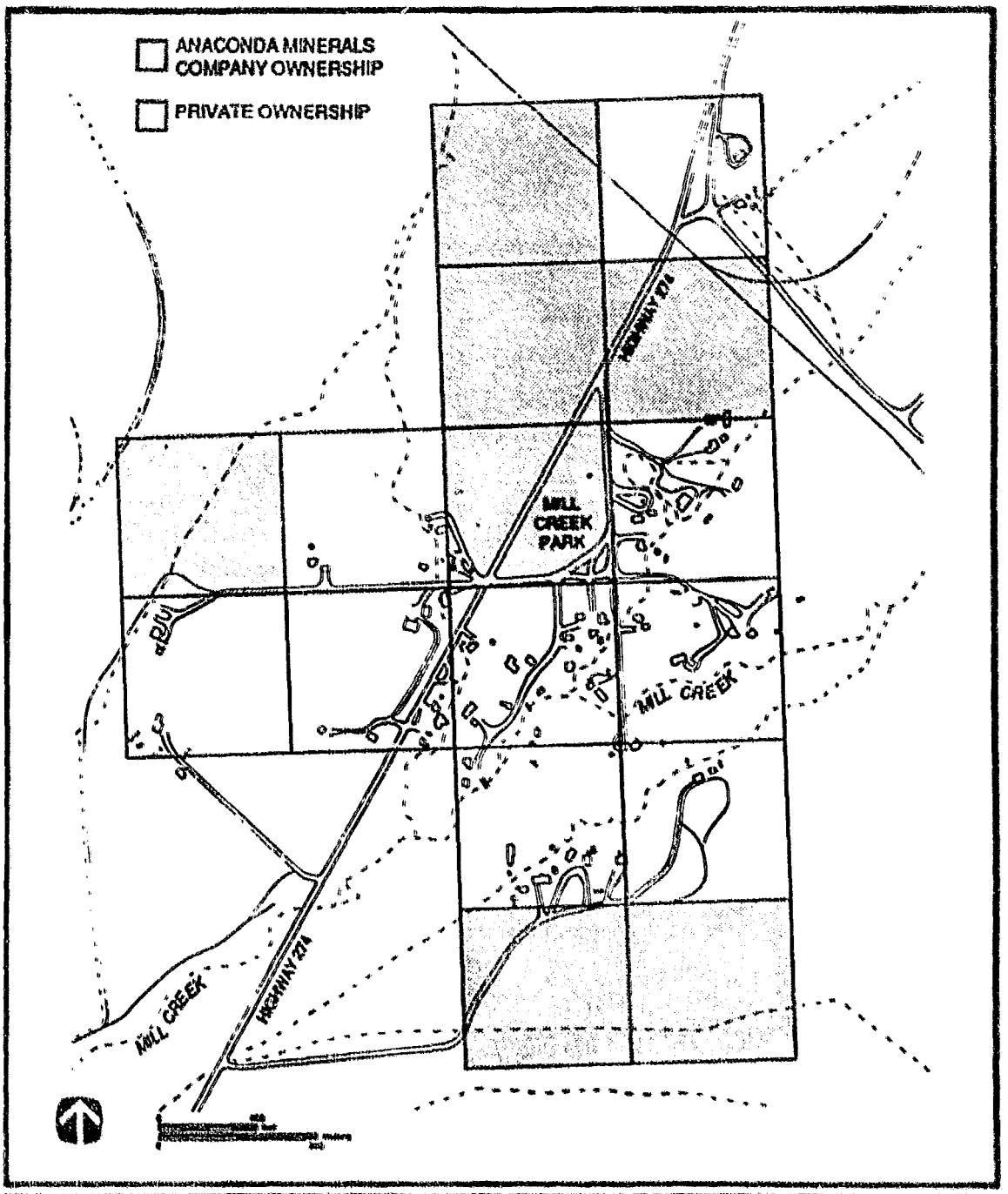

Figure 2. Subdivision of lots in the community of Mill Creek, MT.

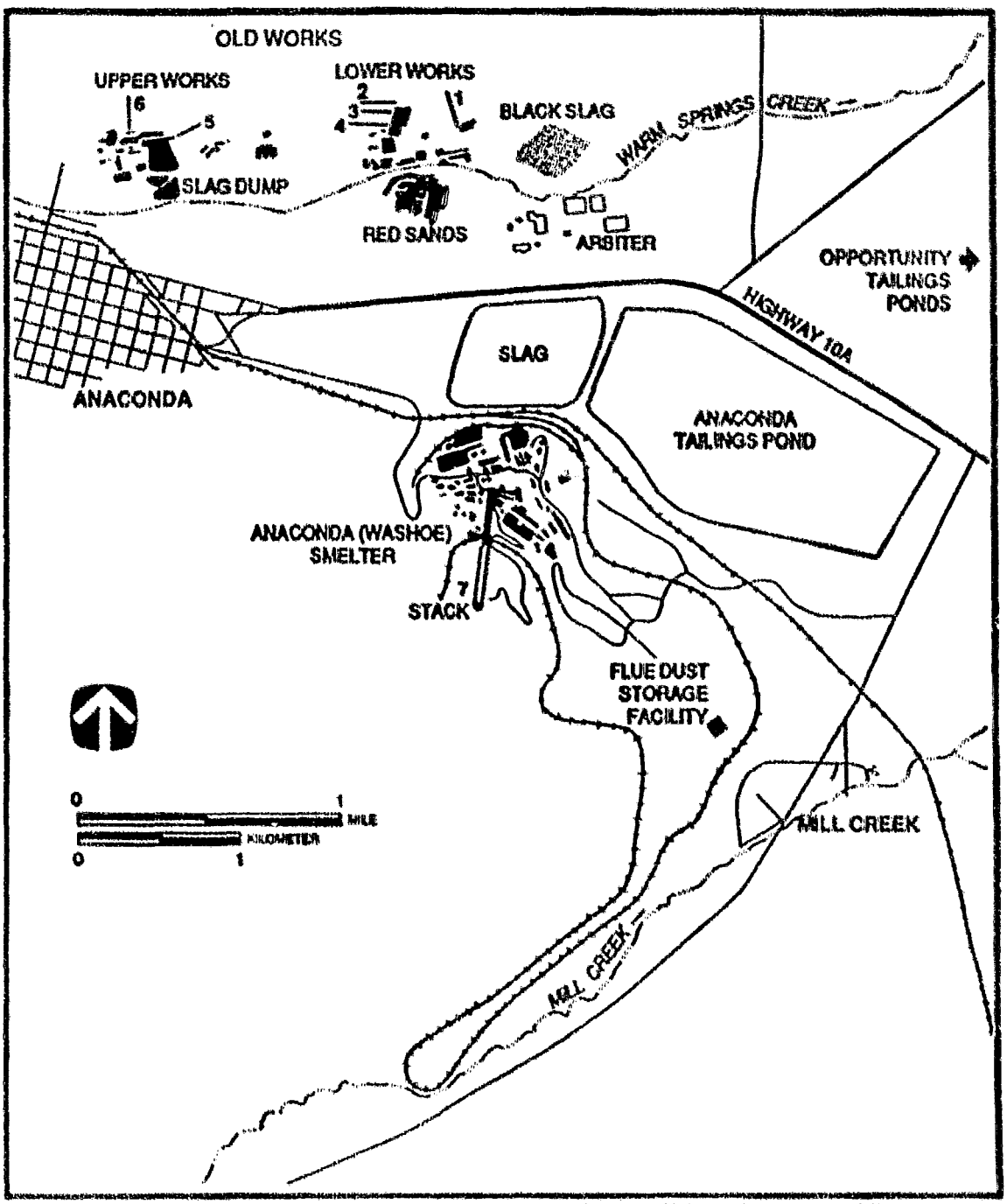

Figure 3. Location of Anaconda Smelter facilities in relation to Mill Creek.

soils. During soil sampling of communities in the vicinity of the smelter, in accordance with CERCLA Section 106 Administrative Order on Consent (CERCLA-VIII-84-06), it was discovered that Hill Creek had extremely high levels of arsenic and other heavy metal contaminants when compared to other communities in the area.

The Center for Disease Control (CDC) showed that pre-school children from the community of Hill Creek had greater arsenic exposure than children of another community in the Anaconda area. This conclusion was made after CDC conducted urine sampling in March 1985. Sampling was continued in July of 1985. This urine survey showed that a CDC attempt to reduce exposure to house dust in Hill Creek did not reduce the children's urinary arsenic levels, and the levels in the Hill Creek children remained higher than those of children in any other community studied. These elevated urinary arsenic levels persisted in spite of house cleaning efforts designed by the CDC and recommendations by both CDC and EPA to residents on how to reduce exposure of children to contaminated materials.

Mean urinary arsenic levels in Hill Creek decreased after several residents were relocated. No persons tested after the move had urinary arsenic levels above 50 ug/l, a concentration which CDC considered to be a "level of concern". The fact that children's urinary arsenic levels before the move were so much greater than the levels for adults is consistent with the hypothesis that children can serve as a sentinel population in certain circumstances.

A detailed, quantitative endangerment assessment was prepared by Clement and Associates, Inc. for Hill Creek, Montana (in April 1986). This assessment evaluated the actual and potential exposures of the residents in Hill Creek to hazardous substances through soil, air, drinking water, and household dust pathways. The results of this study and the CDC study led EPA to sign an Action Memorandum on April 29, 1986, requesting funding to temporarily relocate high risk residents of Hill Creek and remove them from the threat of harmful exposure posed by the Anaconda Smelter site.

Residents of fourteen households have been temporarily relocated under this action. A urinary arsenic survey was conducted after residents were relocated in the Fall of 1986. Mean urinary arsenic levels in Hill Creek decreased after residents were relocated. Although 5 individuals had urinary arsenic levels above 50 ug/l (considered to be a "level of concern") prior to the move, none had urinary arsenic levels above 50 ug/l after relocation from Hill Creek. The CDC stated that strictly speaking, one cannot infer from the data that excess arsenic exposure has ceased, except for around the time of testing. Nevertheless, CDC believes that their sampling was representative of exposures generally occurring in our study population and that the relocation has effectively decreased exposure. The quantitative endangerment assessment was revised in October of 1987 and continues to indicate significant risks.

In July 1986, AMC agreed to implement an expedited RI/FS focusing on the human health issues only. Subsequent operable units (regional soils and regional ground water) will completely address other issues and other areas of the Anaconda Smelter site. This expedited RI/FS was conducted under a CERCLA S106 Administrative Order on Consent (Docket No. CERCLA VIII-86-07).

During the conduct of the RI/FS, ARCO negotiated with the Hill Creek residents to permanently relocate them from the town. ARCO has successfully reached agreement with all but eight of the families and continues to negotiate with those remaining.

B. Quantity, Type, and Concentration of Hazardous Substances Present

The principal waste sources that have contributed to contamination in Hill Creek are the result of Anaconda Smelter operations that have occurred for nearly 100 years. These sources include historic stack and fugitive emissions and ongoing fugitive emissions from contaminated areas surrounding the Anaconda Smelter. Information on arsenic and heavy metals concentrations (ug/g) of the various waste sources is listed below.

	Arsenic	Cadmium	Lead
Flue dust	49,900-69,600	1,130-1,300	9,790-14,600
Slag	498-3,190	4.4-44	364-4,310
Opportunity Tailings	36-535	1.5-46.5	<10-2,290

Analysis of soil, dust, air, and water samples collected to date at the Hill Creek site show extensive contamination by Anaconda Smelter wastes. Of primary concern are elevated concentrations of arsenic and heavy metals in soils, drinking water, and household dust, with corresponding elevated urinary arsenic levels of children (two to six years old) in Hill Creek.

C. KNOWN OR SUSPECTED RISKS

The community of Hill Creek was originally comprised of approximately 36 households and had a permanent population of less than 100 people. As a result of temporary relocation efforts by EPA and ARCO's buyout program, only 8 residences are currently occupied. The risk estimates summarized below are based in part on the assumption that children between the ages of one to six years old are living in Hill Creek, Montana. This was the case until the summer of 1987 when ARCO voluntarily permanently relocated the families with children of that age. EPA has continued to use the assumption of the presence of children because of the potential that additional children could move into Hill Creek or be born in Hill Creek.

EPA has identified significant public health risks for children and adults posed by exposure to arsenic and heavy metals in soil, drinking water, air, and households in the community of Hill Creek. The toxicological properties of arsenic, cadmium, copper, lead, and zinc are fully discussed in the Hill Creek endangerment assessment.

Arsenic is a known carcinogen that has been associated with an increased frequency of skin cancer when ingested, and lung cancer when inhaled. Cadmium has been associated with an increased frequency of lung cancer in

humans when inhaled. Arsenic and cadmium can be acutely or chronically toxic, and can be fatal if ingested or inhaled in sufficient quantities by humans, livestock, and wildlife.

Other hazardous substances of concern at the site include lead, copper, and zinc. Lead is a cumulative poison which can cause neurological, kidney, and blood cell damage in humans. Some lead compounds are also animal carcinogens adversely affecting the lungs and kidneys. At elevated levels, some copper and zinc compounds are toxic to a number of animal species, including humans. Copper and zinc are particularly toxic to fish. Severe illness and/or death can result from exposure of humans, livestock, and wildlife to toxic levels of arsenic, cadmium, and lead.

Currently, there are no uniform national standards identifying what constitutes a hazardous level of arsenic in soil. Therefore, it was necessary to estimate the levels of carcinogenic risk posed by potential exposure to arsenic in the community of Hill Creek, Montana.

The carcinogenic risk was calculated in accordance with EPA's current guidelines for carcinogenic risk assessment. The cancer potency factor was multiplied by the average lifetime exposure in mg/kg/day, to yield estimates of lifetime excess risks of cancer resulting from exposure. Geometric mean concentrations of arsenic, cadmium, and lead in each medium were used in average case risk estimates, whereas maximum concentrations for these substances in each medium were used in reasonable maximum risk estimates. For arsenic and cadmium, daily chemical intake for soil ingestion, drinking water, and the non-respirable fraction of the inhalation pathway were summed in order to determine cumulative exposure for each substance. In the case of lead, a multimedia exposure model developed in the Hill Creek endangerment assessment was used to linearly estimate average and reasonable maximum blood lead concentrations in children. Finally, the cumulative risk estimates for individual substances were used to assess potential risks associated with multiple chemical exposures. Carcinogenic risks for multiple chemical exposure were

determined by adding cadmium and arsenic lung cancer risks. Because of the difference in the two target organs, potential skin cancer risks associated with arsenic ingestion were considered independently from lung cancer risks.

Non-carcinogenic risks for multiple chemical exposure were estimated by calculating a cumulative hazard index for ingested cadmium, and inhaled or ingested lead.

Using this approach, EPA evaluated the risk associated with the no action alternative for the Hill Creek operable unit in the October, 1987 Revised Final Endangerment Assessment for Hill Creek, Montana. Using the average exposure scenario, the excess risk from all exposure pathways of developing skin cancer in Hill Creek is 1.5×10^{-4}. Similarly, for the reasonable maximum exposure scenario the excess skin cancer risk is 2.8×10^{-3}. With respect to lung cancer from all exposure pathways, the excess cancer risk for the average and reasonable maximum exposure scenarios is 1.0×10^{-4} and 1.6×10^{-3} respectively.

The cumulative hazard index for cadmium ingestion and lead exposure ranged from 0.73 in the average case analysis to 1.96 in the reasonable maximum case analysis. The hazard index assumes simple additivity of effects and provides a numerical indication of the nearness to acceptable limits of exposure or the degree to which acceptable exposure levels are exceeded (U.S. EPA 1986a). A hazard index greater than 1.0 suggests that exposure to an individual substance or all substances collectively exceed a generalized level of concern for a common toxicological endpoint or target organ.

EPA has concluded that the elevated arsenic levels in the urine of the children formerly living in Hill Creek demonstrate that they were exposed to elevated levels of arsenic and other metals associated with the smelter. The estimated rate of intake of arsenic (estimates reinforced by the arsenic levels found in their urine) suggests that the children's exposure,

if continued, would pose substantial risks of adverse health effects, including cancer. EPA believes that any children moving into or born in Hill Creek in the future would be subjected to similar exposure and risks.

No quantitative biologic data have been collected which indicate excess exposure of adults to smelter related contaminants. Adults may ingest contaminated soil, but they are less likely to be exposed via this route than are children. Exposure of adults would occur by inhalation of airborne contaminants in ambient and household air, and by consumption of contaminated drinking water. These exposure routes would contribute to an individual's lifetime cumulative dose and may add to substantial risks already incurred as children.

The available data do not definitively indicate the presence of acute exposures to arsenic that might cause other adverse health effects, such as skin lesions or neurological impairment; but such effects could occur if sufficient amounts of the contaminants were ingested or inhaled.

Exposure of children in Hill Creek to lead via inhalation and ingestion would be sufficient to potentially increase their blood levels of lead to a range at which they could be at risk of behavioral or neurological effects. Although the levels of cadmium in water and soil samples from the town of Hill Creek are high enough to cause concern, this contaminant may also have an additive or potentiating effect on other metal contaminants present in the environment.

EPA is in the process of revising its position on the carcinogenic unit risk factor for ingested inorganic arsenic. Under any scenario for revision considered by EPA, significant health risks associated with ingestion of arsenic exist in Hill Creek. The most current published EPA position on the degree of carcinogenicity of ingested arsenic is in the draft "Special Report on Ingested Arsenic and Certain Human Health Effects", EPA Risk Assessment Forum, October, 1986. This report was relied on in the Hill Creek RI/FS and Endangerment Assessment as well as this

Record of Decision. EPA also considers the cumulative carcinogenic and toxic risk posed by ingestion of arsenic, lead, and cadmium in soil; drinking water; and inhaled and later swallowed particulate matter to independently warrant remedial action. Significant risks of lung cancer from inhalation of arsenic and cadmium also warrant action.

The contamination of the Hill Creek area poses an imminent and substantial endangerment to the health of any children who may reside there (Clement 1987). Exposure of adults to ingestible forms of arsenic in dust, soil, water, and food in the Hill Creek community would most likely result in additional elevated cancer risks. Exposure to cadmium and lead in soil and dust may also have adverse effects on human health and the environment.

D. Extent of Contamination

Contamination of soils in the community of Hill Creek is widespread. A number of investigations have been conducted to determine the spatial and vertical distribution of arsenic and heavy metals in soils in and around the community of Hill Creek. An inventory of soils studies for the Hill Creek RI/FS is provided in Table 1. Results of soil analyses for Hill Creek and surrounding communities are summarized in Table 2. The geometric mean concentration of arsenic, cadmium, and lead in Hill Creek surface soils are 638 mg/kg, 25 mg/kg, and 508 mg/kg. These mean values are substantially higher than those for surrounding communities (Table 2).

The spatial distribution of contaminants in the Hill Creek area is somewhat heterogeneous, but widespread. Figures 4, 5, and 6 illustrate the distribution of arsenic, cadmium, and lead in surface soils in the Hill Creek area.

Soil profile samples were also collected by AHC as part of the Hill Creek RI/FS. Summary statistics for arsenic, cadmium, and lead in soil profile samples are compiled in Table 3. Although the profiles were sampled to varying depths and a few were sampled in different increments, the data

TABLE 1. INVENTORY OF SOILS STUDIES FOR THE MILL CREEK STUDY AREA

Sampler	Project	Sampling Date	Number of Samples	Location	Sample Depth (in)	Analytical Lab	Analytical Techniques	No. of[1] Level B Samples	Elements Analyzed	Horizontal Composite	Sample Method
Anaconda Minerals Company (AMC)	Screening study	Sept 1982	1	AMC property	0-1/2	EPA-NEIC	Aqua regia	0	As, Cd, Cr, Cu, Pb, Sb, Zn	No	Trowel
Tetra Tech	Health effects soils study Anaconda RI/FS	Dec 1984	4	2 in Mill Creek yards; 1 on AMC property; 1 near southernmost Mill Creek homes	0-1	California Analytical	Nitric peroxide	1	As, Cd, Cu, Pb, Zn	Yes	Pick and shovel, plastic scoops
Tetra Tech	Mill Creek yard sampling Anaconda RI/FS	Oct 1985	3	3 Mill Creek yards	0-2	Weyerhaeuser Analytical Laboratories	Nitric peroxide	0	As, Cd, Pb	Yes	Shovel, plastic scoops
Tetra Tech	Phase II soils Anaconda RI/FS	Sept-Oct 1985	1 1 1	1 profile on AMC property	0-2 2-10 10-25	Weyerhaeuser Analytical Laboratories	Nitric peroxide	0 0 0	As, Cd, Cu, Fe, Pb, Pb, Zn	Yes	Stainless knife scoops, plastic bowls
Ecol. and Environ. (EPA FIT Team)	CDC study	June 1985	10	5 Mill Creek yards	0-1	Rocky Mtn. Analytical	Nitric peroxide	10	As, Cd, Cu, Pb, Zn	Yes	Stainless steel spoon
Weston-Sper (EPA FIT Team)	Fast track program	Feb-March 1986	85 8	Mill Creek yards	0-2	Weyerhaeuser Accu-Labs	Nitric peroxide Nitric peroxide	0 16	As, Cd, Cu, Pb, Zn As, Cu, Pb, Zn	No	Shovel, pick, stainless spoon and trowel
Weston-Sper (EPA FIT Team)	Fast track program	April 1986	23 7	Mill Creek yard surface and surrounding AMC property Mill Creek yard and AMC property subsurface samples	0-2, 0-3, or 0-4 to 15 in	Wilson Labs	Nitric peroxide	23 0	As, Cu, Pb, Zn	No	Split spoon sampler and stainless spoon; split spoon sampler
Weston-Sper (EPA FIT Team)	Fast track program	April 1986	43	Mill Creek yard surface and surrounding AMC property	0-2, 0-3, 0-3.5, 0-4, or 0-5 to 15 in	Comp. Brasser and McKee	Nitric peroxide	0 17	As, Cu, Pb, Zn	No	Split spoon sampler and stainless spoon
Tetra Tech	Mill Creek RI/FS Soil Leach bench test	June 1986	3 27	3 leach test profiles (1 south end Mill Creek, 1 west of Mill Creek Park, 1 center Mill Creek)	0-3 3 in intervals to 30 in	Weyerhaeuser Analytical Laboratories	Nitric peroxide	0 0	As, Cd, Pb	No	Stainless knife, plastic scoops, bowls
Tetra Tech	Mill Creek RI/FS demo till pilot test	June 1986	52 28	Deep till plots west of Mill Creek Park on AMC property	0-3 3 in intervals to 18 or 24 in	Weyerhaeuser Analytical Laboratories	Nitric peroxide	0 0	As, Cd, Cu, Pb, Zn	No	Stainless knife, plastic scoops, bowls
Tetra Tech	Mill Creek RI/FS yard profile survey	July 1986	7 49 14	1 profile in each of 7 Mill Creek yards	0-3 3 in intervals to 24 in 12 in intervals to 48 in	Weyerhaeuser Analytical Laboratories	Nitric peroxide	0 0 0	As, Cd, Pb	No	Stainless knife, plastic scoops, bowls

[1] Additional Soil Profile data were unqualified by EPA using statistical comparisons (U.S. EPA, 1987). These data are considered level B quality and are utilized in support of the cost analysis in the Mill Creek FS.

TABLE 2. COMPARISON OF METALS CONCENTRATIONS IN SURFICIAL SOILS AT MILL CREEK WITH OTHER NEARBY COMMUNITIES[a]

Area	Number of Samples	Range (mg/kg)	Geometric Mean (mg/kg)
Mill Creek			
As	177	25-4,080	638
Cd	146	2-145	25
Pb	177	12-2,910	508
Anaconda			
As	23	28-345	114
Cd	23	1-20	6.8
Pb	23	28-1,510	229
Warm Springs			
As	5	20-96	35
Cd	5	<0.4-5.9	1.8
Pb	5	12-297	61
Opportunity			
As	14	16-370	106
Cd	14	1-15	4.7
Pb	14	24-5,760	141
Philipsburg[b]			
As	3	11-13	12
Cd	3	0.7-1	0.8
Pb	3	21-28	23
Townsend[c]			
As	3	3.4-5.7	4
Cd	3	0.8-1.4	1.1
Pb	3	30-55	39

[a] Both qualified and unqualified data (U.S. EPA 1987).

[b] Control community located 30 mi north of Mill Creek.

[c] Control community located 110 mi northeast of Mill Creek.

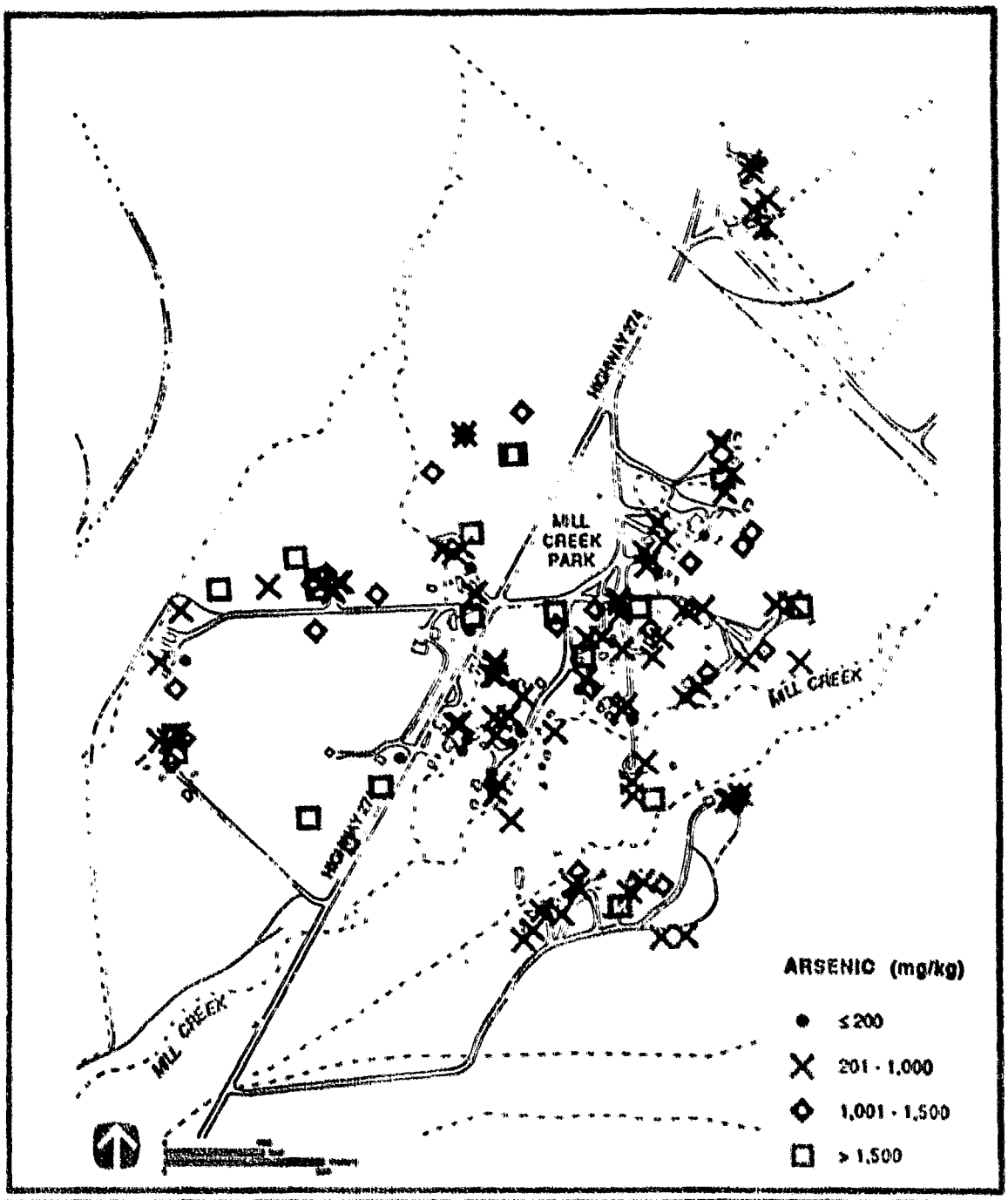

Figure 4. Surface soil arsenic distribution.

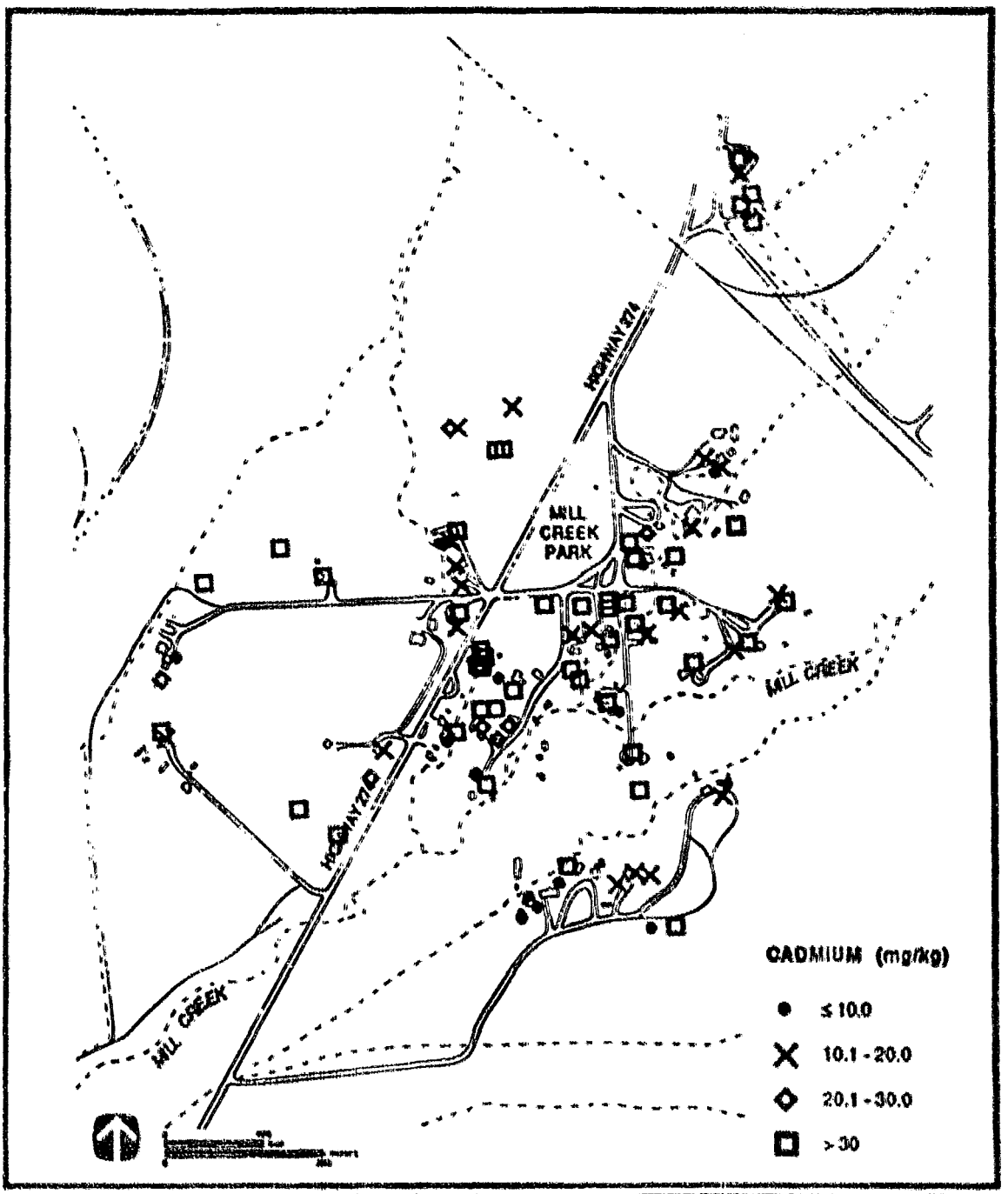

Figure 5. Surface soil cadmium distribution.

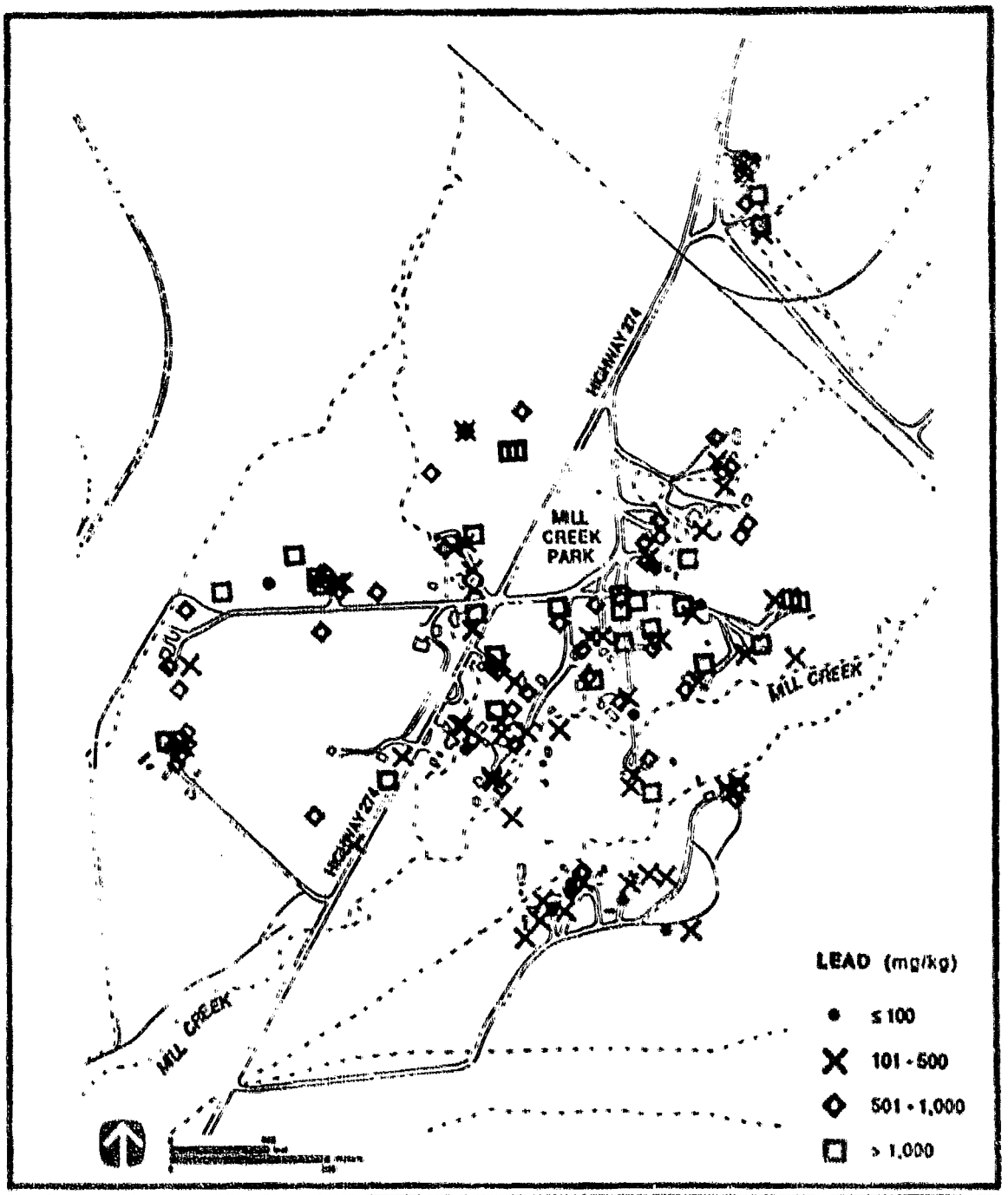

Figure 6. Surface soil lead distribution.

TABLE 3. CONCENTRATIONS OF ARSENIC, CADMIUM, AND LEAD (mg/kg) FOR ALL MILL CREEK SOIL PROFILES BY DEPTH INCREMENT

Depth (in)	Sample Size	Geometric Mean	Maximum	Coefficient of Variation (%)
Arsenic				
0-3	16	592	2,650	12
3-6	16	273	780	12
6-9	16	186	840	15
9-12	15	132	1,020	21
12-15	14	88	320	21
15-18	14	74	2,600	33
18-21	13	55	720	31
21-24	13	53	165	22
24-27	3	15	74	41
27-30	3	8	74	87
24-36	7	47	100	19
36-48	7	22	60	31
Cadmium				
0-3	14	17	51	25
3-6	14	11	31	35
6-9	14	3	24	102
9-12	14	2	18	179
12-15	14	1	11	268
15-18	14	1	23	484
18-21	13	1	8	17,992
21-24	13	1	12	1,106
24-27	3	1	1	--
27-30	3	1	1	--
24-36	7	1	8	1,550
36-48	7	1	1	--
Lead				
0-3	16	369	1,750	17
3-6	16	68	740	33
6-9	16	29	558	42
9-12	15	20	548	39
12-15	14	11	179	34
15-18	14	12	943	52
18-21	13	11	354	45
21-24	13	11	28	25
24-27	3	10	13	15
27-30	3	8	17	26
24-36	7	10	17	13
36-48	7	6	10	14

show similar trends. Arsenic is concentrated in the top six inches. In the majority of the soil profiles, arsenic concentrations are below 100 mg/kg at 18 inches, and approach background levels established for this area below 42 inches.

For cadmium and lead, the highest concentrations are also found in the top six inches of the profiles. However, cadmium and lead concentrations decrease more rapidly with depth than do arsenic concentrations. In the majority of the profiles, cadmium levels are less than detection limits (1.2 or 1.5 mg/kg) below nine inches, and lead levels are within the range of background concentrations below six inches.

Quarternary alluvial deposits underlie the Hill Creek site and supply domestic well water for the area. The water table beneath Hill Creek is generally 20 feet or deeper below the ground surface depending upon seasonal flow. Domestic tap water in Hill Creek has been sampled on three occasions. The first sampling occurred on December 5 and 17, 1985, and the second on May 20 and 21, 1986, and a third set of samples were collected on March 24 and 25, 1987.

Results of water analyses are shown in Table 4. All household tapwater analyses were within U.S. EPA primary drinking water criteria and State of Montana primary drinking water standards for arsenic, cadmium, and lead. However, during the May 1986 sampling, seven household water supplies were found to have detectable arsenic levels (Table 4). Cadmium and lead concentrations were generally at or below detection limits. From a multiple exposure standpoint all contributions to arsenic exposure are important to consider. It is likely that wells yielding arsenic contaminated waters are locally contaminated from soils introduced into the wells.

Hill Creek, the major surface drainage system in the area, was sampled four times between April 1985 and April 1986, as part of the smelter investigation. Sampling station locations are shown in Figure 7. Arsenic

TABLE 4. MILL CREEK WELL WATER ANALYSES

HOUSE NO.	DEC 1985 SAMPLE NO.	MAY 1986 SAMPLE NO.	MARCH 1987 SAMPLE NO.	TOTAL/ DISS.	(Dec 5 & 17, 1985) DEC 1985 SAMPLE (ug/L) As	Cd	Pb	(May 20, 21 1986) MAY 1986 SAMPLE (ug/L) As	Cd	Pb	U.S. EPA SAMPLE (March 24,25 1987) (TOTAL) MARCH 1987 SAMPLE (ug/L) As	Cd	Pb	Hg	WELL DEPTH (ft)	COMMENTS
1	MC-18	MC-117	228-GW-001	T	11	< 2	< 3	4	< 5	< 3	2	0.56	< 1	<0.2	88	Drilled 25 yr ago
				D	5	6	12	4	< 5	< 3						
2	MC-17	MC-101	228-GW-002	T	19	< 1	2	8.1	< 5	< 3	10	0.63	< 1	<0.2	58	Hand dug - probably around 1910
				D	20	< 1	1	7.9	< 5	4						
3	MC-1	MC-103	228-GW-003	T	<10	< 1	< 1	4	< 5	3	2.2	0.76	< 1	<0.2	96	36 to 40 yr old
				D	<10	1	1	< 4	< 5	3						
4		MC-102	228-GW-004	T				< 4	< 5	< 3	1.4	0.72	< 1	<0.2	96	Shares well with House No. 3
				D				< 4	< 5	4						
6	MC-2	MC-104		T	< 5	< 2	5	< 4	< 5	< 3					70	
				D	< 5	< 2	< 3	< 4	< 5	< 3						
7	MC-3	MC-105	228-GW-007	T	<10	< 1	< 1	< 4	< 5	< 3	< 1	0.54	< 1	<0.2	62	12 yr old
				D	<10	1	1	< 4	< 5	< 3						
11	MC-6	MC-107		T	< 5	< 2	< 3	< 4	< 5	< 3					82	
				D	< 5	< 2	< 3	< 4	< 5	< 3						
12	MC-5	MC-125		T	<10	1	3	< 4	< 5	< 3						
				D	11	2	3	< 4	< 5	< 3						
13	MC-4	MC-108		T	<10	< 1	1	< 4	< 5	< 3					60	At least 7 yr old
				D	<10	1	1	< 4	< 5	< 3						
14		MC-126		T				< 4	< 5	< 3						Hauls water from Anaconda
				D				< 4	< 5	< 3						
15	MC-14	MC-109		T	< 5	< 2	< 3	< 4	< 5	< 3					110,120	Well #1, 10 yr old; Well #2, 15 yr old
				D	< 5	6	< 3	< 4	< 5	< 3						
21		MC-112		T				< 4	< 5	4						
				D				< 4	< 5	< 3						
17	MC-19	MC-110		T	27	2	9	< 4	< 5	7					60	Drilled
				D	<10	2	4	< 4	< 5	3						
18		MC-129		T				21	< 5	< 3						Share well with House No. 19, 15 yr old
				D				19	< 5	< 3						
20	MC-22	MC-111	228-GW-020	T	< 5	< 2	< 3	< 4	< 5	< 3	< 1	0.68	< 1	<0.2	115	25 yr old
				D	< 5	< 2	< 3	< 4	< 5	< 3						
23	MC-10	MC-113		T	< 5	< 2	< 3	< 4	< 5	< 3						Approximately 20 yr old
				D	< 5	< 2	< 3	< 4	< 5	< 3						
27	MC-21	MC-114	228-GW-027	T	< 5	< 2	< 3	< 4	< 5	< 3	< 1	0.64	< 1	<0.2	60	
				D	< 5	< 2	< 3	< 4	< 5	< 3						
28	MC-9		228-GW-028	T	<10	< 1	1				< 1	0.54	1	<0.2	55	At least 18 yr old
				D	<10	< 1	1									
25	MC-12	MC-122	228-GW-025	T	10	< 1	1	16	< 5	< 3	13	0.45	< 1	<0.2		Well age appx. 10 yr
				D	10	< 1	< 1	18	< 5	< 3						
26	MC-11	MC-123	228-GW-026	T	<10	< 1	1	< 4	< 5	< 3	< 1	0.95	< 1	<0.2	50	
				D	<10	< 1	2	< 4	< 5	< 3						
29	MC-7		228-GW-029	T	<10	1	1				< 1	0.69	4.3	<0.2	65	Well implaced in 1973
			228-GW-030	D	<10	1	1				< 1	0.67	< 1	<0.2		
30	MC-8	MC-115		T	<10	< 1	2	< 4	< 5	< 3						
				D	<10	< 1	1	< 4	< 5	< 3						
31		MC-116		T				< 4	< 5	6	< 1	0.43	< 1	<0.2	110	Shares well with House No. 29
				D				< 4	< 5	34						
32	MC-15	MC-120		T	31	< 1	2	72	< 5	4					18	Hand dug, 1940s or 1950s
				D	30	1	1	28	< 5	< 3						
33	MC-20	MC-119	228-GW-033	T	< 5	< 2	< 3	< 4	< 5	< 3	< 1	0.66	< 1	<0.2	112	
				D	< 5	< 2	< 3	< 4	< 5	< 3						
24	MC-23	MC-118		T	< 5	< 2	< 3	< 4	< 5	< 3						20 yr old
				D	< 5	< 2	< 3	< 4	< 5	< 3						
16	MC-16	MC-127	228-GW-036	T	12	1	1	57	< 5	< 3	16	0.58	< 1	<0.2	90	Hand dug, 1940s or 1950s Resampled July 1986 As = 52 ppm
				D	13	< 1	1	57	< 5	< 3						

Note: < detection limit.

is consistently present in Hill Creek in concentrations above the analytical detection limits (4 ug/l). Concentrations of total arsenic range between 12 and 32.2 ug/l. Zinc has also been detected; values ranged up to 18 ug/l.

Streambed sediments were sampled in Hill Creek in April and July 1985, as part of the Anaconda Smelter Remedial Investigation. Trace metal concentrations in the streambed sediments were consistently lower than in the surrounding soils.

Airborne release of hazardous substances occurred during smelter operations at the Anaconda Smelter. Fugitive transport of dust containing hazardous substances from the site persist even after smelter shutdown in 1980. Of major concern are releases of arsenic, cadmium, and lead because of the potential human health hazards associated with these compounds.

Until the fugitive transport of hazardous substances from the Smelter Hill area into the Hill Creek area is remediated, the continued contamination (or recontamination) of the area will occur at a rate of 1.5 ug/kg soil per year. This potential for continued human exposure and recontamination greatly reduces the effectiveness that other alternatives involving soil excavation (i.e., clean up of the site) might have. Recent Hi Vol air sampling data indicate that highly contaminated particulates continue to be deposited on the community despite the efforts to control source materials on Smelter Hill.

Samples of airborne particulate matter are collected at four locations in the vicinity of the Anaconda Smelter site using Hi-Vol samplers. The locations of these sampling stations are shown on Figure 7. Samples collected at these sites were analyzed for total suspended particulates (TSP), respirable particulate, and trace metal content. The mean and range of concentrations of arsenic, cadmium, lead, copper, and zinc in airborne particulate samples collected at each station during 1984 are shown on Table 6.

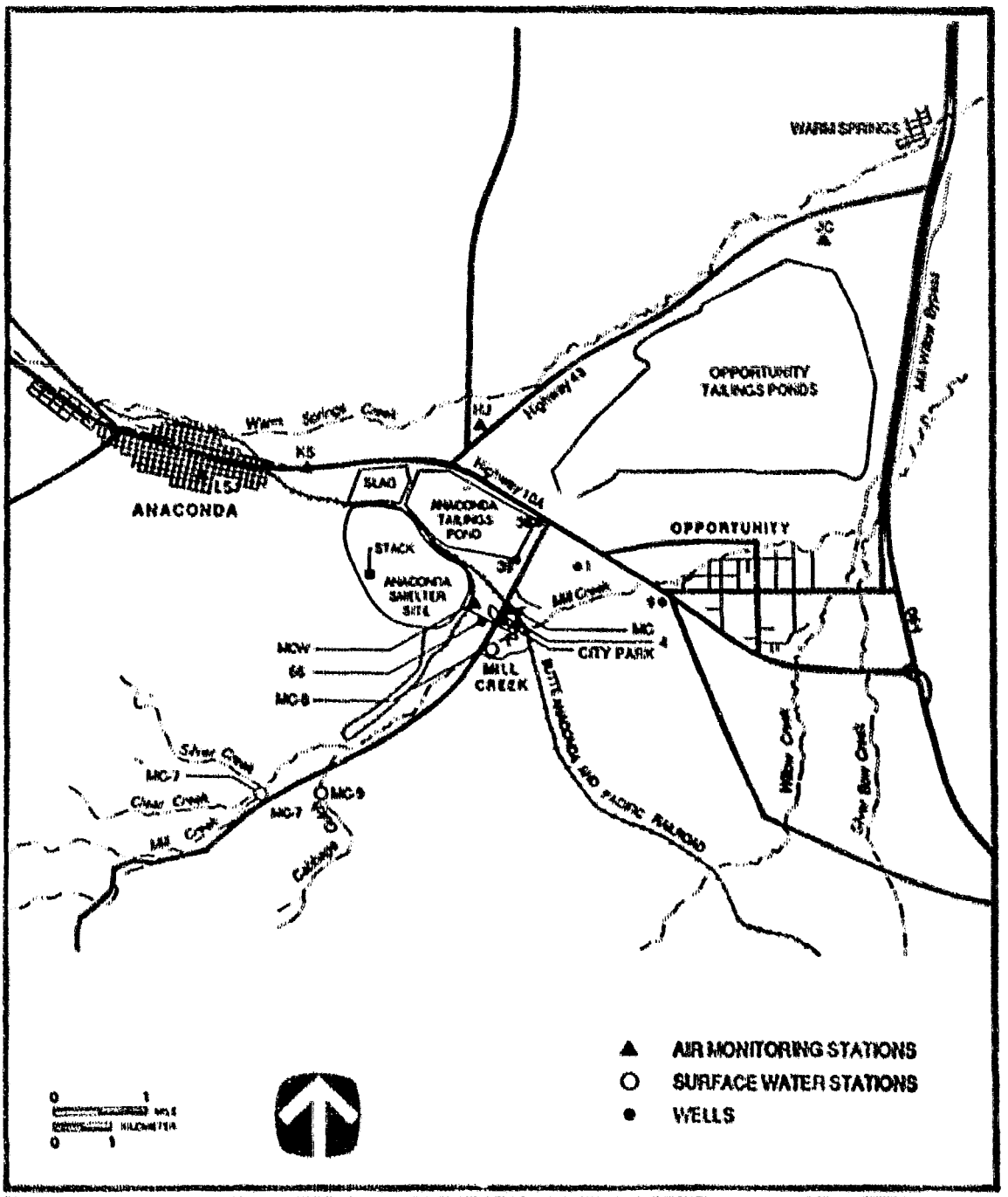

Figure 7. Locations of surface water, groundwater, and air monitoring stations in the Hill Creek study area.

TABLE 5. ARITHMETIC AVERAGE AND GEOMETRIC MEAN CONCENTRATIONS OF TOTAL SUSPENDED PARTICULATES, ARSENIC, CADMIUM, AND LEAD AT MILL CREEK (ug/m^3)[a]

	Arithmetic Average	Geometric Mean	Range of Concentration	
			Minimum	Maximum
Total suspended particulates	27	19	3	187
Arsenic	0.039	0.015	0.001	0.681
Cadmium	0.004	0.002	0.001	0.112
Lead	0.03	0.02	0.01	0.32

[a] April, 1984 through March, 1986, excluding data collected during the Mill Creek Park construction, October 2, 1985 through October 22, 1985.

TABLE 6. MEAN CONCENTRATIONS AND RANGES OF TRACE ELEMENTS IN RESIDENTIAL DUST AND INDOOR AIR

	Residential Dust (Vacuumed) Mg/Kg Arsenic Ave (Range)	Indoor Respirable Arsenic (ug/m^3) Ave (Range)
Mill Creek	264 (104-386)	0.019 (0.011-0.131)
Anaconda	58	0.007
Opportunity	62	0.005

A review of current air quality data was conducted to establish background concentrations for arsenic, cadmium, and lead. The following estimates of background levels were established based on data collected by the states of Arizona, Montana, Utah, and Washington.

Element	ug/m^3
Arsenic	0.01
Cadmium	0.01
Lead	0.04

In general, arsenic data collected at the Highway Junction monitoring station located east of Anaconda was a factor of ten (0.1 ug/m^3) greater than the background concentration. On December 29, 1984 a maximum of 2.0 ug/m^3 of arsenic was measured at the site. A maximum concentration of 0.681 ug/m^3 was measured at the Hill Creek monitoring station. The geometric mean concentration for the Hill Creek station was 0.015 ug/m^3 (Table 5).

No regulations specifically applicable to arsenic and cadmium that are applicable to the Hill Creek RI/FS curently exist under the Clean Air Act or the Toxic Substances Control Act.

Household dust samples collected in selected homes in Hill Creek indicate that elevated levels of arsenic, lead, and cadmium are present. Daily exposure to these hazardous substances in household dust is likely. Results of vacuum dust and indoor respirable dust sampling are summarized in Table 6.

B. Surface and Subsurface Pathways of Migration

On the basis of the available data on environmental levels, it can be concluded that the soil in the Town of Hill Creek is highly contaminated with arsenic and other toxic metals derived from the Anaconda Smelter site. Significantly elevated levels of arsenic have also been reported at times

in airborne particulates near the site, in residential dusts, and in the drinking water. Other communities around the smelter have been found to have much lover levels of contamination.

For Hill Creek children, direct ingestion of soil is the most likely route of exposure to hazardous contaminants from the Anaconda Smelter site. For adults and children, the important potential exposure pathways are ingestion of contaminated drinking water, inhalation, and ingestion of airborne dirt and household dust.

The total environmental exposure, and therefore the actual risk, of the children of Hill Creek to arsenic is compounded by the many routes of exposure. The combined ingestion of soil, dust, and drinking water and the inhalation exposure to airborne arsenic can be considered additive. A portion of the inhaled particles may also be ingested.

P. Location and Number of Affected Receptors

Public health concerns have been addressed in the Endangerment Assessment (Clement 1987). The risk assessment identified the general Hill Creek populace as a potential receptor of environmental trace metal contamination, and further identified Hill Creek children as a population of particular concern because children are likely to ingest appreciable amounts of soil and because high levels of urinary arsenic have been measured in Hill Creek children.

III. ENFORCEMENT (Confidential)

For enforcement analysis see confidential Attachment 1.

IV. COMMUNITY RELATIONS

Beginning with the first newspaper reports that Hill Creek residents may be relocated, community concern at the Operable Unit has been high. On

several occasions, new information about the Operable Unit has been front-page news in area newspapers and has occasionally attracted full camera crews from television stations in Salt Lake City, Utah. An active community-based group, the Mill Creek residents Association, was formed in May 1986, to present a united front in gaining consideration for views of the residents of Mill Creek. This group presented EPA with a list of demands, seeking EPA's agreement to consider remedial options that would allow some people to stay and others to move out of the community. EPA agreed to consider that request. Other demands included mental health care for residents suffering from stress related to Superfund activities, and full replacement value for any Mill Creek homes that EPA may buy during a permanent relocation.

During the course of the RI/FS, EPA representatives, including the director of the Region VIII Waste Management Division from Denver, have met with Mill Creek residents. EPA has had numerous discussions with ANC, the general public, and federal, state, and local agencies. Details on correspondence, meetings,and other interactions among the interested parties are included in the Responsiveness Summary and the Administrative Record for the site. All of the interested groups and entities have been consulted in planning and conducting the investigations and evaluations. All have been invited to and have attended monthly meetings (as frequently as once/month, recently on a quarterly basis) of the Anaconda-Deer Lodge County Environmental Advisory Committee for the Anaconda Smelter site, where EPA presented and discussed information about the site and options for action. EPA prepared summaries of these meetings, including EPA responses to issues raised by those who attended the meetings. EPA also prepared five fact sheets with information directly relevant to the Mill Creek Operable Unit. These documents are available from EPA upon request.

EPA has also had a resident community relations specialist working with the community of Mill Creek to explain RI/FS activities to the citizens and obtain their input.

A public meeting was held on December 23, 1986, to inform the public of the availability of the Draft RI/FS reports for Hill Creek. The public comment period of the Draft RI/FS was scheduled from December 23, 1986, to February 4, 1987. The comment period was extended from its originally scheduled period to January 20, 1987.

Key concerns regarding the remedial alternatives considered in the FS are addressed in the Responsiveness Summary (attached).

The State of Montana and the Federal Emergency Management Agency (FEMA) have concurred in the selected remedy.

V. ALTERNATIVES EVALUATION

Hill Creek, Montana is being addressed as an operable unit of the Anaconda Smelter NPL Site (40 CFR Subsection 300.68(C)). Hill Creek is a community of approximately 160 acres in size which is immediately southeast of the Anaconda Smelter. The community originally consisted of 37 residences, however, following recent acquisition of properties by ARCO, only 8 residences are currently occupied.

EPA does not intend at this time to address all public health and environmental problems present in Hill Creek. The limited number of regional environmental issues not addressed in the Hill Creek RI/FS will be addressed under subsequent operable units. EPA's primary objective for the Hill Creek operable unit is protection of the health of the residents of Hill Creek. This includes both short-term and long-term protection of public health. Two categories of alternatives were presented in the RI/FS to support this objective: (1) cleanup alternatives, and (2) the permanent relocation alternative. For the cleanup alternatives, EPA's objective was permanent protection of public health within the boundaries of the community to the maximum extent possible at this time and to not contribute to environmental problems. For the permanent relocation alternative, EPA's objectives are adequate protection of the current residents of Hill Creek

consistent with paragraph 121(d)(1) of SARA, supplemented by interim controls in Hill Creek to minimize short-term public health problems for current non-residents who may visit or pass through the area. Subsequent operable units of the Anaconda Smelter NPL site will address the long term public health and environmental issues associated with regional contamination problems.

The selected remedy of permanent relocation of Hill Creek residents, together with temporary site stabilization, was determined in the RI/FS to be a more reliable remedy over the long term. The selected remedial alternative is required by Section 101(24) of CERCLA to be "more cost-effective than and environmentally preferable to the transportation, storage, treatment, destruction, or secure deposition off-site of hazardous substances or may otherwise be necessary to protect the public health or welfare". The National Contingency Plan (NCP) requires that the selected remedy be "cost-effective" and one that effectively "mitigates and minimizes threats to and provides adequate protection of public health and welfare and the environment" (40 CFR subsection 300.68(i)(1)). Unless specified exceptions apply, the selected remedy must attain or exceed applicable or relevant and appropriate Federal and State requirements.

Remediation of the environmental effects resulting from the existing site contamination will not be a direct objective of the selected remedial alternative for Hill Creek. However, implementation of the Hill Creek remedial response will not cause significant increases in adverse impacts to the environment. The temporary site stabilization will provide some environmental protection. Environmental effects of the existing contamination will be addressed in the Anaconda Smelter site RI/FS.

In accordance with Section 300.68(i) of the NCP, EPA has developed alternatives which address the following categories:

Category	Description
1.	Alternatives for treatment or disposal at an off-site facility.
2.	Alternatives which attain applicable or relevant and appropriate public health or environmental standards.
3.	Alternatives which exceed applicable or relevant and appropriate public health or environmental standards.
4.	Alternatives which do not attain applicable or relevant and appropriate public health or environmental standards but will reduce the likelihood of present or future threat from the hazardous substances and which provide significant protection to public health, welfare, and the environment. This must include an alternative which most closely approaches the level of protection provided by the applicable or relevant standards.
5.	No action alternative.

A total of 12 remedial action alternatives were developed through the course of the Remedial Investigation/Feasibility Study (RI/FS) for the community of Hill Creek, Montana. These 12 alternatives are listed below. The specific category (see above) addressed by each alternative is also included:

		Category
Alternative 1:	Relocation of all residents.	1A
Alternative 2:	Complete soil removal from private property to RCRA facility.	1
Alternative 3:	Complete soil removal from private property with on-site disposal.	4
Alternative 4:	Partial soil removal with on-site disposal, partial soil till.	4
Alternative 5:	Partial soil fill and sod cap, partial soil till.	4
Alternative 6:	Partial soil fill and sod cap.	4
Alternative 7:	Common response action.	4
Alternative 8:	Partial relocation	4

Alternative 9:	Relocation of houses	4
Alternative 10:	Relocation of sensitive population	4
Alternative 11:	No action	5
Alternative 12:	Complete soil removal with no future institutional controls	2 or 3*

* This alternative satisfies ARARs identified for the limited operable unit and interim remedial action objectives. It does not address ARARs for a permanent remedy.

** Whether alternative meets or exceeds ARARs depends on depth of soil removal and replacement.

An additional alternative which included temporary relocation of residents until the permanent remedy was implemented was included in the addendum to the RI/FS.

A summary of the major components of each remedial alternative is included in Figure 8.

The remedial action alternatives were subjected to preliminary public health and environmental screening and cost screening pursuant to 40 CFR Section 300.68 (g). Through this screening, alternatives which would not offer adequate protection of public health and environment were eliminated from further consideration. Cost screening was conducted to eliminate alternatives which far exceed the cost of other alternatives and would not offer substantially greater protection of public health.

An alternative for relocation only of families with children between the ages of 2 and 6 (alternative 10) was eliminated because it would fail to provide long-term protection of public health of families who remain, move into, or visit Mill Creek frequently. The other alternative eliminated during screening was for complete soil removal from private property with disposal at an off-site RCRA disposal facility (Alternative 2). This alternative would provide essentially identical public health protection as disposal of the soil at the Anaconda Smelter site (Alternative 3) but at nearly ten times the cost of the on-site disposal alternatives. The No

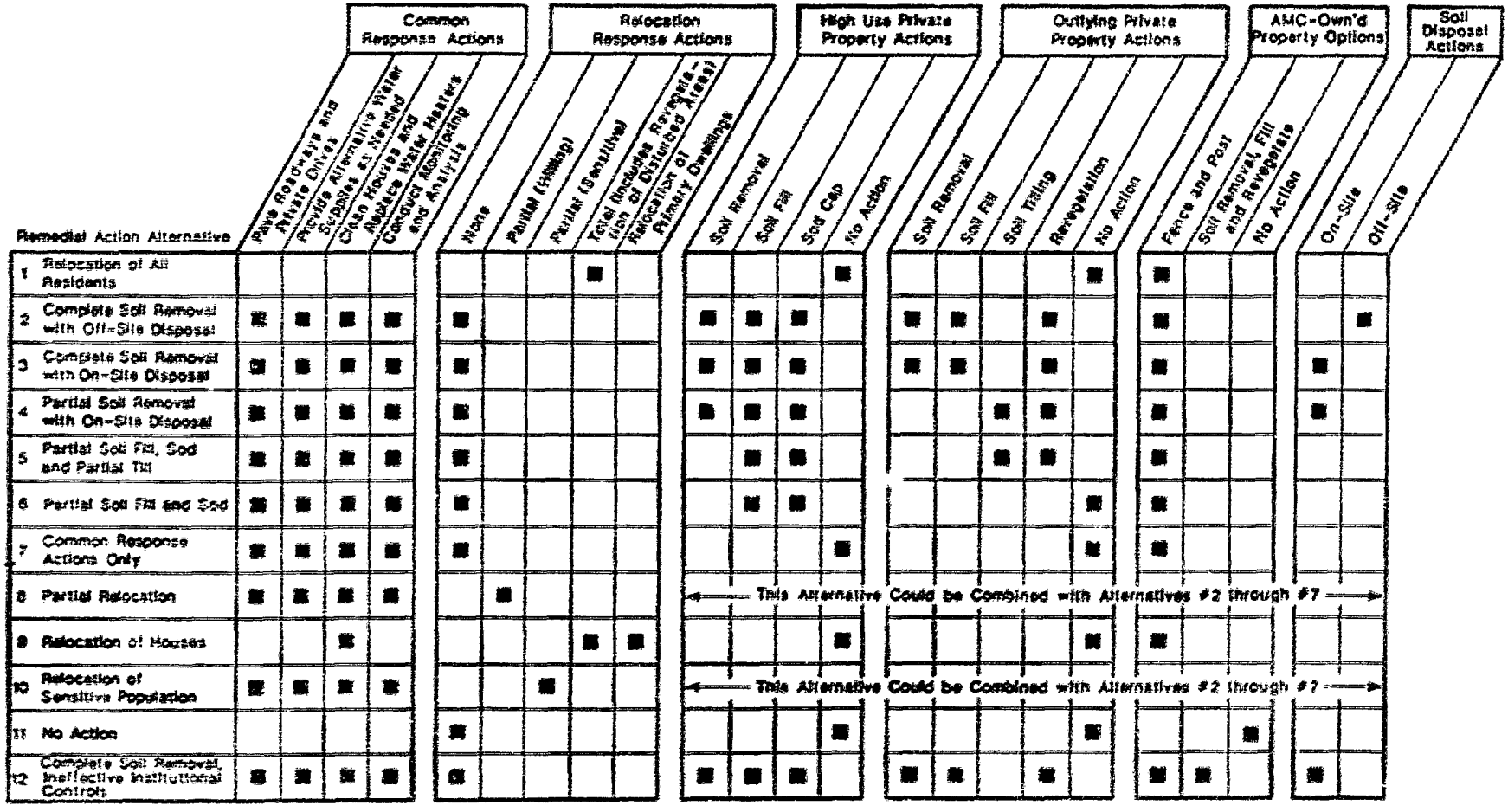

Figure 8.

Summary of Remedial Action Alternatives

Action alternative, by definition, would also fail public health and environmental screening, but for comparison purposes was retained during detailed analysis of the remaining alternatives. Detailed technical, institutional, public health, environmental, and cost analyses were performed for the remaining ten remedial action alternatives, including the No Action alternative. The major findings of these analyses are summarized in Table 7.

An assessment of the reliability of each remedial alternative was conducted and is summarized in Figure 9. For comparison purposes, the remedial alternatives considered can be divided into 4 general groups as follows:

Group	Alternative #
No Action	11
Partial Soil Removal	4, 5, 6, 8, 10
Complete Soil Removal	2, 3, 12
Relocation	1, 8, 9, 10

Protectiveness

EPA's Superfund Program has established a 10^{-6} excess cancer risk as its goal for cancer risk reduction. On a site specific basis, the Agency can establish a remedial action objective of between 10^{-4} and 10^{-7} excess cancers. Soil capping, soil replacement, or relocation of residents would bring the estimated skin cancer risk to 4.7×10^{-5} (average case) and 1.7×10^{-4} (reasonable maximum case) within the range of 10^{-4} to 10^{-7}. Only Alternatives 1 and 12 (or alternative 3 combined with soil removal or capping on AMC property) would reduce the excess skin cancer risk to 4.7×10^{-5} (average case) and 1.7×10^{-4} (reasonable maximum case) for all residents and/or all areas of the site.

The No Action alternative was rejected because it failed to adequately protect public health. Alternatives dealing with partial soil removal were determined to be unreliable because certain areas in the community would not be remediated and effective institutional controls were not available

TABLE 7.
Detailed Analysis Summ

Alternative[a]	Overall Reliability[b]	Time to Implement[c]	Institutional Requirements[d]		Social Considerations	Affected Population Or Use Area	Skin Cancer[f] Excess Risk	
			To Implement	Post-Implementation			Probable Case	Worst Case
1: Relocation of All Residents	High	1 Year	Purchase agreements. Condemnation may be required.	Access or use restrictions pending completion of Shelter Site Rifts.	Not all residents wish to move.	Relocated Residents	4.7E-05	1.7E-04
3: Complete Soil Removal from Private Property with On-site Disposal	Moderate	1 to 2 Years	Property access agreements.	Private Property: No use restrictions. Amc Property: Access or use restrictions.	Property owners would not be given option of buyout. Not all components of a remedial action would necessarily be viewed as desirable. Same considerations apply to Alternatives 3 through 7.	Current High Use Areas	4.7E-05	1.7E-04
						Outlying Private Property Fenced Amc Property.	4.7E-05	1.7E-04
							1.1E-04	2.1E-04
4: Partial Soil Removal with Onsite Disposal, Partial Soil Fill	Low to Moderate	1 to 2 Years	Property access agreements.	Private Property: Land use restrictions. Amc Property: Access or use restrictions.		Current High Use Areas	4.7E-05	1.7E-04
						Outlying Private Property Fenced Amc Property	8.7E-05	1.1E-03
							1.1E-04	2.1E-03
5: Partial Soil Fill and Sod Cap, Partial Soil Fill	Low	1 to 2 Years	Property access agreements.	Private Property: Land use restrictions. Amc Property: Access or use restrictions.		Current High Use Areas	4.7E-05	1.7E-04
						Outlying Private Property Fenced Amc Property	8.7E-05	1.1E-03
							1.1E-04	2.1E-03
6: Partial Soil Fill and Sod Cap	Low	1 to 2 Years	Property access agreements.	Private Property: Land use restrictions. Amc Property: Access or use restrictions.		Current High Use Areas	4.7E-05	1.7E-04
						Outlying Private Property Fenced Amc Property	1.1E-04	2.1E-03
							1.1E-04	2.1E-03
7: Common Response Actions	Low	1 Year	Property access agreements.	Private Property: Greatest land use restrictions. Amc Property: Access restrictions.		Current High Use Areas	1.1E-04	2.1E-03
						Outlying Private Property Fenced Amc Property	1.1E-04	2.1E-03
							1.1E-04	2.1E-03
8: Partial Relocation	High for Relocated Residents. Low to Moderate for Remaining Residents	1 to 2 Years	Purchase and property access agreements.	Private Property: See Alternatives 3 through 7. Amc Property: Access or use restrictions.	Would offer choice to property owners. Community demographics would be altered.	Relocated Residents		Same as Al
9: Relocation of Houses	High	1 to 2 Years	Purchase and property access agreements.	Relocated House: No land use restrictions. Mill Creek: Access or use restrictions.	Offers alternative to complete buyout.	Relocated Residents	4.7E-05	1.7E-04
11: No Action	Low	Not Applicable	Not Applicable	Not Applicable	Not Applicable	No Action	1.1E-04	2.1E-03
12: Complete Soil Removal Assuming Institutional Controls Will Not Be Effective	Moderate to High	1 to 3 Years	Property access agreements.	No restrictions or ineffective restrictions are assumed.	See Alternatives 3 through 7.	Current High Use Areas	4.7E-05	1.7E-04
						Outlying Private Property Fenced Amc Property	4.7E-05	1.7E-04
							4.7E-05	1.7E-04

TABLE 7.
led Analysis Summary

Affected Population Or Use Area	Cumulative Risk[a] Skin Cancer[f] Excess Risk Probable Case	Skin Cancer[f] Excess Risk Worst Case	Lung Cancer[g] Excess Risk Probable Case	Lung Cancer[g] Excess Risk Worst Case	Cadmium Ingestion[h] (mg/kg/day) Probable Case	Cadmium Ingestion[h] (mg/kg/day) Worst Case	Blood Lead[i] (ug/dl) Probable Case	Blood Lead[i] (ug/dl) Worst Case	Total Systemic[j] Hazard Index (HI) Probable Case	Total Systemic[j] Hazard Index (HI) Worst Case	Total Present[k] Worth Cost
Relocated Residents	4.7E-05	1.7E-04	1.0E-04	1.6E-03	2.05E-05 HI=0.07	4.93E-05 HI=0.17	12.8 HI=0.51	13.5 HI=0.54	0.58	0.71	Relocation Only: $ 1,190,000 with 6-inch removal: $ 3,560,000 with 12-inch removal: $ 5,860,000 with 18-inch removal: $ 7,843,000 with 42-inch removal: $15,160,000
Current High Use Areas	4.7E-05	1.7E-04	1.0E-04	1.6E-03	2.05E-05 HI=0.07	4.93E-05 HI=0.17	12.8 HI=0.51	13.5 HI=0.54	0.58	0.58	6-inch removal: $ 3,660,000 12-inch removal: $ 5,000,000 18-inch removal: $ 6,370,000 42-inch removal: $11,570,000
Outlying Private Property	4.7E-05	1.7E-04	1.0E-04	1.6E-03	2.05E-05 HI=0.07	4.93E-05 HI=0.17	12.8 HI=0.51	13.5 HI=0.54	0.58	0.71	
Fenced AHC Property.	1.5E-04	2.5E-03	1.0E-04	1.6E-03	2.40E-05 HI=0.09	2.00E-04 HI=0.50	12.8 HI=0.55	13.5 HI=0.70	0.64	1.20	
Current High Use Areas	4.7E-05	1.7E-04	1.0E-04	1.6E-03	2.05E-05 HI=0.07	4.93E-05 HI=0.17	12.8 HI=0.51	13.5 HI=0.54	0.58	0.71	6-inch removal: $ 2,840,000 12-inch removal: $ 2,940,000 18-inch removal: $ 3,230,000 42-inch removal: $ 4,030,000
Outlying Private Property	8.7E-05	1.1E-03	1.0E-04	1.6E-03	2.28E-05 HI=0.08	8.51E-05 HI=0.30	13.2 HI=0.53	15.0 HI=0.60	0.60	0.90	
Fenced AHC Property	1.5E-04	2.5E-03	1.0E-04	1.6E-03	2.40E-05 HI=0.09	2.00E-04 HI=0.50	12.8 HI=0.55	17.5 HI=0.70	0.64	1.20	
Current High Use Areas	4.7E-05	1.7E-04	1.0E-04	1.6E-03	2.05E-05 HI=0.07	4.93E-05 HI=0.17	12.8 HI=0.51	13.5 HI=0.54	0.58	0.71	
Outlying Private Property	8.7E-05	1.1E-03	1.0E-04	1.6E-03	2.28E-05 HI=0.08	8.51E-05 HI=0.30	13.2 HI=0.53	15.0 HI=0.60	0.60	0.90	$2,610,000
Fenced AHC Property	1.5E-04	2.5E-03	1.0E-04	1.6E-03	2.40E-05 HI=0.09	2.00E-04 HI=0.50	12.8 HI=0.55	17.5 HI=0.70	0.64	1.20	
Current High Use Areas	4.7E-05	1.7E-04	1.0E-04	1.6E-03	2.05E-05 HI=0.07	4.93E-05 HI=0.17	12.8 HI=0.51	13.5 HI=0.54	0.58	0.71	
Outlying Private Property	1.5E-04	2.5E-03	1.0E-04	1.6E-03	2.40E-05 HI=0.09	2.00E-04 HI=0.50	12.8 HI=0.55	17.5 HI=0.70	0.64	1.20	$2,350,000
Fenced AHC Property	1.5E-04	2.5E-03	1.0E-04	1.6E-03	2.40E-05 HI=0.09	2.00E-04 HI=0.50	12.8 HI=0.55	17.5 HI=0.70	0.64	1.20	
Current High Use Areas	1.5E-04	2.5E-03	1.0E-04	1.6E-03	2.40E-05 HI=0.09	2.00E-04 HI=0.50	12.8 HI=0.55	17.5 HI=0.70	0.64	1.20	
Outlying Private Property	1.5E-04	2.5E-03	1.0E-04	1.6E-03	2.40E-05 HI=0.09	2.00E-04 HI=0.50	12.8 HI=0.55	17.5 HI=0.70	0.64	1.20	$1,030,000
Fenced AHC Property	1.5E-04	2.5E-03	1.0E-04	1.6E-03	2.40E-05 HI=0.09	2.00E-04 HI=0.50	12.8 HI=0.55	17.5 HI=0.70	0.64	1.20	
Relocated Residents: Same as Alternative 1					Remaining Residents: Same as Alternatives 3 through 7						With Alternative 2: $1,610,000 to With Alternative 3: $5,240,000 (42-inch removal)
Relocated Residents	4.7E-05	1.7E-04	1.0E-04	1.6E-03	2.05E-05 HI=0.07	4.93E-05 HI=0.17	12.8 HI=0.51	13.5 HI=0.54	0.58	0.71	$1,040,000
No Action	1.5E-04	2.5E-03	1.0E-04	1.6E-03	2.40E-05 HI=0.09	1.42E-04 HI=0.50	12.8 HI=0.55	17.5 HI=0.70	0.64	1.20	Not Applicable
Current High Use Areas	4.7E-05	1.7E-04	1.0E-04	1.6E-03	2.05E-05 HI=0.07	4.93E-05 HI=0.17	12.8 HI=0.51	13.5 HI=0.54	0.58	0.71	6-inch removal: $ 1,550,000 12-inch removal: $ 2,040,000 18-inch removal: $ 2,380,000 42-inch removal: $10,350,000
Outlying Private Property	4.7E-05	1.7E-04	1.0E-04	1.6E-03	2.05E-05 HI=0.07	4.93E-05 HI=0.17	12.8 HI=0.51	13.5 HI=0.54	0.58	0.71	
Fenced AHC Property	4.7E-05	1.7E-04	1.0E-04	1.6E-03	2.05E-05 HI=0.07	4.93E-05 HI=0.17	12.8 HI=0.51	13.5 HI=0.54	0.58	0.71	

Potential Failure Criteria

Remedial Alternatives	Potential for Ground-Water Contamination	Potential Changes in Land Uses	Potential Failure of Institutional Controls	Potential Failure of Soil/Vegetative Cap	Potential for Existing or Replacement Wells to be come Contaminated	Potential Exposure of Humans to Elevated Metals Concentrations in Soil or Ground-Water Resulting from Soil Leaching	Potential Exposure of Humans to Elevated Metals Concentrations in Soils Resulting from Soil Disturbance	Potential for Recontamination of Soil and Surface Water via Fugitive Dust from Adjacent Contaminated Areas
#1 Relocation of All Residents	M [1,4]	H [4]	H [4,7]	NA [4,9]	NA [3,14]	NA [4,16]	NA [4,16]	NA [21]
#3 Complete Soil Removal from Private Property with On-Site Disposal	L to M [2]	H [5]	H [7]	L to H [10,11]	M [15]	L to M [17]	L to M [17]	M [22]
#4 Partial Soil Removal with On-Site Disposal, Partial Soil Till	M [1]	H [5]	H [7]	M to H [10,11,12]	M [15]	M [18]	M [20]	M [22,23]
#5 Partial Soil Fill and Sod Cap, Partial Soil Till	M [1]	H [5]	H [7]	H [10,12]	M [15]	H [19]	H [19]	M [22,23]
#6 Partial Soil Fill and Sod Cap	M [1]	H [5]	H [7]	H [10,13]	M [15]	H [19]	H [19]	H [22,24]
#7 Common Response Actions	M [1]	H [5]	H [7]	NA [9]	M [15]	H [19]	H [19]	H [22,25]
#8 Partial Relocation	M/NA [3]	H/NA [3]	H/NA [3,7]	L to H/NA [3,10]	M/NA [3,15]	L to H/NA [3]	L to H/NA [3]	L to H/NA [3]
#9 Relocation of Houses	M/NA [3]	H/NA [3]	H/NA [3,7]	L to H/NA [3,9,10]	M/NA [3,15]	L to H/NA [3]	L to H/NA [3]	L to H/NA [3]
#11 No Action	M [1]	H [5]	NA [8]	NA [9]	M [15]	H [19]	H [19]	NA [22,21]
#12 Complete Soil Removal Assuming Institutional Controls will not be Effective	L to M [2]	L to H [17]	L to H [17]	L to H [10,11]	M [15]	L to M [17]	L to M [17]	M [22]

AMC Property Options

Fence and Post	M [1]	H [5]	H [7]	NA [9]	M [15]	H [19]	H [19]	NA [22,21]
Establish Vegetation	M [1]	H [5]	H [7]	H [10]	M [15]	H [19]	H [19]	M [22,23]
Tilling and Revegetation	M [1]	H [5]	H [7]	H [10,12]	M [15]	H [19]	H [19]	M [22,23]
Soil Filling with Revegetation	M [1]	H [5]	H [7]	H [10]	M [15]	H [19]	H [19]	M [22]
Soil Removal, Soil Fill, and Revegetation	L to M [2]	H [6]	H [7]	L to H [10,11]	M [15]	L to M [17]	L to M [17]	M [22]

Legend	
H	- High Potential for Failure
M	- Moderate Potential for Failure
L	- Low Potential for Failure
NA	- Criterion Not Applicable to Remedial Alternative

Figure 9.
Potential Failure Ranking Matrix

to prevent others from building new homes in these areas and significant risk levels would remain for areas where soil was not removed. Soil removal to a depth of 18 inches throughout Hill Creek was identified as being less reliable and having a greater failure potential than did permanent relocation or complete soil removal. Complete soil removal was considered less reliable than permanent relocation. Several factors lead to this last conclusion: 1) long-term soil recontamination from adjacent non-remediated sources, 2) potential failure of vegetative cover and, 3) potential for continued direct contact if human activity disturbs the cover. It was concluded that the permanent relocation alternative is preferable and reliable in protecting the health of current Hill Creek residents. This alternative provides adequate protection of the health of these individual (see Table 7). By physically removing residents, direct contact with contaminants is prevented. The remedy is reliable since there are no technical components to "fail". In fact, urinary arsenic levels in all residents that were temporarily relocated in 1986 have decreased further indicating the reliability of this alternative.

Cost Effectiveness

A summary of the cost analyses is presented in Table 8. The alternative with the lowest cost is Alternative 1: Relocation of all residents. It should be noted that ARCO has currently relocated all but 8 residences, leaving a net cost of $300,000 to complete this remedy.

The cost for Alternative #1 does not, however, include the cost of soil cleanup. In the Feasibility Study, the cost of permanent relocation including complete removal and replacement of 6 to 42 in. of soil was compared to similar soil removal and replacement with the residents remaining in Hill Creek so that EPA could consider what the total remedial costs would be for Hill Creek when the interim remedy costs were added to projected costs of a potential final remedy. These comparative costs are summarized below:

TABLE 8. SUMMARY OF COST ANALYSES[a]

Remedial Action Alternative	Capital Costs ($1,000)	O&M Present Worth ($1,000)	Total Present Worth ($1,000)
Alternative 1A	1,470	20	1,490
Alternative 1B1	3,840	120	3,960
Alternative 1B2	5,740	120	5,860
Alternative 1B3	7,700	140	7,840
Alternative 1B4	15,240	220	15,460
Alternative 3A	3,300	360	3,660
Alternative 3B	4,600	400	5,000
Alternative 3C	6,060	410	6,470
Alternative 3D	11,130	440	11,570
Alternative 4A	2,500	340	2,840
Alternative 4B	2,610	350	2,960
Alternative 4C	2,970	360	3,330
Alternative 4D	4,240	390	4,630
Alternative 5	2,320	350	2,670
Alternative 6	1,970	330	2,300
Alternative 7	820	210	1,030
Alternative 8A	1,560	80	1,640
Alternative 8B1	2,320	130	2,450
Alternative 8B2	2,780	140	2,920
Alternative 8B3	3,280	150	3,430
Alternative 8B4	5,050	190	5,240
Alternative 9	1,820	20	1,840
Alternative 12A	4,140	410	4,550
Alternative 12B	6,660	420	7,080
Alternative 12C	8,950	440	9,390
Alternative 12D	17,840	510	18,350

[a] Costs estimated to within +50% and -30%

Soil Depth	Alternative 1 Soil Cleanup with Permanent Relocation	Alternative 12 Soil Cleanup without Permanent Relocation
6"	$ 3,840,000	$ 4,140,000
12"	$ 5,740,000	$ 6,660,000
18"	$ 7,700,000	$ 8,950,000
42"	$15,240,000	$17,840,000

Costs for permanent relocation are lower for all of the soil cleanup depths even though this alternative includes the cost of property acquisition. This is because cleanup can be done at less expense using heavy equipment after homes have been removed, than using more labor intensive cleanup methods around houses. In addition, Alternative 1 provides the greatest protection to the current residents of Hill Creek by reducing risks to background levels. Alternative 1 is therefore the most cost effective remedy consistent with Subsection 101(24) of CERCLA. The temporary relocation alternative (Alternative #13) would have higher total costs than either Alternative #1 or #12 because of the additional costs to temporarily relocate residents until implementation of the final remedy for the Anaconda Smelter site.

Air quality modeling conducted during this remedial investigation identified a very real problem of long-term recontamination of the community of Hill Creek. This modeling identified a rate of recontamination of the soils in Hill Creek of up to 1.5 ppm of arsenic per year. The September, 1987 EPA Endangerment Assessment indicates that even background levels of arsenic in soils pose skin cancer risks of 1.7×10^{-5} (maximum probable scenario). Soils could quickly become recontaminated above background levels and continue to become worse. The source of this recontamination is windblown dust from the smelter and surrounding contaminated areas. Up to 10 square miles is significantly contaminated with high levels of arsenic; vegetation is sparse and wind moves large quantities of dust and soil. This problem will be addressed in a later regional operable unit. The "environmentally preferable" requirement for permanent relocation in Subsection 101(24) of CERCLA is clearly satisfied.

Preference for Treatment

Subsection 121(b) of SARA identifies a preference for implementation of permanent solutions and use of alternative treatment technologies. Alternative treatment technologies evaluated as part of the Hill Creek RI/FS including a deep tilling of contaminated surface materials and leaching of contaminants from surface soils.

A pilot study was conducted to evaluate the effectiveness of various tilling procedures in reducing the surficial soil arsenic, cadmium, copper, lead, and zinc concentrations. Two plots located on Anaconda Minerals Company property were selected for the tilling project. Each plot was subdivided in half. Four tilling techniques were employed, one on each of the subplots.

The measurement of surficial soil metals concentrations before and after tilling demonstrate the relative effectiveness of each treatment. All surficial (0-1 in.) metals concentrations were reduced between 30 and 86 percent. A mean reduction in soil metals concentrations of 62 percent was calculated for all subplots. However, this reduction in soil metals was not adequate to reduce exposure risks to acceptable levels.

A bench test was conducted to evaluate the potential of using topically-applied water to leach the surficial contaminants farther into the soil horizon. Three sites in Hill Creek were chosen to collect soil profile samples. These sites represent slightly different soil types throughout the community. It was impossible to core undisturbed soil columns. Therefore, columns were recompacted to original site densities and land depth intervals.

The results of the soil column leach bench test indicate that the metal concentrations in surficial soils following leaching would be sufficiently high to pose an unacceptable risk to public health. For the final

permanent remedy, additional testing will be necessary to satisfy requirements concerning alternative treatment technologies.

Compliance with Other Environmental Laws

Subsection 121(d)(2) of CERCLA and 40 C.F.R. Section 300.68(i) together require that the lead agency select a cost-effective remedy that effectively mitigates and minimizes threats to and that provides adequate protection of public health, welfare, and the environment. Except as provided in Subsection 121(d)(4) of CERCLA, this requires selection of a remedy that attains or exceeds applicable or relevant and appropriate federal public health and environmental requirements identified for each specific site.

A comprehensive analysis of Federal and State ARARs has been conducted to identify and evaluate ARARs for all remedial alternatives considered in the Mill Creek RI/FS. It is an attachment to the Feasibility Study report. The identification of ARARs in the ARARs analysis was developed for purposes of conducting an RI/FS. The following discussion selects the ARARs that apply only to the selected alternative of permanent relocation and temporary site stabilization. ARARs associated with a permanent remedy will be selected in future operable unit decision selecting a final, permanent remedy. If EPA determines that relocation assistance should be handled by the Federal Emergency Management Agency (FEMA), the action would follow the rules pursuant to the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (44 CFR Part 25).

Federal ARARs

- Primary and Secondary National Ambient Air Quality Standards for respirable particulate and lead (40 CFR Part 50).
- Montanas Air Quality Bureau's requirements for particulate matter and construction/demolition sites (ARM Sections 16.8.821 and 16.8.1401(3) and (4)).

- Federal Water Quality Criteria (40 CFR Part 131) criteria for surface water quality for aquatic life.

- Arsenic at 0.19 mg/l, Cadmium at 0.00066 mg/l, Lead at 0.0013 mg/l, Copper at 0.0055 mg/l, Zinc at 0.059 mg/l.

- OSHA requirements for an occupational health and safety program as well as general and construction industry standards (29 CFR Part 1926 and 29 CFR Section 910.32).

- EPA regulations concerning proper handling and disposal of asbestos materials during demolition activities (40 CFR Section 61.140, et sq).

- Federal requirements regarding archaeological and historic preservation (40 CFR Part 6.301(c), 36 CFR Part 800, and 40 CFR Part 6.301(a and c)).

- Floodplain and wetland management requirements to minimize, to the extent possible, adverse impacts associated with activities in the floodplain (40 CFR Part 6, Appendix A; 40 CFR Sections 6.302 (a) and (b); Executive Order 11990; and Executive Order 11988).

- Clean Water Act Section 404 Dredge and Fill requirements (40 CFR parts 230, 231; 33 CFR part 323 and 330).

- Archeological and Historic Preservation Act (16 U.S.C. Section 469; 40 CFR Section 6.301(b)).

- National Historic Preservation Act (16 U.S.C. Section 470; 40 CFR Section 6.301(b); and 36 CFR Part 800).

- Endangered Species Act of 1973 (16 U.S.C Section 1531; 40 CFR Section 6.302(h); and 50 CFR Part 402.

- Fish and Wildlife Coordination Act (16 USC Section 1531; 40 CFR Section 6.302(g).

State ARARS

- State Historic Preservation Officer's clearance on surface disturbance occurring during demolition of structures.

- Junk Vehicles -- MCA Sections 7 - 10 - 504 and 522.

Other Federal and State criteria, advisories, and guidance to be considered:

a. Health based performance goals of 0.23 ng/m^3 for arsenic and 0.6 ng/m^3 pollution of natural background based in part on EPA carcinogenic potency factors ("Health Assessment Document for Inorganic Arsenic" March 1984, EPA-600/8-83-021F; "Updated Mutagenicity and Carcinogenicity Assessment of Cadmium; Addendum to the Health Assessment Document for Cadmium (May 1981)"; June 1985, EPA-600/8-83-025F and EPA's target risk level of 1×10^{-6} and risk range of 1×10^{-4} to 1×10^{-7} (Public Health Evaluation Manual, 1986) (Alternatives 1, 3, 4, 5, 6, 7, 8, 9, 11, 12)

b. Health based performance goal for arsenic in drinking water of 0.035 ug/l (detection limit for compliance) based in part on EPA carcinogenic potency factors ("Special Report on Ingested Arsenic and Certain Human Health Effects" EPA Risk Assessment Forum/ October, 1986) and EPA's target risk level of 1×10^{-6} and risk range of 1×10^{-4} to 1×10^{-7} (Public Health Evaluation Manual, 1986) (Alternatives 3, 4, 5, 6, 7, 8, 11)

c. See Table 5.2-3 of Feasibility Study report.

d. Other Federal Criteria, Advisories, Guidance and State Standards in NCP at 50 Fed. Reg. 47949-47950.

Operable Unit Consistency with the Final Remedy

Permanent relocation as a first operable unit is consistent with any final remedy that EPA may select at a later date (40 CFR Section 300.68(c)). EPA can elect to clean the vacated townsite in any manner determined appropriate after the residents have been relocated.

VI. SELECTED REMEDY

Based on the evaluation of the remedial action alternatives in accordance with the NCP (40 CFR 300.68) and FS guidance, Alternative No. 1, Relocation of All Residents, has been identified as the preferred remedial action alternative.

This alternative involves buyout of all property owners in the town of Hill Creek and may require condemnation of the community by the United States or the State of Montana in order to accomplish the relocation of those residents who do not wish to relocate. Demolition of structures would be conducted and the entire site would be fenced and posted following relocation of residents.

Temporary stabilization would be performed following demolition of structures. Disturbed areas of the site would be stabilized from erosional forces by establishing and maintaining vegetation on those areas.

Because the Hill Creek area is immediately adjacent to highly contaminated areas of the Anaconda Smelter site, there is potential for continued transport of contaminants into the area. For this reason, and to ensure consistency of the remedy for Hill Creek with that for the remainder of the smelter site, it was decided to consider the final remedy in the Hill Creek area in conjunction with the implementation of the final remedy for the Anaconda Smelter site.

For the detailed analysis of alternatives, Section 300.68(h)(2) of the NCP specifies that an evaluation of reliability, implementability, and constructability be conducted. Alternative No. 1 would be the most reliable alternative, being easily implemented with little or no probability of failure. The alternative is institutionally manageable. Condemnation or other legal procedures could be required to implement complete relocation of residents.

The permanent relocation of all Hill Creek residents is an effective means of eliminating the public health threat to the current resident population. Total relocation of residents would eliminate the pathways of exposure of the resident population to contaminated soil, water, and air sources. This remedy would therefore effectively mitigate and minimize threats to and provide adequate protection of public health on an interim basis.

Useful life of this interim remedial action would be indefinite for the relocated residents of Hill Creek. For the town site, the useful life would be until implementaion of the final remedy. Fences and signs would be required or replaced as necessary to maintain property access control. A final remedy will be required to ensure long-term protection of public health and the environment.

Total relocation of all Hill Creek residents would be of moderate difficulty in terms of implementability. Demolition of all structures at the Hill Creek site could be readily implemented. Revegetation actions on disturbed areas could be easily implemented, but phytotoxicity, semi-arid climate, or other site limitations could adversely affect the establishment of a stable vegetative cover.

The time required to implement this remedial action alternative is dependent on the willingness of the residents to relocate and the institutional issues associated with the relocation action. Once relocation is complete, demolition, fencing, and posting activities could be implemented rapidly.

Total relocation of all Hill Creek residents poses few safety concerns for the relocating population. Worker safety concerns for this alternative include those concerns associated with conventional demolition activities, namely accidental injuries resulting from the use of heavy equipment and movement of debris. No long-term safety concerns for the resident population are associated with this remedy.

Implementation of this remedial alternative would not alter the extent of site contamination. Potential adverse impacts during implementation include short-term increases in windblown dust associated with demolition of structures and localized destruction of vegetation and wildlife habitat.

Constructability, as such, is not applicable to this action.

Consistent with procedures in 44 CFR Part 25, the United States will take adequate measures to ensure that relocating residents of Hill Creek relocate in areas which do not pose a significant risk to public health.

It is anticipated that exposure to arsenic and heavy metals at the relocation sites will be reduced to levels at or near background, making Alternative No. 1 the remedial action alternative with the lowest risk using the health risk assumptions presented in the Endangerment Assessment. Having both the lowest risk and lowest cost ($1,700,000 total present worth based on market value), relocation of all residents is clearly the most cost-effective alternative. In addition, because ARC has aquired all but 8 residences, approximately $300,000 is necessary to complete the remedy. The alternative would also have minimal environmental impacts and would be consistant with any final remedial action.

OPERATION AND MAINTENANCE

O&M requirements for the selected alternative would be simple and infrequent, involving maintenance of fencing and warning signs around the site boundary. Labor requirements for fence and sign maintenance would be minimal as would materials for repair. The reliability of site stabilization of areas disturbed during demolition activities would be dependent on the successful establishment of vegetation on these areas. Certain areas may have levels of contaminants present that would be phytotoxic. It is anticipated, however, that most disturbed areas can be temporarily revegetated, although soil amendments may be necessary. The amount of barren soil remaining in Hill Creek after temporary site stabilization activities would be minor compared to adjacent areas on Smelter Hill.

Operating and maintenance costs include maintenance of the vegetative cover used to stabilize the topsoil cap and maintenance of the fences around the perimeter of the area. An allowance of $35,000 per year was made to cover this cost.

ADDITIONAL DATA REQUIREMENT

The State of Montana 1987 Legislature enacted legislation funding for a state match; a portion of interest money from the resource indemnity trust fund. This legislation also authorized the State to use this interest money to offer (underwrite) bonds to provide increased funding for a State match, as necessary.

The Montana Department of Health and Environmental Sciences (MDHES) is the State Agency responsible for O&M activities and funding (see above paragraph).

SCHEDULE

Activity	Date
Start Enforcement Negotiations	Sep. 3, 1987
RA Signs Record of Decision (ROD)	Oct. 2, 1987
Complete Enforcement Negotiations[a]	Dec. 30, 1987
Begin Remedial Action[b]	Jan. 30, 1987
Complete Remedial Action	Dec. 30, 1988

[a] This time frame is the maximum statutory time frame in subsection 122 (e) of CERCLA. The Anaconda Company (ANC) has already reached agreement with all except eight families to permanently relocate. Therefore, negotiations should be complete.

[b] EPA Region VIII preferred alternative, permanent relocation, has already been initiated by ANC. ANC has undertaken this initiative at its own risk. This date reflects further efforts

needed to complete the remedy. EPA Region VIII preferred alternative also included stabilization of contaminated soils and fencing to restrict access.

FUTURE ACTIONS

The community of Mill Creek is included as an operable unit, under the on-going Anaconda Smelter site RI/FS. Therefore, remedial actions recommended for Mill Creek must be consistent with potential actions for the smelter site. The 160-acre community of Mill Creek will be included under future actions taken on the smelter site.

ATTACHMENT 1

RESPONSIVENESS SUMMARY

HILL CREEK OPERABLE UNIT

ANACONDA SMELTER SITE

ANACONDA, MONTANA

October 2, 1987

TABLE OF CONTENTS

1.0 OVERVIEW

This Responsiveness Summary for the Hill Creek Operable Unit of the Anaconda Smelter Site was prepared to document and respond to the issues and comments raised by the public regarding activities of the U.S. Environmental Protection Agency (EPA) and Anaconda Minerals Company (AMC) at the smelter site. AMC is an operating unit of Atlantic Richfield Company (ARCO) and has responsibility within ARCO for managing the Anaconda smelter properties. In the State of Montana, this operating unit is commonly refered to as "Anaconda" or AMC. However, because AMC is legally a part of ARCO, all further references in the Responsiveness Summary will be noted as ARCO.

EPA prepared an Endangerment Assessment (EA) for Hill Creek and ARCO conducted and prepared a Remedial Investigation and Feasibility Study (RI/FS) to determine the health risks present to residents from concentrations of arsenic and other heavy metals that have resulted from historic smelter activities. A set of remedial alternatives that would protect the present and future public health and welfare of these residents was subsequently developed and made known to the public. These alternatives and the public reaction are summarized in this section.

1.1 REMEDIAL ALTERNATIVES

The Agency (EPA) identified thirteen remedial alternatives in the draft FS for the Hill Creek Operable Unit. Among these alternatives: five involved relocation of residents; four involved removal of contaminated soils; two would make use of soil fill and a sod cap to cover the contaminated soil; one called Common Response Actions would require paving of walkways and driveways, replacement of water supplies, house-cleaning, and replacement of water heaters; and lastly, a "no action" alternative meaning EPA would do nothing at the site.

Four of the thirteen alternatives were identified as the leading alternatives. These alternatives were: relocation of all residents; relocation of all residents and residents' houses; partial relocation with complete soil removal and on-site disposal; and partial relocation with partial soil removal, on-site disposal, and partial soil till. In order to fulfill its primary objective, the protection of public health and welfare of the current residents of Hill Creek, EPA's preferred alternatives involved the relocation of all residents. Soil treatments and other such issues would be considered in the Master RI/FS for the Anaconda Smelter Site as part of the longer-term public health and environmental issues remaining after resident relocation.

1.2 PUBLIC REACTION TO THE PREFERRED ALTERNATIVES

At the time of the public comment period, which opened in December 1986 with the release of the draft FS and closed February 1987, permanent relocation was identified as the preferred alternative by EPA. Subsequently, EPA has chosen relocation of all residents as the selected alternative. It was judged as the most cost-effective and environmentally preferred alternative that would provide for adequate protection of the health of the current residents of Hill Creek.

Public reaction as recorded in written comments or voiced at public meetings was mixed. Atlantic Richfield Company (ARCO), the responsible party, expressed, in several written documents, reservation at the necessity of relocation based upon data and conclusions in the Endangerment Assessment document.

State and local agencies also responded to EPA's activities. The Anaconda-Deer Lodge County Commission expressed a preference for voluntary partial relocation and complete cleanup so that environmental factors would not be an issue in future land use decisions. The Montana Department of Health and Environmental Sciences (MDHES) supported the selection of the

four leading alternatives but did not put forth a favored alternative. In principle, MDHES favors remedial actions that are final and lead to site delisting. EPA received subsequent concurrence from MDHES when the selected alternative was chosen. Concurrence with the selected alternative was also received from the Federal Emergency Management Agency (FEMA).

EPA requested that the Agency for Toxic Substance and Disease Registry (ATSDR) evaluate the RI/FS reports for the Hill Creek operable unit. ATSDR stated that the selection of Alternative 1, Relocation of all Residents, would maximally reduce all public health risks. Comments were submitted on the information used to establish the risk at Hill Creek.

Residents of Hill Creek expressed their reactions to the Agency in various ways; some commented individually, some through a law firm which represented twenty-two residents, and some through a Hill Creek resident who conducted an informal telephone survey. Resident reaction to relocation was divided. About half were willing to move depending on the settlement for their property. About a third expressed an unwillingness to move under any conditions. Others favored soil removal and partial relocation. Many residents expressed concern about the disruptive effect site activities had on their personal lives and on the life of their community. Negative effects on property values and future health problems were additional issues raised in reaction to the relocation alternatives.

2.0 BACKGROUND ON COMMUNITY INVOLVEMENT

2.1 THE COMMUNITY RELATIONS PROGRAM AT THE HILL CREEK OPERABLE UNIT OF THE ANACONDA SITE DURING THE PREPARATION OF THE RI/FS

EPA's activities at the Hill Creek Operable Unit began in late 1984 with the completion of a preliminary Endangerment Assessment in October 1984. In order to make information on the Operable Unit available to residents of Hill Creek and to the general public, EPA established information repositories at the Hearst Free Library and the Metcalf Senior Citizens Center in Anaconda, Montana where fact sheets and the project documents would be kept. EPA also provided for a resident Community Relations Specialist to work with the community of Hill Creek, primarily to explain RI/FS activities to the citizens and to obtain their input. In addition, during the preparation of the RI/FS, EPA representatives met monthly with Hill Creek residents and the Hill Creek Residents' Association.

EPA also participated in local meetings and held discussions with ARCO, the general public, and federal, state, and local agencies. In addition a public meeting to discuss the results of the urinary arsenic study and a public meeting on Superfund activities were conducted by EPA. All of the above mentioned interested groups and entities were consulted in planning and conducting the investigations and evaluations for the RI/FS. All were invited to attend monthly meetings of the Environmental Advisory Committee for the Anaconda Smelter site, where EPA presented and discussed information about the site and options for action. The Environmental Advisory Committee included groups and agencies such as city and county officials, local environmental groups, state officials and EPA representatives. EPA prepared and distributed summaries of these meetings, including EPA responses to issues raised by those who attended. EPA also prepared and distributed six fact sheets with information directly relevant to the Hill Creek Operable Unit.

2.2 SUMMARY OF MAJOR COMMUNITY CONCERNS AND EPA'S RESPONSE DURING THE PREPARATION OF THE RI/FS

Major community concerns that were expressed about the Hill Creek Operable Unit from October 1984 following the completion of the preliminary EA until December 1986 when the RI/FS was released and the formal comment period began can be grouped into five categories. There were questions and concerns about: 1) the remedial alternatives, 2) health risks, 3) cost and funding for cleanup, 4) loss of property values and sense of community, and 5) the Superfund process.

Remedial Alternatives

Concern: The Hill Creek Residents' Association expressed concern that the lack of consensus in the community concerning relocation would negatively effect EPA's decision-making policy and procedure. Residents felt that individual needs would not be addressed in the selection of the remedial alternatives due to this division.

Cleanup alternatives were viewed as not really feasible in the long-run because of several reasons: wind erosion would cause recontamination from contaminated areas outside the community, the size of the cleanup area, and recontamination from property not undergoing cleanup within the community. There were basic information requests concerning details of EPA's proposed removal plan and the extent of soil cleanup necessary to adequately protect children from exposure to contaminated soil.

Response: EPA addressed these concerns in monthly meetings with the Hill Creek Residents' Association. A community relations specialist was provided by EPA to provide current information on the EPA's activities and decisions. EPA prepared and distributed question-answer fact sheets for the residents of Hill Creek.

Health Concerns

Concern: Community health concerns focus primarily on the short- and long-term effects of arsenic exposure on their health, especially the health of their children. In particular, they needed information on what effects of arsenic EPA was studying, where arsenic accumulates in the body and what measures EPA had or was going to make in order to reduce the exposure to arsenic. Some residents asked about adult exposure to arsenic and a rancher sited cattle death from arsenic poisoning and asked if humans were also at risk. Questions were also raised about the health effects of exposure to elevated concentrations of other metals (cadmium and lead) found at the Hill Creek site.

Concerns for pregnant women and other issues related to cancer incidents were expressed.

Response: EPA implemented the following activities in response to these concerns.

- families with children age six and under and other families who may have been at risk from arsenic contamination were relocated pending implementation of a permanent solution to the problem;
- the Hill Creek RI/FS was expedited in order to develop an early solution to the contamination problem;
- the Centers for Disease Control (CDC) was asked to assist in developing the initial study that revealed the high arsenic exposure among the children of Hill Creek, and later to address specific health concerns at two public meetings and with individuals in the community;
- ARCO was required to oil the dirt roads in Hill Creek to reduce residents' exposure to airborne arsenic-contaminated road dust.
- ARCO was ordered to limit exposure to contamination by covering flue dust piles, monitoring the effectiveness of the flue dust cover, assuring controls of dust during demolition at the smelter, and posting warning signs near areas containing flue dust;
- Hill Creek homes were provided with thorough professional house-cleaning to reduce the indoor exposure to arsenic; and

- Hill Creek families were informed about precautions they could take to reduce their exposure to arsenic.

Cost and Funding

Concern: Prior to October 1986 there was concern that funding for the remedial action at Hill Creek might not be available due to the delay in the reauthorization of Superfund. Questions were asked about the amount of money spent by EPA on the remedial planning efforts thus far and about who would bare the ultimate cost responsibility for removal and relocation activities.

Response: EPA officials assured residents that funding was available for temporary relocation and for the expedited Hill Creek RI/FS and proceeded on the assumption that Superfund would be reauthorized. Superfund was reauthorized in October 1986.

Property Values and Stress

Concern: Negative effects on property values resulting from EPA's activities was a pressing concern for residents during remedial planning. They requested that EPA provide full replacement value for their homes if permanent relocation was selected. Residents who wanted to remain in Hill Creek requested compensation for the devaluation of their property and some residents were concerned about losing the right to compensation for permanent relocation if they accepted temporary relocation.

Response: EPA responded to questions by stating compensation rules under Superfund. Replacement value would be considered and moving costs are often paid; however, EPA can not provide compensation for losses in market value for residents who remain in Hill Creek nor compensation for stress. Temporary relocation would not affect compensation for permanent relocation.

The Superfund Project Process

Concern: Residents expressed concern over the length of time that passed before contamination was discovered at the Hill Creek site and the long process to identify a satisfactory solution to the problem. Some residents felt data were not always available.

Questions were raised about citizens input into the decision making process, what factors are considered in selecting a preferred alternative, separation of families, access to private property, and what recourse residents might have to reject the selected alternative.

Response: EPA participated in meetings with residents at which these concerns were raised. EPA solicited input from residents and assured them it would be considered. However, the protection of public health and welfare would remain EPA's first priority.

Scientific study is often slow, but EPA attempted to expedite the RI/FS process as much as possible and release data to the public when it was finalized.

3.0 SUMMARY OF PUBLIC COMMENTS ON THE RI/FS AND ENDANGERMENT ASSESSMENT AND AGENCY RESPONSES

This section summarizes EPA's response to comments received during the public comment period concerning the Mill Creek Operable Unit. Written comments were received from ARCO in two documents: Comments on Mill Creek RI/FS CERCLA Docket VIII 86-07, February 3, 1987 and Comments on Endangerment Assessment: Mill Creek Montana, Anaconda Smelter Site, December 1, 1986, and in Attachment 3: Supplemental Legal Concerns, February 4, 1987. Written and verbal comments were received from individual citizens and their representatives. Comments were also received from Montana state and local agencies. ATSDR submitted comments on the RI/FS as requested by EPA.

EPA has grouped these comments according to topical areas and has prepared responses to them. The commentor is identified in parenthesis at the end of each comment. A complete list of individual commentors is found in Appendix B at the end of the Responsiveness Summary.

3.1 ENDANGERMENT ASSESSMENT

Comments received by EPA on the Endangerment Assessment are grouped into the topical areas of Risk Assessment, Toxicology, and Exposure and are responded to by EPA in the following sections.

3.1.1 RISK ASSESSMENT

Uncertainties Inherent in Risk Assessment

1. Comment: "...the EA failed to follow EPA guidelines (for the conduct of risk/endangerment assessments)...(in its) neglect of uncertainties in risk characterization... Given the high degree of uncertainty (in the EA risk estimates), it could also be argued that the actual health risks may be much lower than those estimated." (ARCO)

   Response: The EA discussed the uncertainties associated with estimating the exposure/risks to Hill Creek residents (e.g., bottom of pp. 46,87). In addition, calculated risks to area residents were described as "most probable" and "worst case" risk estimates, not as absolute risks. The finalized PHE manual suggests that uncertainties should be indicated in the risk assessment. Although the 1986 EA did address uncertainties, a more detailed discussion of uncertainties has been presented in the revised EA. Additionally, scientific publications and reports dealing with the health effects of contaminants, such as that issued by the Risk Assessment Forum of the EPA, extensively discuss any uncertainties relevant to the issues.

2. Comment: Risk assessment are always based on limited data, assumptions, and models. The uncertainties inherent in this process have not been addressed. (ARCO)

   Response: Although the original EA addressed the specific uncertainties associated with the assessment of risks in Hill Creek

(see response to comment 1 above), a more detailed discussion of the uncertainties inherent in the risk assessment process has been provided in the revised EA. Again, it should be pointed out that articles published in the scientific literature or produced by various regulatory agencies commonly include discussions of scientific uncertainty in order to place issues in perspective.

Studies on the Effects of Exposure

3. Comment: "The EA failed to consider the fact that there appears to be no observable adverse health effects to the residents of Hill Creek or of other communities with similar or even greater exposures to arsenic." (ARCO)

Response: The EA considered the evidence that exposures to contaminants in Hill Creek have not been shown to cause acute toxicities (see p. 87, last paragraph). That has little relevance to the carcinogenic risks being experienced by Hill Creek residents at exposure levels too low to cause acute, readily discernible toxicities. It must be emphasized that the primary risks identified at Hill Creek are to children whose risks of cancer will not become apparent for many decades. The long latency of arsenic-induced skin cancer, combined with the relatively small population of Hill Creek, would make it difficult to discern a statistically valid change in the number of cancers in Hill Creek residents. Noncarcinogenic health effects will also be difficult to identify because of the levels of exposure and the small numbers of individuals involved.

4. Comment: The Endangerment Assessment does not consider the Montana Air Pollution Study (July 1981) that demonstrates a high incidence of respiratory disease (including cancer) and circulatory disease in the study area. (Public)

Response: The purpose of the EA is to assess risks associated with current or future use of a particular study area. The Montana Air Pollution Study addresses risks that occurred in the past, probably as a result of the smelter operation. Because the smelter is currently shut down and is unlikely to reopen, results obtained in the Montana Air Pollution Study are not directly applicable to current or future exposure and were not considered in the EA.

Exposure to Other Environmental Agents

5. Comment: "Incidence rates of lung cancer due to natural background sources of exposure are much higher than arsenic and cadmium induced rates in Mill Creek. According to EPA's radon report, certain regions of western Montana are likely candidates for elevated radon levels. The lung cancer mortality risks corresponding to these levels (200 picocuries per liter) range from 440-770 cases per 1000." [Average radon levels (4 picocuries per liter) can pose risks ranging from 13-50 cases per 1000.] (ARCO)

Response: The existence of background risks to other causes was irrelevant to the focus of the EA which was the calculation of risks resulting from environmental contamination. The purpose of the EA was to assess the risks associated with contamination from specific substances at Mill Creek, and to determine whether or not this contamination poses an imminent and substantial endangerment to public health, welfare, or the environment, irregardless of other non site-related risks. If anything, lung cancer risks due to naturally occurring radon would be additive to these caused by environmental contaminants, making the lung cancer risks even higher than calculated in the EA.

Exposure to "Background" Levels of Contamination in Neighboring Towns

6. Comment: Additional perspective on the risk to residents at Hill Creek would be provided by preparing worst-case and most probable estimates of risk to residents in the reference communities of Livingston, Townsend, and Phillipsburg, Montana. (ARCO)

Response: The EA addressed the health risks to residents of Hill Creek that result from the ARCO smelting activities. To compare those estimates of risk to similar estimates for residents of reference committees with uncertain environmental contamination would be inappropriate.

Health Risks

7. Comment: Worst-case risk estimates are based on combining maximum concentrations of contaminants in all media. As it seems extremely unlikely that the same individual would be exposed to maximum concentrations in several media, this approach may give unrealistic estimates of human exposure. (ARCO)

Response: Although it is unlikely that any one individual would experience exposure to maximum concentrations of contaminants in the various media, the EA presented the range of possible risks for illustrative purposes. The worst-case or highest probable exposure is used to provide an upper limit to the possible risks.

8. Comment: The use of a time-weighted approach to estimating exposure, which would allow consideration of difference in contaminant concentration between high use and low use areas, would have more accurately reflected risks to Hill Creek residents. (ARCO)

Response: There are no data available to justify the use of the high use and low use areas proposed by ARCO.

9. Comment: The Endangerment Assessment fails to demonstrate imminent and substantial endangerment. (ARCO)

Response: Given the demonstration of high exposures of Hill Creek residents to carcinogenic and toxic substances, the EA established an imminent and substantial endangerment.

10. Comment: Risks to adults were not adequately addressed. (Public)

Response: Risks to adults were considered in the EA, but the risks to children were emphasized because of the obligation to protect the most sensitive population.

11. Comment: The risk assessment should not be based exclusively on cancer risks, but should also emphasize other health risks. (Public)

Response: The EA emphasized cancer risks because they were the risks of greater concern. However, other health risks have been more fully developed in the revised EA.

Comparison of Concentrations of Contaminants to Applicable or Relevant and Appropriate Requirements (ARARs)

12. Comment: "...the EA failed to follow EPA guidelines (for the conduct of risk/endangerment assessment)...(in its)...failure to compare media concentrations with requirements, standards and criteria." (ARCO)

Consideration of ARARs is central to the baseline public health evaluation at Superfund sites, and, therefore, they should be considered for the Hill Creek assessment. (ARCO)

Response: Evaluation and Identification of "Applicable or Relevant and Appropriate" Federal and State Requirements for Hill Creek,

Montana, CERCLA Site has been prepared by the EPA and referenced in the revised EA.

13. Comment: The ambient water quality criteria for arsenic (EPA 1980) is not an ARAR for ground water. (ARCO)

Response: The identification of the drinking water ARAR for arsenic (water quality criteria vs. MCL) has been deferred to a later operable unit. See "Evaluation and Identification of "Applicable or Relevant and Appropriate" Federal and State Requirements for Hill Creek, Montana, CERCLA Site".

15. Comment: The MCLs are ARARs for drinking water.

Response: As stated in the review of ARARs for Hill Creek ("Evaluation and Identification of "Applicable or Relevant and Appropriate" Federal and State Requirements for Hill Creek, Montana, CERCLA Site"), MCLs for arsenic, cadmium, and lead are set forth at 40 CFR Section 141.11. These MCLs are not legally applicable to the current Hill Creek drinking water supply because it is not a public water system. However, they are potentially relevant and appropriate.

3.1.2 TOXICOLOGY

Inappropriate Cancer Potency Factors with Respect to Ingestion Exposures to Arsenic.

1. Comment: "of greatest concern is the use of the Carcinogen Assessment Group model and its estimated potency (unit cancer risk) factor is assessing lifetime skin cancer risk due to arsenic ingestion in Hill Creek." (ARCO)

Response: EPA has revieved the CAG model and has endorsed it as relevant and appropriate for use in risk assessments. As is the

Agency policy with all scientific issues affected by new information, the potency factor for arsenic was reviewed and was updated as a result of a series of actions extending over the past year. Based upon the best available information and on a consensus opinion reached by the EPA Risk Assessment Forum, the CAG potency factor has been adjusted. The new value in the October 1986 draft Risk Assessment Forum Report applies to ingested arsenic and has been used in estimating risks at Hill Creek.

2. Comment: "The EA based its estimate of skin cancer from arsenic ingestion of a Taiwan study which is known to be flawed because: the investigators were not 'blinded' as to (exposure);... the Taiwanese drinking water supply was contaminated with other toxic substances known (to have effects on the skin);... the exposed population was racially different...; the Taiwanese study population had nutritional deficiencies and skin conditions... that might influence the disease outcome; and the actual exposure levels from food, soil and water,... are poorly documented..." (ARCO)

Response: It would not have been possible to "blind" a study of this kind, since it would have involved moving people between villages, etc. The possible relationship of other contaminants in the well waters of Taiwan to skin cancer is highly speculative; however, the relationship of ingested arsenic to skin cancer is firmly established. The significance of the comment about race is obscure, and its relevance to the induction of skin cancer by ingested arsenic is unclear. Melanoma, which has been observed to have different prevalence rates in various races, is not at issue in Hill Creek. Any nutritional deficiencies or skin conditions in the Taiwan population may well be similar to those found in the population found in Hill Creek. And, finally, the actual exposure levels of the Taiwanese have been discussed at some length in the CAG document and are felt to be adequately characterized for risk assessment purposes.

The Taiwan study of the risks of arsenic in drinking water is not flawed in the sense that it doesn't provide useful data as implied by the ARCO comment. As with any study, there are minor deficiencies that an epidemiologist would wish to avoid in the design of a perfect study, but the end result of the deliberations of the Risk Forum is a scientific consensus that the data are sufficient to indicate a real human risk of skin cancer from arsenic in drinking water. The October 1986 risk estimate adjusts the unit risk from arsenic ingestion for survivorship for the larger water consumption of Taivanese as compared with U.S. males, utilizes a maximum likelihood approach, and employs a model which is quadratic as well as linear in dose.

3. Comment: The study 'Feasibility Study to Resolve Questions on the Relationship of Arsenic in Drinking Water to Skin Cancer' recommended that the Taiwan based prevalence model should not be used to predict the risk of arsenic... This study was not referred to in the EA, nor was it listed in the table of references, nor was the model modified. (ARCO)

Response: The "Feasibility Study to Resolve Questions on the Relationship of Arsenic in Drinking Water to Skin Cancer" (Andelman and Barnett 1983) was considered during the preparation of the EA. It was not referenced because it is a document that primarily deals with drinking water considerations, whereas the primary exposure of concern at Hill Creek is with contaminated soil. The suggested modification to the CAG risk model for arsenic carcinogenicity (national differences in incidence and prevalence) was not incorporated into the EA because the Agency had not yet endorsed these changes in the model. The Andelman and Barnett report has been addressed in the new arsenic report by the Risk Assessment Forum and has been acknowledged in the bibliography of the final EA.

4. Comment: "The EA appears to have ignored the statements of the EPA Office of Drinking Water in its Draft Arsenic Health Advisory dated

September 30, 1985, which concludes that 'it is judged that there is currently no suitable quantitative risk estimate for excess cancer due to cancer ingestion which is applicable to the US...'. The EA does not in any way attempt to reconcile the risk estimates it derives with the concern in the EPA draft Document." (ARCO)

Response: Although the EPA Office of Drinking Water Draft Health Advisory (HA) was released while the EA was in the final stages of preparation, the draft views expressed in the HA were considered by the scientists preparing the EA. The body of evidence supporting the carcinogenicity of ingested arsenic is overwhelming. Therefore in order to protect human health it is appropriate to use the CAG evaluations of the best available data, which, for ingested arsenic, are in the Taiwan Study. The questions raised about the Taiwan drinking water epidemiological study, i.e., that there are racial differences to arsenic induced skin cancer, that there were other sources of arsenic in the Taiwanese diets, or that there may have been other carcinogens in the deep well waters, have been considered in reaching this decision, and have not changed that evaluation, nor have they prevented the Risk Assessment Forum, which considered the same issues, from endorsing the CAG approach. Additionally, the draft Health Advisory has not been adopted as a final Agency position on arsenic toxicity or on the Taiwan study.

5. Comment: In addition to the EPA Office of Drinking Water, EPA Administrator Lee Thomas also acknowledges the flaws of the Taiwan based model. In a letter to Senator Paul Laxalt, Administrator Thomas cited concerns over the deficiencies of the Taiwan model as one of the bases for his decision to postpone enforcement action under the Safe Drinking Water Act in Fallon, Nevada. Again the EA fails to acknowledge or address the position taken by Administrator Thomas. (ARCO)

Response: EPA acknowledges this position taken by the Agency. However, the Risk Assessment Forum is working to resolve these concerns. The October 1986 draft report of the Risk Assessment Forum supersedes the draft Health Advisory and the correspondence related to Fallon, Nevada, and represents a new Agency position based on the best available information.

6. Comment: "Preliminary results from (an EPA study presented at the) November, 1986 Annual Meeting of the Society for Risk Analysis indicate the EPA now believes that inorganic arsenic potency is more than an order of magnitude less than the value used in the EA." (ARCO)

Response: The Risk Assessment Forum has recommended that the UCR be moved approximately "one order of magnitude" because of new assumptions made when calculating the apparent risk. These include 1) assuming that males performing manual labor in the hot climate drink 3.5 liters of water per day; 2) adjusting the analysis for survivorship in the U.S. population; and 3) using both quadratic and linear dose assumptions to better fit the data to the model. The revisions to the UCR are designed to respond to issues that have been raised by interested parties and that they represent the consensus of the Forum.

7. Comment: ARCO believes that the skin cancer risks in the EA should have been determined based on mortality rather than morbidity and that the morbidity/mortality issue would be considered in determining appropriate remedial measures. (ARCO)

Response: To calculate cancer risks based solely on mortality would not be protective of human health and welfare. Although ARCO is correct in indicating the much lower mortality for skin cancer than for other tumors, this lower mortality is primarily due to the ease of early detection and subsequent treatment. If undiagnosed and not removed, skin cancers can become invasive, metastasizing to various

internal sites where they are much more lethal. Additionally, the skin cancers which have been most easily associated with arsenic exposures are those which occur on non-sun exposed areas. These types of non-melanoma skin cancer may have a worse prognosis than tumors occurring on the sun exposed areas, thus these tumors may well have higher mortality rates than the majority of non-melanoma skin cancers (as cited in Laerum and Iverson 1981).

In addition, there are new data that implicate arsenic as a cause of internal cancers, including lung, liver, bladder, and kidney tumors (Chen et al., 1985; Chen et al., 1986). These tumors are expected to have high mortalities.

8. Comment: "With respect to the calculation of excess skin cancer risks, ARCO notes that there is a extra conservatism in an arsenic exposure parameter (the parameter "n") used in the CAG model. (ARCO)

Response: The revised arsenic UCR calculated by the Risk Assessment Forum has addressed this issue by using a different approach in estimating the shape of the dose response curve at lower exposures.

9. Comment: The CAG model inappropriately excludes the lower cancer rate found among females in Taiwan. Omitting these conservatisms would result in a net reduction in risk estimates of about a factor of ten." (ARCO)

Response: The CAG model has always considered the cancer rates in females, and the revised UCR developed by the Risk Assessment Forum has calculated cancer risks for males and females. The emphasis on males in the EA has been due to the need to protect the most sensitive population, as there are both male and female residents of Hill Creek.

10. Comment: "An Argentine study linking very high levels of arsenic in drinking water with skin cancer has been referred to in the EA in a

way that obscures the authors' actual conclusions for the situation of interest in Hill Creek." (ARCO)

Response: The comment in the EA referred to the Astolfi et al (1981) study to put the relative arsenic ingestion levels which were found to cause arsenic intoxication and skin cancer in perspective, and was not considering other issues. Although the authors' basis for claiming that "regular intake of drinking water containing more than 0.1 ppm of arsenic leads to clearly recognizable signs of intoxication, and ultimately in some cases to skin cancer" was their review of observations in Taiwan, Germany, Chile, and Argentina, they concluded that drinking water containing <0.2 ppm probably was "not sufficient to cause chronic arsenicism and subsequent cancer" in their Argentina study. Interestingly, the mortality rate from the high arsenic regions of Cordoba for cancer was 23.8% versus 15% for the entire province.

11. Comment: "The EA's conclusions regarding the risks due to arsenic ingestion at Hill Creek are totally at odds with the EPA's promulgated drinking water standard for arsenic." (ARCO).

Response: The Agency has compared the total lifetime ingested arsenic dose in Hill Creek to the MCL and found the Hill Creek dose to be 2.86 ug/kg/day compared to the equivalent MCL dose of 1.43 ug/kg/day. However, the comparison of total ingested arsenic dose in Hill Creek to the MCL and the proposed RMCL (MCLG) at Hill Creek is inappropriate for the reasons described below. A comparison of soil contamination to the MCL for arsenic is inappropriate. EPA's "Superfund Public Health Evaluation Manual (page 58, ICF, October 1986) states that "ARARs should correspond to the medium (e.g., air, water) for which they were developed and must be applicable or relevant and appropriate for site conditions." MCLs are clearly not applicable to soil contamination. MCLs are required by law to reflect the technological and economic feasibility of removing contaminants from drinking water.

(See Section 1412(b)(4) of SDWA and page 58 of Superfund Public Health Evaluation Manual). Such considerations are clearly not "relevant and appropriate" to soil concentrations at Hill Creek. Technical and cost considerations of drinking water treatment are simply not relevant to soil contamination. In addition, the technical and economic feasibility of soil removal are not a significant issue at Hill Creek. Such removal is technically and economically feasible.

SARA and the NCP allow identification of cleanup goals that attain or exceed ARARs (Section 121(d) of SARA, 40 CFR Section 300.68(1) and 50 Fed. Reg. 47919 November 20, 1985). The Agency's Superfund Program has established a 10^{-6} excess cancer risk as its remedial action primary target. On a site specific basis the Agency can establish a remedial action objective of between 10^{-} and 10^{-7} excess cancers. At Hill Creek the background concentration of arsenic in soils is approximately 9 to 16 micrograms/gram. This level of arsenic in soil yields a 1.7×10^{-5} excess cancer risk for the "reasonable maximum scenario" and 1.7×10^{-6} excess cancer risk for the "average case scenario". Both of these scenarios yield an excess cancer risk calculation falling between 10^{-4} and 10^{-7} excess cancers, and the "average case scenario" cancer risk is the same as the 1×10^{-6} excess cancer risk primary target established by the Agency's Superfund Program. In accordance with the guidance which permits site specific decisions, EPA has preliminarily identified the background soil arsenic concentration of approximately 9 to 16 micrograms/gram as the remedial action objective at Hill Creek.

The primary taret for overall site cleanup to 10^{-6} excess cancers for the cumulative dose from all pathways will be used in establishing the potential cleanup levels for the site. The measure of cleanup success for drinking water has been preliminarily identified as the detection limit for arsenic or 4 µg/l. For risk assessment purposes, EPA assumes that one half the detection limit of 2 µg/l arsenic remains in the drinking water. Based on the Risk Assessment Forum's October 1986

draft document addressing the health effects of inorganic arsenic, the risk associated with this level of drinking water exposure is 1×10^{-4} in males. For soils the arsenic concentration at background levels is 9 to 16 micrograms/gram. The cancer risk associated with this arsenic level is 1.7×10^{-6} using the average exposure scenario. Similarly, background concentrations in air correspond to a 5.7×10^{-5} and 1.7×10^{-5} excess cancer risk for arsenic and cadmium, respectively. Clearly EPA's primary target of 10^{-6} excess cancer risk as a site-specific cleanup target is not appropriate when natural background levels of these elements exceed a 10^{-6} cancer risk.

12. Comment: "EPA has permitted exposures which exceed the drinking water standard to persist without requiring action." (ARCO)

Response: As discussed above, the arsenic MCL is not the correct "ARAR" for soils or drinking water at Hill Creek. The MCL for arsenic is set forth at 40 CFR Section 141.11 at 50 µg/l, but the MCL is not legally applicable to the Hill Creek drinking water supply because it is not a public water system. However, the MCL is potentially relevant and appropriate since it is applicable to alternative public water systems which may be available to Hill Creek. In addition, variances granted under Section 1415 of SDWA are granted only where there is poor raw source water which cannot meet an MCL after application of the best treatment technology, treatment techniques, or other means which EPA finds are available taking cost into consideration. Exemptions granted under Section 1416 of SDWA are granted only where, due to compelling factors (including economic factors), a water system is unable to comply with the MCL.

Variances and exemptions can only be granted upon a finding of no unreasonable risks to health, upon establishment of a compliance schedule to cause site compliance with the MCL, and mitigation measures such as medical monitoring, alternative water supplies, etc., to protect health during the limited duration of the variances and

exemptions. See "Guidance for the Issuance of Variances and Exemptions" (May 1979, Office of Drinking Water, WSG 64).

In addition, the unique factors pertaining to EPA and State SDW enforcement discretion at individual community water supplies are not related to or relevant to CERCLA or Mill Creek, Montana's problems.

13. Comment: "Dietary inorganic arsenic intake has been and may be substantial and may in certain population subgroups exceed arsenic exposures in Mill Creek." (ARCO)

Response: The intake of arsenic from dietary sources has little bearing on the risk assessment which is concerned with incremental environmental risk. Use of the UCR from the Taiwanese study for the population in Mill Creek requires the assumption that the dietary levels of arsenic are the same in the two populations. Indeed, if populations in Mill Creek have a greater dietary intake of arsenic than the Taiwanese, then the risk estimates should be revised upward to take into account the additional intake of arsenic from dietary sources.

14. Comment: "Elevated urinary arsenic levels are not an adverse health effect or an indicator of such effects, but are merely an indicator of arsenic exposure." (ARCO)

Response: Elevated urinary arsenic is an indicator of higher than normal arsenic exposure. Given the carcinogenicity and toxicity of arsenic, it is prudent to consider the possible adverse effects in individuals with higher than normal exposures.

15. Comment: "Evidence suggests that arsenic metabolism and induction of adverse effects may operate in a nonlinear fashion. (Some data suggest) a threshold or non-linear response region may exist for the induction of cancer." (ARCO)

Response: The data suggesting a threshold or non-linear dose response region for the induction of cancer are tenuous at best. The fact that there is evidence that one pathway of metabolism saturates at high levels of exposure is hardly convincing given that the mechanism of arsenic induced carcinogenesis is unknown. The reversibility of some precursor skin lesions would also be difficult to evaluate. Risk assessment methods currently in use have no way of incorporating this latter type of information. The use of the linear nonthreshold dose response model is perhaps a conservative assumption (as stated in the EA); however, no other assumptions with regard to plausible dose response relationships are either useful or defensible with the current state of knowledge. When the Risk Assessment Forum applied a quadratic model to the Taiwan data to compare the goodness-of-fit to the linear model, the results were quite comparable, indicating that use of the linear nonthreshold dose model was appropriate.

Additionally, the progression and reversibility of the early lesion is totally irrelevant to the metabolism of arsenic. The issue of nonlinear metabolism was addressed in the Risk Assessment Forum document which cited evidence that methylation capacity in humans is not saturated until doses on the order of 600 to 1000 ug per day (several orders of magnitude over the estimated exposures at Hill Creek) are reached.

16. Comment: The discussion of negative epidemiological studies is very limited, "the EA appears to be selectively excluding studies and information which contrast with its chosen position in the EA." (ARCO)

Response: The negative epidemiological studies reported in the literature were considered in preparing the EA. The studies were generally flawed and of inadequate quality to detect effects. Problems with these studies are noted in the Health Assessment

Document for Inorganic arsenic (EPA (1984) and are included in the EA by reference. Additionally, the other epidemiological studies were considered by the Risk Assessment Forum as reflected in the October 1986 draft report and were found to be deficient. The Forum reaffirmed the appropriateness of using the Taiwan study for risk assessment purposes.

Inappropriate Cancer Potency Factors with Respect to Inhalation Exposure to Arsenic

17. Comment: "Overall, the EA risks from arsenic inhalation are overestimated because the occupational data that EPA used is the basis for the cancer potency estimate included inhalation exposure to cadmium as well as arsenic. Separate consideration of cadmium and arsenic inhalation in Hill Creek results in double counting the risks posed by these elements. The EA should have taken the effects of double counting into consideration in the assessment of cadmium and arsenic inhalation risks." (ARCO)

Response: The UCRs have been developed with an awareness of possible concomitant exposures to other contaminants. Consequently, the UCRs have already been adjusted where adequate data exist to make such modifications. When possible, the UCRs have been based on studies that have one primary contaminant. Therefore, the UCRs for arsenic and cadmium are reflections of only arsenic or cadmium exposures and risks, respectively. See EPA (1984) Health Assessment Document for Inorganic Arsenic for further detail.

18. Comment: "In the case of arsenic,... the Agency did not adjust for the contribution of smoking to the observed lung cancer risk when calculating the UCR." (ARCO)

Response: The Agency considered the potential contribution of smoking to lung cancer risk in deriving the UCR for arsenic but did not adjust

for smoking because the data were often not available. The Agency considered the evidence sufficient to show that arsenic was responsible for the increased incidence of respiratory cancer in exposed workers irregardless of other exposures. (EPA, 1984 Health Assessment Document for Inorganic Arsenic). The Agency acknowledges that the unit cancer risk is an upperbound estimate of risk, i.e., that actual risks may be lower but are unlikely to be higher than the UCR. Even if smoking did have an impact on lung cancer rates in the reported studies, the UCR would be applicable to populations with a similar population of smokers to that of the work place studied.

19. Comment: "...the Agency did not attempt to apportion the observed lung cancer incidence among... contributing causes (in deriving the UCR's for cadmium and arsenic from studies with confounding exposures, e.g., beryllium, sulfur dioxide). The failure to consider these additional factors leads to an inflation of the UCRs developed from these studies which instead of reflecting the results of exposure to a single substance actually represent the combined effects of exposures to arsenic, cadmium and smoking as well as other factors." (ARCO)

Response: The Agency considered the potential contribution of other agents to lung cancer risk in deriving the UCR arsenic. Exposure to these other agents was not felt to have a significant impact on the cancer risk attributable to arsenic and the agency considered the evidence that arsenic was a human lung carcinogen sufficient irregardless of exposure to other agents. The Agency acknowledges that the UCR is an upperbound risk estimate. See EPA (1984) Health Assessment Document for Inorganic Arsenic.

20. Comment: ARCO felt that in developing arsenic inhalation UCRs EPA significantly underestimated exposures to the compounds of concern by ignoring exposures during non-working hours. CAG did not take into consideration that the majority of smelter workers lived in nearby communities and were thus exposed to environmental levels for 16 hours

per day for 240 days and 24 hours per day for essentially the rest of the year. This failure to account for environmental exposure leads to an overestimation of the cancer potency. (ARCO)

Response: The available data indicate that environmental levels of cadmium and arsenic are considerably lower than in the work places studied. If CAG had used environmental exposures to calculate the UCRs, the cancer potency values would have been higher. Given the relatively low exposure in the environment as compared to the high levels in the workplace, the failure to include environmental, nonworkplace exposures in the calculation has had an insignificant effect on the UCR.

21. Comment: The respiratory health effects including noncarcinogenic effects of arsenic are not adequately addressed. (Public)

Response: The EA was written to evaluate the current health risks at Hill Creek. The adverse health effects reported during the operation of the smelter are not relevant to the purpose of the EA, and no current data are available on the respiratory health effects in Hill Creek.

Inappropriate Cancer Potency Factor with Respect to Ingestion Exposure to Cadmium and the RfD

22. Comment: The noncarcinogenic hazard index for cadmium exposure was inappropriately derived as it was based on an HCL rather than on an ADI or RfD. The HCL represents only a fraction of the ADI. (ARCO)

Response: While it is usually true that the HCL is only a fraction of the ADI, there are instances where the HCL may approximate the ADI. In the revised EA, the best available data has been utilized to develop an ADI for ingested cadmium, including consideration of other possible sources of cadmium.

Inappropriate Cancer Potency Factor with Respect to Inhalation Exposure to Cadmium and the RfD

23. Comment: "Overall, the EA risks from cadmium inhalation are overestimated because the occupational data that EPA used as the basis for the cancer potency estimate included inhalation exposure to arsenic as well as cadmium. Separate consideration of cadmium and arsenic inhalation in Hill Creek results in double counting the risks posed by these elements. The EA should have taken the effects of double counting into consideration in the assessment of cadmium and arsenic inhalation risks. (ARCO)

Response: The UCRs have been developed with an awareness of possible concomitant exposures to other contaminants. Consequently, the UCRs have already been adjusted where adequate data exist to make such modifications. When possible, the UCRs have been based on studies that have one primary contaminant. Therefore, there is no double counting involved, and it is appropriate to consider the effects of arsenic and cadmium on lung cancer as additives while evaluating risks in Hill Creek. See EPA (1984) Health Assessment Document for Inorganic Arsenic.

24. Comment: The EA did not use the most up-to-date UCR for cadmium inhalation which would further reduce the risk estimate. (ARCO)

Response: The best currently available UCR has been used in the EA. Currently EPA is recommending a UCR or 1.8×10^{-3} $(ug/m^3)^{-1}$ equivalent to 6.1 $(mg/kg/day)^{-1}$. This value was reported in the EA but was inadvertently not used in the risk calculations. A recent document prepared by the State of California Department of Health Services (DHS 1986) and based on new information provided by Thun (1986) suggests that the UCR for cadmium may be underestimated in the EPA CAG

document. A careful consideration of this new evidence has been conducted before determining the proper UCR for use for cadmium in the EA.

25. Comment: ARCO felt that in developing the cadmium inhalation UCRs, EPA significantly underestimated exposures to the compounds of concern by ignoring exposures during non-working hours because CAG did not take into consideration that the majority of smelter workers lived in nearby communities and were thus exposed to environmental levels for 16 hours per day for 240 days and 24 hours per day for essentially the rest of the year. This failure to fully acknowledge the conditions of the underlying studies leads to an overestimate of the UCRs thus developed." (ARCO)

Response: As stated in another response, the available data indicate that environmental levels of cadmium and arsenic are considerably lower than in the work places studied. If CAG had used environmental exposures alone to calculate the cadmium UCR, the cancer potency value would have been much higher. Given the relatively low exposures in the environment as compared to the high levels in the workplace, the failure to include environmental, nonworkplace exposures in the calculation has had an insignificant effect on the UCR.

26. Comment: The respiratory health effects of cadmium are not fully evaluated (Public)

Response: The calculated inhalation exposures of cadmium were not thought to be high enough to cause acute respiratory health effects in and of themselves. In other to be more complete, the revised EA has fully considered such effects.

Inappropriate Approach To Determine Health Risk Associated with Exposure To Lead.

27. Comment: "The EPA states that it has chosen to depart from the standard exposure assessment procedures because of the extreme dependence of lead toxicity on its chemical form in the environment and individual variation in susceptibility to toxic effects. Thus, the EA concludes the body burdens are more accurate indications of toxicity than exposure. Since, however, the EA merely estimates body burden (i.e., blood lead) levels for Hill Creek based on environmental contaminant levels rather than actually measuring blood lead, it is unclear how this approach provides any increase in assessment validity over using the approach to evaluating health risk based on exposure. Specifically, the EA suggests that the values used in the multimedia scenario may underestimate exposure. However, use of one of the data sets indicates that the model may overestimate exposure. (ARCO)

Response: Nowhere does the EA state that "it has chosen to depart from the standard exposure assessment procedures because of the extreme dependence of lead toxicity on its chemical form in the environment." Dosimetry is critical to risk assessment and the preferred estimate is the "effective" dose--the dose delivered to the target which induces the adverse effect. More often than not, however, it is necessary to estimate the "exposure" dose-- the dose to which an individual is exposed. In the case of lead, it is possible to get a step closer to the "effective" dose by estimating the dose which makes it into the blood stream--the blood lead level. Since the toxicity of lead has been correlated with blood lead levels and shows a much better relationship to these (the intake "doses"), the EA estimates the blood lead levels because the toxicity information is provided in terms of blood lead levels correlated to adverse effects, e.g., neurotoxicity.

The apparent variation of the regression coefficients among studies is discussed in the EA, and the reasons for selection of specific values are explained. It would not be scientifically justified to use a regression coefficient from any one of the studies without considering the others.

28. Comment: The intercept term used in the risk estimate for lead of 12.7 ug/dl may result in an overestimation of exposure and risk. (ARCO)

Response: The intercept term of 12.7 ug/dl was obtained from a draft EPA document (EPA 1983). More recent data (CDC, 1985, Preventing Lead Poisoning in Young Children) suggest that a value of around 6-7 ug/dl may be more appropriate. This updated value has been used in the revised EA.

29. Comment: The potential health risks associated with exposures to lead are not sufficiently addressed. (Public)

Response: Toxic effects of lead that are observed at low exposure levels are discussed in detail in the EA. Toxic effects that are only associated with very high exposure to lead or that are minor compared to effects occurring at the same or lower levels of exposure are discussed briefly or not at all in the EA, because these effects are either considered unlikely to be manifested in the Hill Creek area or if they did occur would have only a minor impact relative to more serious effects that would be present. A complete discussion of the health effects associated with exposure to lead is beyond the scope of the EA.

Carcinogens Not Addressed at the Hill Creek Site

30. Comment: "Medical data and research indicate that ten metals or compounds of these metals can be considered carcinogenic." These

metals also pose other health risks. However, several of these metals were not considered in the EA and the additional or synergistic effects of these metals were not considered. (Public)

Response: Arsenic and cadmium are considered carcinogenic by EPA, are present at elevated levels in the Hill Creek area, and were therefore considered as carcinogens in the EA. Lead and zinc are present at elevated levels in the Hill Creek area but are not considered to be carcinogenic by EPA and were therefore treated as noncarcinogens in the EA. (It should be noted that certain lead salts are considered carcinogenic but the metal itself is not considered to be a carcinogen.) Certain nickel salts and beryllium are considered carcinogenic by EPA but were not detected at elevated concentrations at Hill Creek and were not considered as they would not affect the excess lifetime cancer risk. Cobalt, iron, and titanium not present at elevated concentrations at Hill Creek, are not considered to be carcinogens by EPA, and therefore were not considered. The metals present at background levels will have no effect on the excess carcinogenic risk associated with exposure to carcinogens if they interact in an additive fashion. No information is available on potential antagonistic or synergistic interactions and therefore such interactions were not discussed in detail in the EA. However, this does not preclude EPA from considering the additive effects on individual organs.

Effect of Interactions Among the Metals Present at the Hill Creek Site

31. Comment: "...the EA failed to follow EPA guidelines (for the conduct of risk/endangerment assessments)...(in its) failure to develop a hazard index for multiple chemical exposure. (ARCO)

Response: The development of a hazard index for the multiple chemical exposure was considered during preparation of the EA but was not adopted for two reasons. Firstly, the proposed guidelines were not

yet adopted as Agency policy when the EA was written, and, secondly, estimated additive toxicities were thought to be minor compared to the carcinogenic hazards of arsenic or cadmium, or to the acute toxicities of lead. The revised EA has developed a hazard index for multiple chemical exposure.

32. Comment: "In the EA, the Agency has suggested that the risks potentially posed to the Hill Creek residents by smelter-related contaminants may be intensified by the presence of multiple contaminants. There is no evidence suggesting the enhancement of adverse effects for the elements of concern due to the presence of the other contaminants. ...evidence exists that interactions between these elements (Cd, As) may be slight or antagonistic rather than additive." (ARCO)

Response: This comment misrepresents the discussion of additive toxicity on page 90 of the 1986 EA, which simply points out that contaminants affecting the same organ should be viewed additively unless there is sufficient data to support another assumption.

33. Comment: The additive or synergistic interactions among chemicals are poorly understood at this time. (Public)

Response: The interactions between the contaminants of concern at Hill Creek are poorly understood because there is so little experimental information. This situation is not likely to be resolved in the near future because of the inherent study design difficulties.

34. Comment: The cumulative hazard index for lead exposure and cadmium ingestion is inappropriate because the toxicological endpoints are different. (ARCO)

Response: If two agents cause similar toxicities to an organ by unknown mechanisms, then it is Agency policy to consider the effects

to be additive. (Guidelines for the Health Risk Assessment of Chemical Mixtures, EPA 1986; FRSI, No. 185, September 24, 1986; pp. 34014-34023).

Potential Beneficial Effects of Arsenic

35. Comment: "...the EA should have taken into account the possible beneficial aspects of arsenic ingestion at low doses." (ARCO)

Response: The National Academy of Science report on the possible role of ingested arsenic as a dietary essential element was evaluated during the preparation of the EA. It was decided that the evidence for it being an essential element was not sufficient to incorporate into the EA, which was considering the adverse effects of the ingestion of much higher levels of arsenic. The Risk Assessment Forum has recently evaluated the same issue and has concluded that the data supporting arsenic as an essential nutritional element is insufficient.

3.1.3 EXPOSURE

Exposure to Background Concentrations of the Contaminants

1. Comment: "The EA fails to note that the ambient air concentrations of cadmium and arsenic, and hence the estimated inhalation risks are essentially at background, i.e., the levels which would exist in the absence of the smelter." (ARCO)

Response: The September, 1987 Endangerment Assessment/Public Health Evaluation: Mill Creek, Montana Anaconda Smelter site presents airborne concentrations of trace elements in Mill Creek during 1984. For arsenic during 1984 observed average values (82 samples) exceeded background levels (.01 ug/m^3) for both arsenic and cadmium by a factor of 3 (0.039 ug/m^3). In addition, the Final Remedial Investigation

Report for Hill Creek, Montana reports preliminary data on particulate matter and heavy metal concentrations in close proximity to the Smelter collected from August 1986 to February 1987. These data show an average arsenic value of .024 ug/m^3 at station HCW. The August 1986 to February 1987 data set also reported maximum cadmium values of 0.043 and 0.031 ug/m^3 (at the Kortum Storage and HCW stations, respectively) which exceed the background cadmium concentration reported for western states (0.01 ug/m^3).

2. Comment: "... the EA failed to follow EPA guidelines [for the conduct of risk/endangerment assessment] ... [in its] ... neglect of background concentrations of contaminants." (ARCO)

Response: The EA did not neglect background contaminant levels in its conduct of the risk/endangerment assessment (e.g., Tables 1 and 10 in the EA). As can be seen from these tables, and particularly from Table 1, concentrations of arsenic, cadmium, and lead are clearly above expected background levels. See Appendix B, Background Arsenic, Cadmium, and Lead Concentrations in Soil, Water, and Air for Hill Creek, Montana in the Final RI/FS for background levels. Levels of contamination found in Hill Creek exceed background levels.

3. Comment: The levels of lead in soil at Hill Creek are comparable to levels in urban soil. (ARCO)

Response: Whether or not lead levels in soil at Hill Creek are equal to urban levels is irrelevant to whether or not there is a health risk. However, EPA is in the process of banning lead in gasoline, and lead has been removed from a number of other commercial products in order to lower exposures in urban areas.

Inappropriate Samples

4. Comment: "Evaluation of contaminant levels and exposures at Hill Creek suffers from numerous deficiencies which call into question the conclusions for the EA's analysis. ... For example, comparisons of data taken by TetraTech and Ecology and Environment (E&E) suggest that the sample for E&E house number 16 (the source of the maximum lead concentration used in the worst-case analyses) was taken in a garage, which is likely to have sources of lead contamination other than the smelter. Similarly, TetraTech's data indicate E&E house number 14 was uninhabited at the time of sampling. If this is the case, dust and dirt are likely to have accumulated in this home." (ARCO)

Response: The choices of which data to use in estimating the possible exposure levels of residents of Hill Creek were made very carefully during the preparation of the EA. Data were selected, where possible, that had been subjected to the full rigors of the EPA data verification program. The ARCO comment about the inappropriate bias injected in the EA by use of an E&E soil sample value for house number 16 needs to be considered in light of other lead soil values in Hill Creek that were in the same range. Consequently, the reported value of house number 16 has supportive data that substantiate its appropriateness. Similarly, the comment that house number 14 (E&E) was uninhabited at the time of sampling does not deny that the levels of contaminants were high in the house, were higher after professional house cleaning, and were similar to those in other sampled houses. It is also likely that had the house been inhabited at the time of sampling that normal household activities (i.e., open windows, inhabitants tracking dirt into the house, etc.) would have increased the soil contamination levels detected in the house. The issues raised by ARCO do not constitute "deficiencies" in evaluation of contaminant levels or exposure in these instances which would "call into question the conclusions of the EA's analysis." In addition,

much of the data used by EPA was collected by contractors employed by ARCO and was not identified as being of limited value.

5. Comment: "In a related issue, the EA was inconsistent in its use of the available data. For example, in calculating mean soil concentrations, the EA specifically omits the data collected by E&E, claiming that it might "bias the contamination values toward those in soils closer to the homes" which the EA suggests were more likely to have been disturbed by Hill Creek residents (EA, p. 26). Yet later, the EA uses one of these data points (specifically, the high lead value questioned above) for use in evaluating the worst-case exposure scenario." (ARCO)

   Response: The EA was not inconsistent in its use of the available data. The decision not to use samples collected where soil might have been disturbed by Hill Creek residents was made to most accurately determine possible contamination over time at the residence. The E&E data is within the same general range, but was not considered to be as representative as other data. Use of one of the excluded data points for another purpose is not inconsistent with this approach. As pointed out above in response to another comment, ample data exist to justify the use of the lead soil values as an indication of possible minimal and maximal likely case exposures.

6. Comment: People on-site are more likely to contact fine material in soils and, therefore, use of 3-inch soil samples may not be appropriate. Bossard and Associates collected samples of fine (less than 45 microns in diameter) from throughout the Hill Creek area, composited these samples into five samples for analysis, and reported that arithmetic mean concentrations of metals in this soil. These arithmetic mean concentrations were then compared with the geometric mean concentrations of metals in 3-inch soil samples. Based on this comparison, Bossard noted that concentrations of metals in finer soils are higher than in the 3-inch samples. (Public)

Response: Although it is possible that people are more likely to contact finer soil particles, it is not possible to conclude definitively that this is the case. In addition, it is inappropriate to compare arithmetic mean concentrations with geometric mean concentrations of metals. Finally, the maximum soil value used in the worst-case exposure assessment in the EA is the above the arithmetic mean concentration for soil arsenic and, therefore, use of the Bossard data would give a value within the range of risks already presented in the EA.

7. Comment: Sampling in the Mill Creek area appears to have been conducted randomly without a defined plan. (Public)

Response: Over the years, there have been many sampling activities by ARCO and by EPA directed toward defining the environmental hazards to Mill Creek residents, or toward determining the effects of ARCO smelting activities on the surrounding area. The more recent samplings have been designed to specifically determine the levels of contaminants in media that would present exposure to residents. These efforts have been successful; they have consistently documented excessive levels of contaminants and have been found to be statistically representative. Further sampling efforts might be required to determine effectiveness of any remedial activities.

Assumptions Inconsistent with EPA Guidance

General Response: Assumptions used in the revised EA have been changed to be consistent with the finalized PHE manual (EPA 1986) or if the assumptions are not followed, an explanation of the reason for the deviation is presented. EPA may depart from the guidance when it has adequate reasons to do so.

8. Comment: "... the EA failed to follow EPA guidelines [for the conduct of risk/endangerment assessment] ... [in its use of 76.2 year lifespan vs. 70-yr recommended value] ...." (ARCO)

Response: The EA followed the best available EPA guidance in the use of a 76.2-year lifespan vs. the 70-year lifespan recommended in the draft public health evaluation document referenced by ARCO. The recommendation to use 76.2 years came directly from CAG, and is a more representative number for the present day. However, to be consistent with current EPA guidelines for site-specific risk assessments presented in the finalized PHE manual (EPA 1986), a 70-year lifetime was used to calculate risks in the revised EA.

9. Comment: "... the EA failed to follow EPA guidelines [for the conduct of risk/endangerment assessment] ... [in its use of body weights for children 2-6 of 13 to 22 instead of the 10 to 25 kg recommended] ...." (ARCO)

Response: As stated in the previous response, the use of body weights for children 2 to 5 of 13 to 22 kg, instead of 10 to 25 kg recommended in the public health evaluation guidelines, was based upon the specific recommendation of CAG at the time the EA was prepared. However, as noted above, values reported in the finalized PHE manual were used in the revised EA.

10. Comment: "... it should be noted that the absorption factor for arsenic inhalation used by EPA in its calculations for Hill Creek (0.40) differs from that used by the EPA's CAG (0.30)." (ARCO)

Response: As stated above in response to several comments about the approach or assumptions used in evaluation the exposures of risks in the EA, the percent retention of 0.40 for inhaled arsenic was suggested by CAG. Given the particulate sizes and the physiodynamics of human respiration, such a factor appears to be correct. However,

as the figure of 30 percent absorption is presented in the EPA (1984) Health Assessment Document for Inorganic Arsenic, this value was used in the revised EA.

Bioavailability of Arsenic

11. Comment: "... the EA should have taken into consideration the reduced bioavailability of soil-bound arsenic." (ARCO)

Response: The values used in the EA to estimate the arsenic bioavailability in ingested soil are based upon the best estimates in the published literature, and follow normal EPA guidelines.

12. Comment: The assumption that between 88 and 98 percent of soil-bound arsenic is absorbed following ingestion is inappropriate and leads to an overestimation of risks. (ARCO)

Response: As stated above, the listed values, developed in the EPA (1984) Health Assessment Document for Inorganic Arsenic, were the best available in the published, peer-reviewed literature and were deemed to be scientifically appropriate for the EA.

13. Comment: Bench tests of arsenic extractability were not considered in the report (ARCO).

Response: The preliminary data presented by ARCO about the bioavailability of soil-bound arsenic are not of use for the following reasons: (1) the full conditions of the tests are not known; (2) the experiments have not been published in the peer-reviewed scientific literature; and (3) there is no evidence presented about the biological relevance of the rudimentary tests conducted.

There is a discrepancy between the description provided in the text and the actual experimental data reported in Tables 1 and 2 for the

simulated stomach digestions. The introduction refers to SOP-026 (TetraTech 1984) as a procedure for digesting soil samples in HCl (pH 0.8 and pH 2) at 37° in an attempt to mimic stomach conditions. Tables 1 and 2 report on the leaching of metals from soil samples upon digestion at 37° with mixtures of HNO_3/H_2O_2 and $HNO_3/HClO_4$ at pH 0.8 and pH 2. A significant difference between the two procedures is the oxidizing power of the latter combinations relative to HCl solutions.

A complete, step-by-step description of the digestion procedure was not available at this time. This would be critical in establishing how closely the digestion procedures approach the absorption process under physiological conditions. Absorption through a membrane represents a non-equilibrium situation because absorbed material is rapidly removed by the systematic circulation. The digestion procedure used by TetraTech is suggestive of an equilibrium situation where the amount measured as leachate represents a partition value between the liquid and solid phases. Thus, the appearance of metal in the liquid phase indicates that the material is extractable from the soil matrix under the conditions used. The question of how to apply this number to predict bioavailability is more difficult to answer. At pH 2, only 30 percent of arsenic is extracted into the liquid phase in the digestion study. If this information is pertinent to absorption from the gut, one can presume that under physiological absorption conditions only 30 percent of the arsenic would be immediately available for absorption. However, as the metal is removed from the liquid phase by absorption through the stomach or intestinal walls, more metal is released from the solid matrix in order to maintain equilibrium. The final absorption number is likely to be higher than that initially determined by the digestion procedure.

Calculation of Cadmium Exposure

14. Comment: "... the EA made an order of magnitude error in estimating the worst-case cadmium ingestion level which would result in reducing the risk estimate to well below that corresponding to the cadmium drinking water standard." (ARCO)

Response: This error has been corrected and the revised EA will reflects the new value.

Limited Use of the Urinary Arsenic Measurements

15. Comment: "To date, EPA has mainly justified its concern for public health and excess skin cancer risk on the urine arsenic results for children in Hill Creek. Yet, the EA makes no use of the urine arsenic results in calculating its risk estimate." (ARCO)

Response: The EA did use the urine arsenic results to verify the reasonableness of the calculated arsenic exposure in Hill Creek (p. 87), but this point has been further developed in the revised EA. Under steady state conditions, the concentration of arsenic in urine corresponds to 60 percent (approximately) of the absorbed dose (Valentine et al. 1979, Buchet et al. 1981, Charbouueau et al. 1981).

From Table 14 (Hill Creek Endangerment Assessment):

Arsenic levels in urine (µg/liter): range 12-118 (Hill Creek)
range 4-150 (Anaconda West)
range 4-41 (Anaconda East)

Subtract 25 µg As/liter as a reasonable value for dietary contribution (IARC Monograph No. 23, pp. 72-73):

	µg As/liter urine [× 1/0.6]	Absorbed As (µg)
Hill Creek	93	155
Anaconda West	125	208
Anaconda East	16	27

Corresponding soil concentrations assuming ingestion of 100 mg:

	As (ppm) in Soil
Hill Creek	1,550
Anaconda West	2,080
Anaconda East	270

The calculations assume 100 percent absorption of arsenic in soil; lower absorption would lead to higher soil concentrations of arsenic in order to account for the urinary concentrations measured. This leads to the conclusion that the bioavailability of arsenic in soil should be considered high.

From Hill Creek Endangerment Assessment:

- o children ingest 100 mg/day of soil
- o arsenic concentration 2,180 ppm (highest QA/QC)
  541 ppm (geometric mean)
- o absorption fraction 0.88 to 0.98
- o daily ingestion: 54µg/g soil x 0.1 g soil x 0.80(0.98) = 43 (53) µg

References

Valentine, J.; Kaug, H.K.; and Spivey, G. 1979. Arsenic levels in human blood, urine, and hair in response to exposure via drinking water. Environ. Res. 20:24-32.

Buchey, V.P.; Lauvery, S.R.; and Roels, H. 1981. Urinary excretion of inorganic arsenic and its metabolites after repeated ingestion of sodium metaarsenite by volunteers. Int. Arch. Occup. Environ. Health, 48:111-118.

Charbouneau, S.M.; Spencer, K; Bryce, F.; and Sandi, E. 1979. Arsenic excretion of monkeys dosed with arsenic-containing fish or with inorganic arsenic. Bull. Environ. Contam. Toxicol. 20:470-477.

16. Comment: "Elevated urinary arsenic levels are not an adverse health effect or indicator of such effects, but are merely an indicator of arsenic exposure." (ARCO)

Response: Elevated urinary arsenic is an indicator of higher than normal arsenic exposure. Given the known human toxicities or arsenic, it is prudent to consider whether individuals showing evidence of increased exposures to arsenic (as indicated by elevated urinary levels) are likely to suffer adverse effects.

17. Comment: Urinary arsenic levels in Hill Creek children are high. They may not be substantially above levels in other locations, but the Hill Creek environment may be more complex than other areas reporting high urinary arsenic levels. (Public)

Response: The observed urinary levels of arsenic in children in Hill Creek are of concern in and of themselves because of the carcinogenicity of arsenic. Additionally, the urinary arsenic levels may indicate that children of Hill Creek might be susceptible to other, as yet poorly understood, diseases. The presence of other contaminants in the Hill Creek environment raises the possibility that there could be additive or synergistic effects of the contaminants in causing toxicities.

Historical Sampling Data

18. Comment: Air quality sampling data collected prior to cessation of smelter activities should have been reviewed and included. In addition, data collected during Hill Creek construction should have been included. (Public)

Response: The air quality in the Hill Creek area was likely to have been significantly different from current conditions when the smelter was in operation. As the purpose of the EA was to assess risks

associated with current and future exposure under the no action alternative, the use of air data from a former time period would be inappropriate in the EA. The data collected while the smelter was in operation may be used in the future.

Form of Arsenic in the Environment

19. Comment: Is the arsenic in the soil trioxide or pentoxide? (Public)

Response: The majority of the arsenic in the soil and ground water of Mill Creek appears to be in the pentoxide form. This has little relevance to health issues, because there is evidence that the pentoxide form is converted to the trioxide form in the body prior to methylation (Marafante et al. 1985), and the appearance of arsenic in the urine is sufficient evidence of bioavailability.

Incidents of Skin Cancer

20. Comment: The high incidence of skin cancer that would be predicted by EPA's UCR has not been observed in U.S. populations with elevated arsenic levels in their drinking water. See Environmental Health Associates, Inc. (1986) An Epidemiologic Investigation of Skin Cancer in Deer Lodge and Silver Bow Counties, Montana 1980-1986. (ARCO)

Response: See response to Comment #20 in Section 4.0 Health Assessment.

21. Comment: There is no evidence in Mill Creek or neighboring communities that any arsenic induced skin cancers have actually occurred. (ARCO)

Response: See response to Comment #20 above.

Other Types of Exposures

22. Comment: Indoor sampling studies were inadequate. Indoor exposure studies should be thorough because people spend much time indoors. (Public)

Response: EPA agrees that indoor sampling was not extensive. However, considering the magnitude of the problem at the Hill Creek area, and that house dust levels may likely correlate with outdoor soil levels it did not seem necessary to determine levels of indoor contamination before proceeding with the EA.

23. Comment: Exposure to house dust via ingestion or inhalation was not directly considered. (ARCO)

Response: This exposure to household dust was considered implicitly in the draft EA and discussed in more detail in the revised EA.

24. Comment: EPA notes that ingestion of garden vegetables grown in contaminated soil may contribute to exposure, but fails to present information documenting this route as potentially significant. (ARCO)

Response: Detail on the potential for exposure to soil metals via ingestion of contaminated vegetables is presented in the revised EA.

25. Comment: The report fails to address the exposure associated with contaminant transport during surface water run-off. (Public)

Response: Exposure to contaminants mobilized during surface water run-off was not considered in the EA because it was not considered likely to be a problem under current use conditions. However, this assumption has been explained in more detail in the revised EA.

3.2 LEGAL ISSUES

Comments on legal issues received by EPA have been grouped into three categories. They include comments on the EA, comments concerning ARARs, and comments on the Hill Creek draft RI/FS.

3.2.1 ENDANGERMENT ASSESSMENT

1. Comment: The EA fails to consider a number of key scientific studies and recommendations. (ARCO)

   Response: All studies and recommendations available to EPA have been considered in the revised EA. They have been addressed in a manner consistent with the Risk Assessment Forum's evaluation of arsenic. Apparent conflicts between EPA's programs regarding the carcinogenicity of arsenic have been resolved.

2. Comment: EPA failed to follow EPA guidance for conducting endangerment assessments and public health evaluations. (ARCO)

   Response: EPA has made necessary changes to follow the guidance or has provided explanations of where the guidance was not followed and why. EPA may depart from the guidance when it has adequate reason to do so. The guidance is, after all, guidance.

3. Comment: EPA failed to compare media concentrations to requirements, standards, and criteria. (ARCO)

   Response: The draft RI/FS reports and EPA's ARARs analysis Supplement to the RI/FS contain such comparisons. They have also been included in the revised EA.

4. Comment: EPA's Offic of Drinking Water, in the Nov. 13, 1985, proposed RMCL for arsenic and the draft Health Advisory for Arsenic

and the Administrator of EPA in correspondence pertaining to Fallon, Nevada, expressed doubts about the validity of the Tsenq study and other studies relied on for the CAG potency factor for arsenic ingestion. (ARCO)

Response: EPA acknowledges these positions taken by the Agency. However, the Risk Assessment Forum has addressed and resolved these concerns in developing the revised CAG potency factor for arsenic ingestion. The above-referenced documents have, therefore, been superceded by a new agency position based upon new information.

5. Comment: EPA has taken a totally different position with respect to arsenic regulated under the national drinking water program and arsenic in contaminated soil and drinking water addressed by EPA under CERCLA at Hill Creek. This is inconsistent. (ARCO)

Response: The comparison of total ingested arsenic dose and risk in Hill Creek to the MCL and the proposed RMCL (MCLG) at Hill Creek is inappropriate for the reasons discussed below.

a. Comparison of soil contamination to the MCL for arsenic is inappropriate. EPA's "Superfund Public Health Evaluation Manual" (page 58, ICF, October 1986) states that "ARARs should correspond to the medium (e.g., air, water) for which they were developed and must be applicable or relevant and appropriate for site conditions." MCLs are clearly not applicable to soil contamination. MCLs are required by law to reflect the technological and economic feasibility of removing the contaminant from the water. (See section 1412(b)(4) of SDWA and page 58 of Superfund Public Health Evaluation Manual.) Such considerations are clearly not "relevant and appropriate to soil contamination at Hill Creek. Technical and cost considerations of drinking water treatment are simply not relevant to soil contamination. In addition, the technical and economic feasibility of soil removal are not a significant issue at Hill Creek.

   In addition, SARA and the NCP allow identification of cleanup goals that attain or exceed ARARs (section 121(d) of SARA, 40 C.F.R. section 300.68(i) and 50 Fed. Reg. 47919, Nov. 20, 1985).

b. As noted earlier, a proposed RHCL (HCLG) for arsenic was published on November 13, 1985. This proposal was followed by a January 9, 1986, Science Advisory Board recommendation and letter from the EPA Administrator regarding Fallon, Nevada. These documents all raised issues concerning the supporting studies for the old CAG potency factor for arsenic. These documents and proposals were all pre-decisional and do not represent final EPA positions on arsenic carcinogenicity. The draft Risk Assessment Forum report supersedes these statements. In addition, the RHCL for drinking water, like the HCL, is not relevant and appropriate for soils.

6. Comment: EPA has not enforced HCL violations at communities around the U.S. where variances and exemptions have been granted. (ARCO)

Response: Variances granted under section 1415 of SDWA are granted only where there is poor raw source water which cannot meet an HCL after application of the best treatment technology, treatment techniques, or other means which EPA finds are available, taking cost into consideration. Exemptions granted under section 1416 of SDWA are granted only where, due to compelling factors (including economic factors), a water system is unable to comply with the HCL.

Variances and exemptions can only be granted upon a finding of no unreasonable risk to health, upon establishment of a compliance schedule to come into compliance with the HCL, and mitigation measures such a medical monitoring, alternative water supplies, etc., to protect health during the limited duration of the variances and exemptions. See "Guidance for the Issuance of Variances and Exemptions" (May 1979, Office of Drinking Water, WSG 64).

In addition, the unique factors pertaining to EPA and State SDWA enforcement discretion at individual community water supplies are not related to or relevant to CERCLA or Hill Creek, Montana, problems.

3.2.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

Role of ARAR'S in General

1. Comment: The overriding goal of SARA is protection of health and the environment (section 121(d)(1) of SARA). The "circumstances presented by the release or threatened release" are the foundations of all remedial activities at a site, regardless of which Federal or State requirements are deemed to be the proper ARARs. (ARCO)

   Response: ARCO is correct in indicating that section 121(d)(1) of SARA is an overriding goal. Section 121(d)(1) may support more stringent clean-up goals than ARARs. Subparagraph 121(d)(2)(A) of SARA provides that a remedial action selected by EPA must at least attain ARARs. Paragraph 121(d)(4) sets forth limited expections to that requirement.

2. Comment: EPA must decide whether to permanently relocate the residents of Hill Creek, Montana, before choosing ARARs for Hill Creek. (ARCO)

   Response: Permanent relocation is only one remedial alternative considered by EPA. EPA also evaluated other alternatives, including alternatives for various degrees of cleanup of the community of Hill Creek. The National Contingency Plan ("NCP"), at 40 C.F.R. subsections 300.68(e), (f), (g), (h), and (i) requires that all remedial alternatives addressed in an RI/FS be evaluated for compliance with ARARs. This requires preliminary identification of ARARs for purposes of the RI/FS analysis. ARARs associated with permanent relocation have been determined in the ROD. ARARs associated with permanent remedies will be finally determined in future operable units and RODs.

3. Comment: SARA states that only promulgated requirements of general applicability may qualify as State ARARs. (ARCO)

Response: EPA agrees with this comment.

4. Comment: EPA must analyze the purpose for which a requirement was designed in evaluating a potential ARAR. (ARCO)

Response: EPA must identify "applicable" requirements as ARARs if they otherwise qualify. EPA agrees that it must look to the purpose of "relevant and appropriate" requirements when evaluating them.

Surface Water Requirements

5. Comment: The Montana surface water quality numerical standards specified in Table 3.2-1 of the draft FS are not specified in the State water quality standards regulations. The Federal water quality criteria are only used as guidelines by the State in establishing permit effluent limitations. (ARCO)

Response: EPA is evaluating whether State regulations at subsection 16.20.618(3) ARM merely establish Federal water quality criteria as guidelines or adopt them as instream criteria as a matter of State law. As a practical matter, it appears that the State interprets Federal water quality criteria to be guidelines. See ARARs analysis attached to August 27, 1987 letter from John Wardell (EPA) to Jack Davis (ARCO) (hereinafter "EPA's ARARs analysis"); 50 Fed. Reg. 47919, Nov. 20, 1985 and 52 Fed. Reg. 8706, March 19, 1987.

6. Comment: The State-adopted Federal water quality criteria are only guidelines under State law and, therefore, are not ARARs, and maximum contaminant levels ("MCLs") are legally applicable State ARARs. (ARCO)

Response: EPA clarifies that MCLs apply under State law only after conventional treatment of the water. Also, see response to Comment #5 above.

7. Comment: If "legally applicable" standards exist, EPA cannot identify more stringent "relevant and appropriate" requirements as ARARs. (ARCO)

Response: EPA disagrees with this comment. Remedial actions must attain all applicable or relevant and appropriate requirements unless a waiver under section 121(d)(4) of SARA is approved by EPA.

8. Comment: The State nondegradation requirements cannot be an ARAR for Hill Creek because they go well beyond a concern for public health and the environment. (ARCO)

Response: EPA believes that the State nondegradation requirements are not an ARAR for Hill Creek because the only potential sources of discharge into the stream of Hill Creek are non-point sources, and these will be adequately addressed by best management practices. See EPA's ARARs analysis.

Ground Water Requirements

9. Comment: ARCO summarized and characterized Montana's ground water requirements. MCLs are the State ARARs. (ARCO)

Response: EPA concurs with ARCO's analysis, as discussed elsewhere in EPA's responses to ARCO comments and in EPA's ARARs analysis. However, EPA has identified a more stringent Federal health based performance goal for drinking water at the tap. EPA also addressed nondegradation requirements for ground water in EPA's ARARs analysis.

Hard Rock Soil Guidelines

10. Comment: ARCO analyzed the State reclamation program's "Hard Rock Soil Guidelines" and concluded that they are not ARARs. (ARCO)

Response: EPA concurs with ARCO's reasoning and conclusion. However, EPA will consider the guidelines as another "Criteria, Advisory, Guidance, or Standard to be Considered."

Perennial Streams and Floodplains

11. Comment: No Federal counterpart exists to the Montana floodplain and floodway regulatory program (MCA Section 76-5-101, et seq.) in any statute listed in clause 121(d)(2)(A)(i) of SARA. Therefore, no comparison can be made concerning stringency. The Montana perennial stream protection program (MCA Section 75-7-101, et seq.) is not more stringent than the analogous Federal dredge and fill program created by Section 404 of the Clean Water Act. (ARCO)

Response: The federal Floodplain Management Executive Order (E.O. 11988) applies to CERCLA activities and is analogous to the State floodplain and floodway management program. This Executive Order is also incorporated into the Section 404(b)(1) Guidelines (40 CFR Part 230). However, the State requirements are not more stringent than the Federal. EPA agrees with ARCO that the State perennial stream protection program is not more stringent than the Section 404 program. EPA also does not believe the State program is more stringent than the Protection of Wetlands Executive Order (EO 11990) which also applies to CERCLA activities. See EPA's ARARs analysis.

Water Wells and Use

12. Comment: ARCO analyzed the State requirements and concluded that they are not properly ARARs. (ARCO)

Response: EPA concurs with ARCO's analysis and conclusions. However, EPA did identify water well construction standards at ARM Section 36.21.601, et seq. as State ARARs. See EPA's ARARs analysis.

Solid and Hazardous Waste

13. Comment: The State's hazardous waste statutory and regulatory requirements for hazardous waste are identical to Federal RCRA Subtitle C requirements. (ARCO)

Response: EPA concurs with the analysis and conclusion. EPA has responded to ARCO's criticism of Federal RCRA Subtitle C closure requirements elsewhere. EPA has evaluated the State's solid waste management requirements separately and concluded that they are not more stringent than Federal requirements that are "applicable or relevant and appropriate" for Hill Creek.

Air Emissions

14. Comment: The State ambient air quality standard for Total Suspended Particulate (TSP) at ARM Section 16.8.821 is more stringent than the Federal Primary National Ambient Air Quality Standard (NAAQS) for TSP at 50 CFR Section 50.6 and less stringent than the Federal Secondary NAAQS for TSP at 40 CFR Section 50.7. The Secondary NAAQS cannot be an ARAR because it is based on welfare rather than public health considerations. (ARCO)

Response: On July 1, 1987, the former Federal Primary and Secondary NAAQS were superseded by the new PM_{10} Primary and Secondary NAAQS for particulate matter less than or equal to 10 micrometers in diameter (See 52 Fed. Reg. 24634, July 1, 1987). The new PM_{10} Primary and Secondary standards are identical. ARCO's comments on the pre-PM_{10} standards are therefore, no longer relevant. The state total

suspended particulate standard at ARM Section 16.8.821 is a part of the Federally approved and enforceable State Implementation Plan (SIP) and is, therefore, a potential Federal ARAR. There is insufficient data at this time to evaluate whether the PM_{10} NAAQS or the State standard is more stringent so EPA has identified both as Federal ARARs for Hill Creek. See EPA's ARARs analysis.

Underground Storage Tanks

15. Comment: State and Federal regulations for implementing the Federal and State Underground Storage Tank programs have not been promulgated. It is, therefore, impossible to comment on whether State requirements are properly ARARs. (ARCO)

Response: The only State and EPA regulations for underground storage tanks promulgated by EPA to date pertain to notification requirements and interim prohibitions for new tanks. These do not fit the circumstances at Hill Creek. Regulations for tank closure and corrective action have not yet been promulgated. There are, therefore, presently no State or Federal ARARs for Hill Creek for underground storage tanks.

Septic Tank Pumpers and Disposal of Septage

16. Comment: ARM sections 16.14.811 and 16.14.812 appear to be State requirements in addition to Federal ARARs, but it is impossible to say if they are ARARs until it is determined whether septage will be encountered during remedial action at Hill Creek. (ARCO)

Response: EPA agrees with ARCO's reasoning and conclusion that ARM sections 16.14.811 and 16.14.812 are State requirements in addition to Federal ARARs. EPA will consider them to be State ARARs if septage is encountered under appropriate circumstances during the course of remedial action.

Junk Vehicles

17. Comment: The shielding provisions of ARM section 16.14.201(1) are State requirements "in addition to" Federal ARARs. (ARCO)

Response: EPA concurs with ARCO's reasoning and concludes that the shielding provisions will be considered State ARARs if junk vehicles must be collected and disposed of in conjunction with remedial actions. EPA also considers the disposal of junk vehicles in a "motor vehicle graveyard" as defined at MCA subsection 75-10-522 to be a State ARAR.

ARARs in Mill Creek Draft RI/FS

18. Comment 2.B: Cleanup standards for arsenic and heavy metals in soils do not exist. (ARCO)

Response: ARCO is correct that there are no nationally applicable, uniform numerical ambient cleanup standards for arsenic and heavy metals in soil. However, through the use of a risk-based approach to identifying "relevant and appropriate" RCRA Subtitle C closure requirements through the exercise of best professional judgment (50 Fed. Reg. 47919, Nov. 20, 1985), site-specific soil cleanup goals may be established. This is a pure risk-based approach within the general framework of RCRA Subtitle C closure requirements. See also 52 Fed. Reg. 8706, March 19, 1987 and EPA's ARARs analysis.

19. Comment 2.B: "Relevant and appropriate" requirements do not directly fit the case at hand. (ARCO)

Response: EPA's flexible approach to tailoring RCRA Subtitle C closure "relevant and appropriate" requirements for soil contamination

in Hill Creek directly fit the case at hand. See EPA's ARARs analysis.

20. Comment 2.B.1: Mining wastes are not currently regulated under Subtitle D of RCRA. (ARCO)

Response: Mining wastes are currently regulated under Subtitle D. See section 1004(27) of RCRA and definitions of "solid waste" at 40 C.F.R. subsection 257.2. See response to Comment #3 in Section 3.2.3 General Comments Concerning Hill Creek, Montana, Draft Feasibility Study, Supplemental Legal Concerns.

21. Comment 2.B.2: Section 264.228 is not relevant because it addresses surface impoundments, applies to higher concentrations (of arsenic, etc.?), and does not provide for removal and replacement of soil. (ARCO)

Response: Using a flexible, risk-based approach, EPA may use best professional judgment to select "relevant and appropriate" RCRA Subtitle C closure requirements. 40 C.F.R. sections 264.28 and 264.310 allow options of complete removal of hazardous waste or partial removal with capping of the remaining hazardous wastes. An 18-inch cap over remaining contaminated soil in Hill Creek is consistent with this approach. See response to Comment #9 in Section 3.2.3 General Comments Concerning Hill Creek, Montana, Draft Feasibility Study, Supplemental Legal Concerns.

22. Comment 2.B.2: No justification for 18-inch cap is given in addendum. (ARCO)

Response: Such justification is detailed on pages 24 and 25 of October 31, 1986, EPA comments on the draft FS report and summarized on pages 4, 9, and 10 of the RI/FS supplement.

23. Comment 2.B.2: Selective sodding of highly contaminated areas is consistent with 40 CFR section 264.228. (ARCO)

Response: Selective sodding is not as technically reliable and effective over the long term in preserving an adequate cap over remaining contamination as an 18-inch soil cover because of phytotoxicity problems with "thinner" caps and a high risk of incidental disturbance of thinner caps by normal human activities (gardening, etc.).

24. Comment 2.B.2: EPA should follow the risk-based approach it followed at the Crystal Chemical site at Hill Creek. The Crystal Chemical site was in a highly populated area, and Hill Creek is not. (ARCO)

Response: EPA has followed the risk-based approach as described in the Crystal Chemical discussion in the NCP preamble (50 Fed. Reg. 47923, Nov. 20, 1985). The Crystal Chemical site is located in an industrial park. The community of Hill Creek is a residential area. The exposure of residents to contaminated soil is a more immediate problem in Hill Creek than at the Crystal Chemical site. Note: EPA is no longer relying on the Crystal Chemical preamble discussion other than as a general illustration of how to identify "relevant and appropriate" RCRA closure requirements for contaminated soils because a Record of Decision (ROD) has not yet been signed for the Crystal Chemical site.

25. Comment 2.B.2: 40 C.F.R. section 264.310 applies only to hazardous waste sites. EPA should not apply all of section 264.310 to Hill Creek. (ARCO)

Response: 40 C.F.R. section 264.310 requirements may be "relevant and appropriate" at Hill Creek. See EPA's ARARs Analysis for a full explanation. EPA did not apply all of section 264.310 to Hill Creek, only the "relevant and appropriate" requirements. EPA agrees that

long-term covering is consistent with the "relevant and appropriate requirements" of section 264.310 but disagrees with ARCO over the extent of the required cover.

26. Comment 2.B.3: The ARAR for drinking water in Hill Creek should be the MCLG of arsenic of 50 ug/l. (ARCO)

Response: The MCLG (RMCL) for arsenic is only proposed at this time. EPA failed to note this in the RI/FS supplement. As noted in EPA's ARARs analysis, EPA has deferred evaluation of water quality criteria as ARARs for drinking water at the tap pending development of EPA policy for implementing subparagraph 121(d)(2)(B) of SARA and has, instead, identified a health-based performance goal for arsenic in drinking water.

27. Comment 2.B.3: EPA should consider the latest information available in establishing a cleanup level based on water quality criteria. (ARCO)

Response: See response to Comment #9 above and EPA's ARARs analysis. Also, see response to Comments #11, #12, and #13 in Section 3.2.3 General Comments Concerning Hill Creek, Montana, Draft Feasibility Study, Supplemental Legal Concerns.

28. Comment 2.B.4: ARCO agrees with EPA that 10^{-6} is not an ARAR. Achieving a cleanup primary target of 10^{-6} for arsenic and skin cancer doesn't take into account the mortality rate. (ARCO)

Response: Although 10^{-6} is not an ARAR, it is a valid means of implementing section 121(d)(1) of SARA. A risk level of 10^{-6} is identifies as a primary target for cleanup in EPA's Public Health Evaluation Manual (October, 1986) on page 125. See response to Comment #1 in EPA's response in Section 3.2.3 General Comments Concerning the Hill Creek, Montana, Draft Feasibility Study,

Supplemental Legal Concerns. See response to ARCO's comments on Endangerment Assessment for a discussion of morbidity versus mortality.

29. Comment 2.B.4: Background levels of arsenic are cleanup goals and not ARARs. RCRA contains no basis to require cleanup to background levels. (ARCO)

Response: EPA preliminarily identified background as the cleanup goal for the purposes of the RI/FS analysis because of the elevated risks associated with even background levels of arsenic in soil. These risks were calculated using a more recent EPA position on arsenic toxicity than was available when the Crystal Chemical site was discussed in the NCP preamble. This cleanup level was incorporated into the RCRA "storage" closure option as a means of defining removal of all contaminated soils." See response to Comment #9 in Section 3.2.3 General Comments Concerning Hill Creek, Montana, Draft Feasibility Study" (see also 52 Fed. Reg. 8706, March 19, 1987). This is consistent with the flexible approach to RCRA closure for contaminated soils illustrated in the NCP preamble discussion of the Crystal Chemical site. In addition, the NCP preamble discussion of Crystal Chemical indicated that "storage" closure could have been implemented by cleanup to background, even assuming a 100 ppm. arsenic action level was appropriate (50 Fed. Reg. 47923, Nov. 20, 1985).

30. Comment 2.B.5: Does EPA intend to relocate people only to locations where no arsenic can be detected in drinking water? (ARCO)

Response: EPA will take steps to ensure that the health of any residents relocated pursuant to CERCLA authority is adequately protected.

31. Comment 2.B.7: The State's nondegradation policy is more stringent than EPA's antidegradation policy because it is more specific. (ARCO)

Response: The Federal regulations at 40 CFR section 131.12 addressing antidegradation are not a Federal ARAR because they are not directly enforceable nor are they expressly cited in section 121(d)(2) of SARA. Therefore, the State nondegradation policy is not properly analyzed as being more stringent than the Federal requirements for purposes of CERCLA. It is more properly analyzed as being "in addition to" Federal requirements. In any event, EPA has concluded the State's non-degradation policy will not be an issue at Mill Creek because any non-point sources would be adequately addressed by best management practices. See EPA's ARARs analysis and response to comment #32 immediately below.

32. Comment 2.B.7: ARM section 16.20.701(b)(7) specifies that where pollution occurs from non-point sources, surface water quality standards violations from non-point sources are not considered degradation where reasonable land, soil, and water management practices have been applied. Were such measures to be applied in Mill Creek, the State non-degradation policy would not apply. (ARCO)

Response: EPA agrees that where reasonable land, soil, and water management practices are applied, the State nondegradation provisions do not apply.

33. Comment 2.B.7: Even if nondegradation were considered "relevant and appropriate," only activities after December 17, 1982, which would cause exceedances of water quality standards would have to be managed under the non-degradation policy. (ARCO)

Response: EPA does not agree. The purpose of the State's nondegradation requirements is to protect water that is currently of higher quality than required by State standards.

34. Comment 2.B.7: The State's ground water standards are less stringent than EPA's modified water quality criteria for arsenic. Therefore, section 121 of SARA suggests that State standards do not need to be considered further. (ARCO)

Response: EPA has deferred the question of whether water quality criteria are drinking water ARARs as noted earlier. EPA has instead preliminarily identified a health-based performance goal for purposes of the RI/FS analysis that is more stringent than the MCL for arsenic. See EPA's ARARs analysis.

35. Comment 2.B.8: MCA section 28-4-336(7) is not applicable to Hill Creek because the Anaconda Smelter and Hill Creek are not mining activities. (ARCO)

Response: EPA agrees with this comment.

36. Comment 2.B.8: The requirements of MCA section 82-4-336(7) are not "relevant and appropriate" because the purposes of the Montana Mined Land Reclamation law is aesthetic and economic rather than protection of health or the environment. (ARCO)

Response: EPA does not agree with ARCO's reasoning or its conclusion. The Montana Metal Mine Reclamation Act (MCA section 82-4-301, et seq.) clearly addresses environmental values, although not in the same manner or degree as CERCLA. See MCA §§ 82-4-335(c), 82-4-335(h), 82-4-335(j), 82-4-336(4), 82-4-336(5), 82-4-336(6), and 82-4-336(9). The requirements of MCA section 82-4-336(7) are "relevant and appropriate". However, EPA does believe that MCA section 82-4-336(7) is not more stringent than Federal requirements. The language of this provision is a general narrative standard that cannot be easily compared to more specific Federal and State ARARs. EPA concludes that this general narrative standard will be satisfied if the more specific Federal ARARs are complied with.

37. Comment 2.B.8: The State Hard Rock Soil Guidelines are not ARARs because they were not promulgated. (ARCO)

Response: EPA agrees with this comment. However, EPA will consider these requirements as guidance in its evaluation.

38. Comment 2.B.9: State hazardous and solid waste laws are not more stringent than EPA's. If underground storage tanks, septic tanks, or junk vehicles are encountered during remedial action at Hill Creek, the relevant State laws are "applicable or relevant and appropriate". (ARCO)

Response: EPA concurs with this response, except that the State's current underground storage tank requirements are not pertinent to Hill Creek.

39. Comment 2.B.10: The State's 24-hour standard for total suspended particulate ("TSP") matter is more stringent than the primary National Ambient Air Quality Standard (NAAQS). (ARCO)

Response: See response to comment #14 in Section 3.2.2 Applicable or Relevant and Appropriate Requirements (ARARs). Also see EPA's ARARs analysis.

40. Comment 2.B.10: Remedial activities in Hill Creek would not be "stationary sources," so the State TSP standard will not apply. (ARCO)

Response: EPA disagrees. The State and Federal air pollution standard and performance goals identified in EPA's ARARs analysis will apply.

41. Comment 2.B.10: No State air quality permits should be required for remedial activities in Hill Creek. (ARCO)

Response: EPA agrees with this comment (section 121(e) of SARA).

42. Comment 2.B.11: The use of EPA's 1980 water quality criteria for arsenic for drinking water is based partially on ingestion of fish and shellfish from contaminated surface water. This criteria should be revised when applied to ground water for drinking purposes. (ARCO)

Response: See earlier discussion of EPA's position on water quality criteria as a drinking water ARAR.

43. Comment 2.B.11: The use of the carcinogenic potency factor for arsenic based on the Tseng Taiwan study is inappropriate as set forth in ARCO's comments on the Clement Associates, Inc., Endangerment Assessment for Hill Creek. (ARCO)

Response: EPA has recently revised the Endangerment Assessment for Hill Creek based on the October 1986 draft Risk Assessment Forum report on arsenic. See responses to ARCO comments on the Endangerment Assessment in Section 3.1. This revised factor derived from the October 1986 draft report was used to identify the RCRA "storage" closure cleanup pool and the health-based performance goal for drinking water.

44. Comment 2.B.12: The MCLs for cadmium and lead are identical to the water quality criteria for lead and cadmium for drinking water. Therefore, the MCLs for lead and cadmium are "relevant and appropriate". Because the water quality for arsenic for drinking water is of questionable technical validity, the MCL for arsenic is also the proper MCL.

Response: See earlier discussion and EPA's ARARs analysis.

3.2.3 GENERAL COMMENTS CONCERNING THE HILL CREEK, MONTANA, DRAFT FEASIBILITY STUDY, SUPPLEMENTAL LEGAL CONCERNS

On-Site Waste Consolidation

1. Comment: ARCO stated that choice of ARARs based on multiple pathways of exposure is flawed on both legal and scientific grounds. This comment is apparently based upon ARCO's position that the endangerment assessment has exaggerated risks to residents of Hill Creek so that only permanent relocation is an available option and that reduce risk estimates of ARCO would lead to a limited cleanup of soils and drinking water. ARCO also states that Maximum Contaminant Levels are the only "applicable or relevant and appropriate" requirements (ARARs) for Hill Creek. (ARCO)

   Response: EPA has revised the EA assessment based upon the October 1986 draft Risk Assessment forum "Special Report on Ingested Arsenic and Certain Human Health Effects". Even after this revision significant risks remain, as indicated in the revised EA and EPA's response to ARCO's comments on the EA. Selection of permanent relocation of the residents is based in large part on the cost-effectiveness of the remedy and the threat of recontamination rather than a judgment that an "extreme" risk justifies the "extreme remedy of permanent relocation". Because residents are exposed to hazardous substances along several exposure pathways in Hill Creek, it is appropriate and necessary to consider the cumulative effects of dose received through those pathways in preliminarily identifying cleanup goals for the site for purposes of conducting the RI/FS in order to ensure that cost-effective remedies that are adequately protective of human health and the environment are evaluated. Consideration of such site-specific factors is consistent with the overriding cleanup goal in section 121(d)(1) of SARA. This approach

is also consistent with EPA guidance (pages 113 to 123), Superfund Public Health Evaluation Manual, October 1986.

Identification of a health-based performance goal for drinking water at the tap in lieu of the MCL for arsenic based in part on the overall 10^{-6} primary target and of multiple pathway exposure is also appropriate. See EPA's ARARs analysis and Section 121(d)(1) of SARA.

2. Comment: It is premature to select ARARs for on-site consolidation. (ARCO)

Response: On-site consolidation of waste through moving of contaminated soils to the tailings ponds may create additional releases of hazardous substances in the tailings areas. Fugitive dust emissions from the freshly dug, loose contaminated soil may occur if it is not covered. Surface runoff problems may occur. It is appropriate at this time to evaluate and preliminarily identify ARARs for purposes of conducting an RI/FS for the interim storage of piles of contaminated soil pending selection of a final remedy in the selected storage area.

3. Comment: 40 C.F.R. Part 257 is not a proper ARAR for on-site consolidation of waste. Part 257 is not a "standard requirement, criteria, or limitation" under section 121(d)(2)(A)(i) of SARA because part 257 requirements are guidelines. (ARCO)

Response: 40 C.F.R. Part 257 is identified in the National Contingency Plan as a potential ARAR. Part 257 is a promulgated regulation, implementing the ban on open dumping in Section 4005(a) of RCRA which may be enforced by any person under Section 7002 of RCRA. The requirements of 40 C.F.R. Part 257 are, therefore, not just unenforceable, advisory guidelines, but are "standards, requirements, criteria, or limitations" within the meaning of SARA. See EPA's ARARs analysis.

4. Comment: Part 257 requirements do not fully address mine waste concerns and contain criteria which are not appropriate for mining waste. Compliance with part 257 demonstrates adequate protection of health and the environment (floodplains and ground water). (ARCO)

Response: These comments seem contradictory. They admit inadequacies of Subtitle D, but also state that it adequately protects health and the environment. The definition of "solid waste" at 40 C.F.R. section 257.2 does include mining waste within the definition of "solid waste". This includes wastes from air pollution control facilities such as flue dust from smelter emissions which has contaminated Hill Creek (40 C.F.R. section 261.4(b)(7) and 45 Fed. Reg. 76618, Nov. 19, 1980). The contaminated soils are contaminated by solid wastes. However, as acknowledged by EPA at 51 Fed. Reg. 24501 (July 3, 1986), "Part 257 is directed toward municipal and industrial waste and does not fully address mining waste concerns." This point is re-emphasized in the August 19, 1986 policy memorandum from Henry L. Longest III, titled, "Consideration of RCRA Requirements in Performing CERCLA Responses at Mining Waste Sites". That is why EPA is undertaking the development of a revised Subtitle D program for mining waste. As noted on page 6 of EPA's RI/FS supplement for Hill Creek at paragraph III.C.a., Part 257 does not adequately address risks posed by releases of all hazardous substances of concern at Hill Creek into air or direct contact by residents. The only provisions of Part 257 that are pertinent to Hill Creek are the floodplains, endangered species, surface water, State Implementation Plan (SIP), and groundwater provisions. These provisions are duplicated or supercede by other ARARs, criteria, advisories, and guidance (E.O. 11988; 16 U.S.C. section 1531, et seq.; Federal water quality criteria; State water quality standards; Montana State Implementation Plan (SIP), and "relevant and appropriate" RCRA Subtitle C closure requirements). EPA, therefore, will not consider Subtitle D as a significant ARAR for Hill Creek. See EPA's ARARs analysis for further discussion.

5. Comment: 40 C.F.R. section 264.251 requirements for waste piles are not discussed in the RI/FS supplement. The selection of Section 264.251 as a "relevant and appropriate" requirement is premature. A specific plan for storage must be developed by EPA and ARCO before this section can be evaluated. (ARCO)

Response: EPA addressed 40 C.F.R. section 264.251 in October 31, 1986, EPA comments on the draft Feasibility Study. ARCO partially addressed this comment on page 5-32 of the draft FS report. Because permanent relocation was selected as a remedy, a detailed plan for storage of contaminated soils from Hill Creek is not necessary. If such storage becomes necessary in the future, it is EPA's intention to use a flexible approach in applying the technically "relevant and appropriate" requirements of 40 C.F.R. Part 264.251 in addressing potential releases of hazardous substances along potential exposure pathways. (See 50 Fed. Reg. 47919, Nov. 20, 1985). If an exposure pathway is not relevant (e.g., groundwater will not be contaminated by the storage pile), EPA will not require that the relevant (e.g., groundwater-related) design and operation ("D and O") requirements of 40 C.F.R. section 264.251 be met. If an exposure pathway is relevant (e.g., fugitive dust is a problem), EPA will require that the relevant (e.g., air-pollution-control-related) "D and O" requirements be met (e.g., 40 C.F.R. subsection 264.251(f)).

6. Comment: RCRA "D and O" requirements cannot be ARARs under section 121 of SARA (statute and legislative history). In addition, the endangerment assessment is flawed. (ARCO)

Response: As described in the response to Comment #5 above, EPA will use a flexible approach in addressing the "D and O" requirements of RCRA Subtitle C as "relevant and appropriate" requirements. They will be used where they are determined to make good technical sense using best professional judgment. This approach is not inconsistent with

subparagraph 121(d)(4)(D) of SARA. In addition, the waiver provisions of subparagraph 121(d)(4)(D) are discretionary ("The President may select . . . . " (emphasis supplied)). The citation to HR Rep. No. 99-253 at page 211-213 does not appear to be relevant to this issue. Those pages addressed dioxin wastes, State requirements for transfer, and settlement provisions.

Cleanup at Hill Creek

7. Comment: Cleanup of the most stringent level for both drinking water and soil would be improper because the cleanup of soil and water would eliminate multiple pathways. Only a relaxation of cleanup requirements on one pathway would warrant more stringent requirements on the other , and arsenic at MCL levels is necessary for health so cleanup of water would necessiate raising soil cleanup levels. (ARCO)

Response: See response to comment A.1 and response to arsenic micronutrient issue in EPA's response to ARCO's comments on the EA in Section 3.1.

8. Comment: 40 C.F.R. Part 257 guidelines are not "applicable" to Hill Creek. (ARCO)

Response: See response to Comments #3 and #4 in Section 3.2.3. The soil in Hill Creek was contaminated in part by a solid waste -- flue dust. However, Subtitle D is not considered a significant an ARAR, as discussed earlier.

9. Comment: 40 C.F.R. Part 264, Subpart G, and sections 264.228 and 24.310 are not "relevant and appropriate" requirements for Hill Creek. This general comment is supported by several supporting comments which are summarized below with the associated EPA response. (ARCO)

   a. In determining "relevant and appropriateness," the purpose of the requirements should be evaluated. The purpose of RCRA closure

requirements is to address contamination from hazardous waste management. (ARCO)

Response: ARCO's comment is addressed to the question of whether the RCRA closure requirements are applicable. EPA does not argue that they are applicable. It is EPA's position that portions of them are "relevant and appropriate".

EPA agrees that the purpose should be evaluated. However, ARCO has evaluated the purpose too narrowly. The purpose of the requirements is to protect human health and the environment through controlling the releases of hazardous wastes, including hazardous constituents, to the environment along exposure pathways (air, surface water, ground water, and direct contact). Arsenic, lead, and cadmium are hazardous constituents listed in 40 C.F.R. Part 260, Appendix VIII, as well as hazardous substances regulated under CERCLA. It is not necessary for the contaminated soils or their constituents to be hazardous wastes in order for Subtitle C to be "relevant and appropriate". The "relevance and appropriateness" of 40 C.F.R. Part 264, Subpart G, and sections 264.228 and 264.310 for addressing these substances can be evaluated in a flexible manner through the exercise of technical best professional judgment in order to determine if they were intended to apply to circumstances similar to those in Hill Creek (50 Fed. Reg. 47919, Nov. 20, 1985). Using the flexible-pathway-oriented approach, it is within EPA's authority to identify and modify, if necessary, the "D and O" RCRA closure requirements referenced as "relevant and appropriate" requirements for Hill Creek.

In the ARAR analysis attached to the August 27, 1987 directive to ARCO for preparing the final RI/FS reports for Hill Creek, EPA describes the two "closure options" available under 40 C.F.R. sections 264.228 and 264.310; 1) "storage" closure under 40 C.F.R. paragraph 264.228(a)(a) and 2) "disposal" closure under 40 C.F.R. paragraphs 264.228(a)(2) and 264.310(a). EPA has determined that a "storage" closure such as that described in 40 C.F.R. paragraph 264.228(a)(1)

would require excavation of contaminated soils to background levels. See 52 Fed. Reg. 8706, March 19, 1987. Because human or other receptors of the groundwater pathway are not threatened by contaminated soils in Hill Creek but human receptors of the air and direct contact pathways are, a modified cover or "cap" derived from closure requirements at 40 C.F.R. paragraphs 264.228(a)(2) and 264.310(a) was identified as the "disposal" closure RCRA ARAR. An 18-inch cap was deemed necessary to provide adequate protection from casual disturbances by residents and to support a vegetative cover needed to prevent wind and water erosion from exposure and transporting the remaining buried contaminated soil. The "cap" would be comprised of "clean" soil with arsenic at background levels in order to achieve EPA's multiple pathway risk-reduction primary target of 10^{-6}. Note: The presence or absence of institutional controls affects the "reliability" rating of the "disposal" closure option.

b. RCRA closure requirements are not "relevant and appropriate" for areawide problems such as Hill Creek. (ARCO)

Response: The contamination of soil in Hill Creek was caused by stack and fugitive flue dust emission. Regardless of how arsenic was transported to the soil and how extensive the contaminated area is, it presents very similar public health and environmental problems to arsenic as a hazardous constitutuent under 40 C.F.R. Part 60, Appendix VIII. Modified "relevant and appropriate" RCRA Subtitle C requirements have been preliminarily identified in a flexible manner based on the site-specific nature of the risks rather than through strict literal application of Subtitle C. EPA is not currently addressing regional ground water contamination in Hill Creek, and 160 acres does not compare to 210 roadside miles of PCB contamination.

c. Hill Creek is not a surface impoundment or a landfill, so RCRA closure "D and O" requirements are not "relevant and appropriate". (ARCO)

Response: See NCP preamble discussion of flexible approach for analogizing soil contamination to surface impoundments or landfills at Crystal Chemical site (50 Fed. Reg. 47923, Nov. 20, 1985). Off-site soil contamination at Hill Creek is not a surface impoundment or landfill.

d. RCRA closure standards are not "relevant and appropriate" for mining sites because EPA determined they are "technically infeasible or economically impractical". (ARCO)

Response: EPA determined that, ". . . if applied universally . . ." on a national basis, certain Subtitle C requirements such as ". . . closure . . . standards . . . may be technically infeasible or economically impractical to implement because of the quantity and nature of waste involved" in the recent RCRA mine waste regulatory determination (51 Fed. Reg. 24500, July 3, 1986). This determination was national in scope and does not consider the site-specific conditions at Hill Creek. The modified approach to "closure" discussed above is tailored to provide only environmentally necessary controls which address only the actual documented environmental and health risks in the most efficient manner. ARCO has not argued or demonstrated that complete excavation of contaminated soil ("disposal closure") or partial excavation and contaminated soil ("storage closure") in Hill Creek as described above and in EPA's ARAR analysis is "technically infeasible" or "economically impractical." EPA may consider "relevant and appropriate" technical requirements of Subtitle C of RCRA which appear to be technically feasible at mining sites (memorandum from Henry L. Longest, III, to Regional Administrators dated August 19, 1986, and titled "Consideration of RCRA Requirements in Performing CERCLA Responses at Mining Waste Sites").

e. The choice of background as a cleanup goal is arbitrary and capricious under RCRA. EPA should follow it approach at the Crystal Chemical site and use a risk-based approach to establish an arsenic cleanup level. (ARCO)

Response: EPA would like to clarify its position concerning background as a cleanup goal. The Agency's Superfund Program has established a 10^{-6} excess cancer risk as its remedial action primary target. On a site specific basis the Agency can establish a remedial action objective of between 10^{-4} and 10^{-7} excess cancers. At Hill Creek the background concentration of arsenic in soils is approximately 9 to 16 micrograms/gram. This level of arsenic in soil yields a 1.7×10^{-5} excess cancer risk for the "reasonable maximums scenario" and 1.7×10^{-6} excess cancer risk for the "average case scenario". Both of these scenarios yield an excess cancer risk calculation falling between 10^{-4} and 10^{-7} excess cancers, and the "most likely scenario" cancer risk is the same as the 10^{-6} excess cancer risk goal established by the Agency's Superfund program. In accordance with the guidance which permits site specific decisions, EPA has preliminarily identified the background soil arsenic concentrate of approximately 9 to 16 micrograms/gram as the remedial action objective at Hill Creek.

Background was preliminarily identified as a cleanup primary target because even background levels do not achieve a carcinogenic risk level of 10^{-6} considering the soil ingestion exposure pathway alone. The calculated risk for ingestion of soil alone using the maximum probable exposure scenario yields an excess carsenogenic risk level of 1.7×10^{-5}. This does not even consider risks from ingestion of drinking water or ingestion of inhaled particulate matter in phlegm. Background was considered a reasonable primary target compared to cleaning up beyond background in order to achieve 10^{-6}.

As we discussed earlier, there are two RCRA closure options for Hill Creek which satisfy "relevant and appropriate" RCRA closure requirements: 1) "storage" closure, involving excavation and removal of all contaminated soil above background and 2) "disposal" closure, involving partial excavation of contaminated soil, removal, and replacement with a cap of "clean" soil.

Both of these means would help support EPS's overall site risk-reduction primary target of 10^{-6}, although, as noted earlier, an absence of effective institutional controls could adversely affect the reliability rating of the disposal closure option. The risk calculations used to establish the action level of background for arsenic in soils for the "storage" closure option was established using the more current EPA position from EPA's October 1986 Draft Risk Assessment Forum report on Arsenic. EPA used a risk-based approach similar to that used at Crystal Chemical, using a more current EPA position concerning arsenic toxicity using an overall site risk reduction primary target of 10^{-6} cancer risk and tailoring it to the climatic conditions in Hill Creek.

f. EPA is proposing 18 inches of soil removal and replacement to support a native vegetative cap, and not RCRA closure standards. (ARCO)

Response: Native vegetation is necessary to protect the cap from wind and water erosion as well as human activity so that it remains reliable over the long term in preventing direct contact by residents of Hill Creek. As is described in EPA's direction to ARCO to finalize the RI/FS reports and EPA's ARAR analysis, this cap is less than a "full" RCRA cap because groundwater is not an issue and is based only on "relevant and appropriate" RCRA closure requirements. It has been specially tailored to address site-specific conditions.

10. Comment: EPA should not choose an ARAR for ground water at this time. (ARCO)

Response: EPA agrees because regional ground water contamination will be addressed in a later operable unit. However, residents would have remained in Hill Creek if a cleanup alternative would have been selected and they would drink water. It is, therefore, necessary to evaluate cleanup goals for ARARs for drinking water at the tap (rather

than in the aquifer) so that the evaluation of cleanup alternatives in the RI/FS would be complete. EPA cannot ignore risks posed by arsenic in drinking water.

11. Comment: Section 121(d)(2)(B)(i) of SARA requires consideration of "the latest information available" in evaluating whether water quality criteria are "relevant and appropriate". EPA did not evaluate the latest information available as noted in the November 13, 1985 Federal Register notice for proposed RMCL for arsenic. (ARCO)

    Response: EPA has deferred further consideration of water quality criteria as a drinking water ARAR pending development of Agency policy for implementing Section 121(d)(2)(B) of SARA. EPA has instead preliminarily identified a health based performance goal for arsenic that is more stringent than the MCL for arsenic based on Section 121(d)(1) of SARA and multiple pathways of exposure. See EPA's ARAR analysis. Note: EPA inaccurately stated that the proposed RMCL for arsenic was final in the December 23, 1986 RI/FS supplement for Hill Creek.

12. Comment: EPA selected zero as the water quality criteria for Hill Creek. EPA is questioning the applicability of zero-based standard. (ARCO)

    Response: See response to Comment #11 above. Note, however, that in the December 23, 1986 RI/FS Supplement, EPA did not select zero as the water quality criteria for Hill Creek. EPA initially chose 2.2 nanograms per liter because it is associated with a cancer risk of 10^{-6}.

13. Comment: The legislative history of SARA shows that water quality criteria are only to be applied if an MCL or MCLG does not exist for the pollutant. (ARCO)

Response: See response to Comment #11 above.

14. Comment: The purpose behind MCLs and RMCLs indicates the proposed RMCL or MCL for arsenic should be the cleanup goal for Mill Creek. MCLG's are set at the level with no known adverse health effects. MCL's are set as close to MCLGs as feasible using the best technology and treatment techniques available taking costs into consideration, and SARA requires consideration of technical feasibility. (ARCO)

Response: The proposed RMCL for arsenic is based on outdated information and interpretations. The October 1986 draft Risk Assessment Forum report for arsenic reflects the current EPA position and indicates that arsenic can still pose unacceptable risks of cancer at low doses and that the evidence of a micronutrient role for arsenic in humans is inconclusive and preliminary at best (see Response to ARCO comments on Endangerment Assessment). Note: MCLGs (RMCLs) do not take into account unique, site-specific pathways of exposure in addition to drinking water such as ingestion of soil contaminated by arsenic from smelter emissions.

ARCO argues that the MCL for arsenic was established taking into account the best technology and treatment techniques available and technical feasibility and that the MCL should, therefore, be selected as the standard. ARCO has not demonstrated that a health based water quality cleanup performance primary target as identified in EPA's ARARs analysis or the equivalent modified water quality criteria proposed in EPA's December 23, 1986 RI/FS supplement cannot be achieved for Mill Creek. In fact, the FS has identified alternative water supplies as a relatively low-cost and feasible means of achieving the water quality cleanup goal at the drinking water tap in Mill Creek.

15. Comment: The preamble to the NCP indicates that Safe Drinking Water Act requirements are ARARs for drinking water rather than water

quality criteria. MCLs are listed as potential ARARs, and MCLGs and water quality criteria are only "other federal criteria, advisories, and guidance and state standards to be considered." State water quality criteria are not enforceable. (ARCO)

Response: As acknowledged by ARCO, SARA has superceded the November 20, 1985 NCP to the extent that it is inconsistent with SARA. See response to Comment #11 (above) and EPA's ARARs analysis.

3.3 COMMUNITY CONCERNS

EPA's Activities

1. Concern: Some Hill Creek residents have raised concerns about why EPA decided to study the area in the first place and why it has taken them so long to get things done. Many residents said they have lived in the area for a long time with no health problems. Now that the smelter is closed, they believe that the air and the environment are improving naturally. Some county residents also believe that EPA's presence has negatively affected property values and may be discouraging small business owners from moving to the area. Both the notoriety from media coverage of the area and the limitations of the Superfund program are viewed as hampering local economic development.

   Response: EPA is required by law to protect the health and welfare of residents living near hazardous waste sites on the National Priorities List. The RI/FS process is designed to find the most appropriate yet cost-effective solution to the risks that these sites present. EPA extended the study period because of the serious issues that arose regarding the health effects of arsenic contamination, especially for small children. On a short-term basis, the study process requires EPA to be very active in the Hill Creek area. EPA suggests that long-term benefits, especially for those local residents determined to be at risk, will substantially outweigh the short-term problems and inconveniences that may be associated with its efforts.

2. Concern: A number of residents asked EPA to define its program objectives in the area. Residents asked how effective the cleanup can be, given the extent of contamination. They believe EPA cannot afford to clean up the entire area. Yet, with too little cleanup, the area will remain unsafe for either agricultural or residential purposes.

Response: The primary focus of EPA's efforts in Hill Creek is protection of public health. EPA's objectives for Hill Creek are stated in the FS Report (p. 1-4): "The public health protection remedial response objectives for Hill Creek differ between these categories of remedial alternatives: 1) remedial alternatives that involve residents remaining in Hill Creek with various levels of clean up, and 2) the permanent relocation of residents remedial alternative. The remedial response objective for "cleanup" alternatives is permanent protection of public health. The remedial response objective for the permanent relocation alternative is permanent protection of the health of the current residents and supplemented by interim controls to minimize short-term public health risks for current nonresidents. The Master RI/F. for the ANC Smelter Site will address the longer-term public health and environmental issues remaining after the permanent relocation alternative (e.g., regional ground-water contamination)."

Negative Impact on Personal Lives

3. Concern: Residents expressed a high level of satisfaction with their neighbors and with the Hill Creek community and are concerned about loosing their lifestyle and the relationship they have had with their neighbors, in addition to the country setting of their homes.

Response: The "loss of community" that residents may face when they are asked to relocate also is of concern to EPA.

Assistance will be provided in planning for a move and in finding a suitable replacement property. If possible, this replacement property will be found in the Hill Creek vicinity, in an effort to minimize the disruptive effect on residents' lives.

4. Concern: Some residents stated the EPA is not sensitive to the emotional impacts of its remedial efforts on individuals and families.

Some residents also are concerned that they are a "test case" for other hazardous waste areas in Montana.

Response: EPA is sensitive to the circumstances of Hill Creek residents. The Hill Creek site was given high priority among the Anaconda sites and the remedial action process was evaluated thoroughly to make sure that all health and safety concerns were addressed. EPA has provided a community relations specialist to assist with local communications and to help residents deal with a number of other problems and issues. In addition, EPA will work to assist residents in planning for and dealing with the chosen remedial alternative.

5. Concern: Several community members have asked if they will be compensated for the stress they have experienced because of their potential relocation and loss of a sense of community, the potential for health problems, community disruption from EPA and ARCO activities, the constant presence of "outsiders" such as security guards, and the long period of waiting for a decision.

   Response: There are no provisions in the Superfund law or regulations for compensation for stress. EPA is concerned about these issues and will provide the necessary assistance to help residents plan for any changes that may occur with selection of a remedial alternative.

6. Concern: Community members have expressed frustration with the EPA process, which they believe has not provided decisions, concrete information, or even reliable general information about the federal government's plans in the area. They said that the information they get is often vague and open to interpretation.

   Response: The study process at the Hill Creek site has required consideration of a broad range of issues before a remedial alternative could be selected. However, EPA has attempted to provide adequate

information to the community in formal and informal presentations and make it available to the public for study.

Health and Safety

7. Concern: The residents who wish to stay in the community have expressed concerns about whether it is financially feasible to clean up the area so that it is safe. They also asked how they can ensure that the area will remain uncontaminated once it is cleaned up. Similarly, they are concerned about whether their residences can be effectively cleaned to provide a healthy indoor environment.

Response: The selected alternative was chosen to protect the health and safety of residents in the most cost-effective and environmentally preferred manner. The potential for recontamination was considered in this final selection. It was determined that the area and residents' homes could not be cleaned sufficiently to ensure their health and safety. The selection of permanent relocation of all residents as the remedial alternative eliminates the concerns about the future safety and cleanliness of the Hill Creek area.

8. Concern: Some residents expressed strong concern about the near- and long-term health problems they may experience because of exposure to contaminants in the area. They have asked EPA to monitor their health over time.

Response: EPA has concluded that a health study in Hill Creek could not be supported under Superfund. Studies conducted to date are adequate to assess the nature and extent of the contamination and the potential health effects. EPA has conveyed to area residents in a letter to Mrs. Peg Patterson, the opinion of Dr. Sue Binder of the U.S. Department of Health and Human Services (DHHS) regarding additional health studies, which stated:

"I do not think we should conduct a health study in the Anaconda area for two major reasons. First, the exposures which are currently ongoing are substantially less than those of the past. Data collected at this time would largely reflect the effects of past exposures and would not be useful in evaluating the effects of current exposures. Secondly, the population of the Anaconda area is small in epidemiologic terms. The population having the highest exposures, for example, children living in Mill Creek, is extremely small. It is very rare to have interpretable results from study of such a small population.

If the citizens of the area are concerned about specific health effects in residents of the area, they may be interested in developing their own survey. They can document factual aspects of problems they think exist in the area. The "Citizen's Guide for Community Health Studies," prepared by the State of Michigan, offers guidelines for developing such a survey. I would be willing to offer technical assistance to a group wishing to proceed with a survey."

Such a study would make it possible for residents to keep track of health issues over time. The Community Relations Specialist could assist in setting up a workshop with the DHHS representative and in making the appropriate materials available.

9. Concern: A commentor who lives outside of Mill Creek but within the region that could be affected by EPA activities at Mill Creek expressed concern that moving soil for a cleanup would cause negative effects on local air quality, and consequently for his beehives.

Response: EPA was aware of the concerns about dust during soil removal for cleanup. This was given consideration in the decision making process. However, there should be no negative effects on local air quality during the implementation of the selective alternative, the relocation of Hill Creek residents.

10. Concern: One resident said that urinary arsenic levels are similar for his child, who remained in his Hill Creek residence, and for children who were temporarily relocated. Given this, he asks if the temporary relocation effort was really necessary.

Response: The temporary relocation was considered necessary to protect children from potential dangers associated with contaminants in the Hill Creek area. Because arsenic is rapidly excreted from the body, urinary arsenic levels reflect recent exposure. However, a single measure of the arsenic level in any one individual may not be indicative of long-term exposure to arsenic. A series of measurements is needed to make a meaningful judgment of an individual's exposure.

11. Concern: Residents are concerned that they may have to move in order for EPA to carry out more studies. Similarly, with a cleanup effort, some residents ask why temporary relocation is necessary and whether EPA could simply "clean around them" if soil removal is the chosen remedial alternative.

Response: Temporary relocation of residents was considered as a remedial alternative in an RI/FS Report Addendum. However, this alternative is no longer under consideration, thus the public concerns in #11 are eliminated. The selected alternative, permanent relocation of all residents of Hill Creek, is the most cost-effective and environmentally preferred remedy.

Property Values and Costs

12. Concern: Residents expressed strong concerns about how they would be compensated if they were relocated from Hill Creek. They asked whether compensation for their properties will be based on market value or on true replacement value, which provides a similar house and property. Others have asked if some people, such as elderly and retired people, can choose a cash settlement rather than another house.

    Response: The options for relocation of residents from Hill Creek include (1) relocation under the direction of FEMA and (2) voluntary relocation by ARCO. If FEMA manages the relocation process, it would follow the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 and related regulations (44 CFR Part 25). Under these regulations, the FS Report indicates that property owners can be offered fair market value or a higher amount depending on the relocation officials' judgment of just compensation. The fair market value would be based on an appraisal of the property's value prior to discovery of contamination in Hill Creek. Owners can appeal an offer to the government and can pursue judicial review. If FEMA does not manage the relocation process, the compensation process can be more flexible but will follow the same guidelines.

13. Concern: Several Hill Creek community members believe the EPA remedial program has lowered their property values. They stated media exposure has made the properties unsellable and possibly not mortgageable. Residents also are uncertain about whether to improve their homes if they are going to be relocated; as a consequence, many said that their homes are depreciating. They asked when a decision will be made about the remedial alternative and possible compensation, so they can make plans to address any changes that will result from the decisions.

Response: It is possible that negative publicity about Hill Creek has affected attitudes toward property values in Hill Creek. However, under the Superfund guidelines relocation compensation is decided on individual case-by-case basis and could be based on property values before contamination was discovered in Hill Creek. In carrying out the selected alternative consideration will be given to residents' concerns.

14. Concern: Some people in the community expressed concern that EPA or ARCO will relocate current residents, cleanup the property, and then sell it to others at a profit.

Response: Under the selected alternative of relocation of all residents, it is likely that title to the land would be held by ARCO. As presented in the RI/FS cleanup costs for Hill Creek are potentially very high. The potential for profit is considered to be minimal. Permanent cleanup will be evaluated in the RI/FS conducted for a later operable unit.

15. Concern: Residents stated that there are many other direct costs in addition to the value of the property that may be associated with relocation. They asked whether they will be compensated for these other costs, such as higher mortgage payments, moving costs, commuting costs, and increased utility cost, if they must move.

Response: Under a FEMA relocation program, the regulations at 44 CFR Part 25 noted above also would provide for compensation of the increased cost of a comparable residence, and the increased cost of new financing under certain circumstances, title transfer expenses (to the proper governmental body), and moving expenses. However, all settlements are determined on a case-by-case basis.

Land Use and Environmental Concerns

16. Concern: Some residents have asked, in the event they must relocate, what would prevent EPA from finding contaminants in their new neighborhoods and starting the process all over?

Response: If FEMA is the responsible agency, the regulations it must follow in relocating residents, include assistance in finding a comparable replacement dwelling for the people to be relocated. The FS Report (pg. 5-53) describes the process in the following way: "One 'comparable replacement dwelling' must be made available to the displaced person and if possible three or more comparable replacement dwellings. A comparable replacement dwelling is defined as decent, safe, and sanitary (meets applicable housing and occupational codes), functionally similar to the person's displaced house, in an area that is not subject to adverse environmental conditions and is accessible to the person's place of employment, on a site that is typical in size for residential development with normal site improvement, currently available to the displaced person, and within the financial means of the displaced person", [44 CFR Part 25, (emphasis added)].

17. Concern: Local officials expressed concern that the land use classifications given in the FS Report are inconsistent both with remedial response objectives and local land use planning responsibilities. They asked how EPA and ARCO intend to coordinate with them regarding local land use regulations and guidelines. Local land use regulations would require that land in Hill Creek, at a minimum, be returned safely to its intended use, agricultural, or that an alternative classification be requested. Officials further noted that the limits to be put on land through EPA's or the State's authority may conflict with the county's traditional prerogative to regulate land use.

Response: The land use areas in the FS Report created by ARCO to focus the investigation on the areas of Mill Creek that ARCO believed were used by people most frequently (high use areas), less frequently (outlying areas) and very infrequently, if at all (ARCO-owned areas), were used to evaluate different degrees of cleanup programs. EPA indicated reliability problems with remedial alternatives based on these land use categories in the FS report and identified reasons why this classification was not consistent with the remedial response objectives (Final RI/FS, p. 3.3). EPA qualified this land use classification scheme throughout the RI/FS by identifying long-term reliability problems with partial cleanup remedial action alternatives relying upon the ARCO land use classification scheme.

EPA does not intend to supplant traditional land use planning by local authorities. If a need for institutional controls to supplement remedial action is identified by EPA in future operable units at the Anaconda Smelter NPL, EPA will contact the responsible land use planning authorities to discuss alternative approaches. See response to Comment #7 in Section 3.4 Policy Issues for detailed discussion of EPA's position.

18. Concern: Deer Lodge - Anaconda City and County officials have requested a technical assistance grant to help them understand the technical issues related to land use in the county.

Response: A formal application must be filed with EPA before a technical assistance grant request can be considered. The local community relations specialist, who works under contract to EPA with residents living in the vicinity of the Anaconda site can assist community members with this effort. Grant funds will be available as soon as EPA develops and publishes rules for this new program. This is anticipated for December 1987.

19. Concern: The director of the Bureau of Solid and Hazardous Waste of the Montana Department of Health and Environmental Sciences has indicated his concern that the EPA process has been too narrowly focused on public health issues and not adequately considered environmental and welfare issues as required by Superfund.

Response: EPA has followed all of the requirements of Superfund in reviewing and guiding ARCO's work. Public health has been the primary focus of these efforts, as intended by Superfund. Additional environmental and welfare issues will be further addressed in RI/FS activities associated with subsequent operable units at the Anaconda Smelter NPL site.

3.4 POLICY ISSUES

1. Comment 2D(1): ARCO expressed concerns that EPA substantially altered the public health and environmental screening summary table (Table 4.4-1) resulting in an analysis which misrepresents the preliminary screening of remedial action alternatives. (ARCO)

   Response: EPA directed ARCO to make the revisions to Table 4.4-1 in order that the analysis represented by this table be consistent with the analyses presented in section 5 of the FS. As EPA became more aware of the faulty assumptions supporting alternatives which were evaluated in the initial alternatives screening document, EPA directed ARCO to make the necessary changes in the screening summary which would make the FS internally consistent.

2. Comment 2.6: ARCO provided a comment expressing concern over EPA's position that ARCO remove experimental results presented in the Drat RI/FS intended to represent partial release of metals in the human gut. (ARCO)

   Response: The extraction procedures used in the "human gut" experiments had little to do with the conditions of physiologic effects in the stomach or gut. Absorption of metal through the small and large intestine results from multi-faceted mechanisms. Most of the absorption is by facilitated transport pinocytosis. EPA therefore did not feel that the experimental results should be presented in the RI/FS.

Failure Criteria of Potential Failure Ranking Matrix in FS

3. Comment 5.1: ARCO contends that land uses have a roughly equal potential to change regardless of the alternative considered. (ARCO)

Response: As explained by footnote 17 to Figure 5.6-1, failure of the remedy resulting from changes in land use would vary depending on the amount of soil removed from the site. Clearly if all contaminants were removed (42 inch soil removal) there would be a very low potential for failure of the remedy even if land use changed. Conversely, if only 6 inches of soil were removed, leaving a contaminated substrate, the potential for exposure to contaminants (failure of the remedy) would be higher if land use changed to a higher land use where contaminants could be reexposed through any of several human activities such as gardening or constructing foundations.

4. Comment 5.2: ARCO contends the ranking of potential failure for Alternative #12 is inconsistent with the definition of Alternative #12, which assumes institutional controls will not be affective. (ARCO)

Response: EPA disagrees with ARCO's position. Clearly if all contaminants are removed (i.e., 42 inch soil removal) there is little potential for the remedy to fail regardless of the failure of institutional controls. This point is presented in footnote 17 to Figure 5.6-1.

5. Comment 5.3: ARCO contends the rankings in the matrix concerning potential failure of vegetation are incorrect because they are based on an incorrect assumption that 18 inches of suitable rooting material would be necessary in order for vegetation to survive over the long term. (ARCO)

Response: EPA continues to disagree with ARCO's position. EPA's position has been conveyed several times to ARCO. Most recently EPA's RI/FS addendum and letter of August 27, 1987 respond to this concern.

6. Comment 5.4: ARCO disagrees that 0.05 to 1.5 mg/kg annual arsenic deposition in the upper 1 inch of soil represents a moderate potential for recontamination. (ARCO)

Response: EPA's statement that a moderate potential for recontamination exists (see footnote 22, page 5-14) is based on a long term perspective. EPA has no assurance that remedial action will adequately address the expansive source areas of contaminated soils/wastes upwind from Hill Creek. EPA's recent air monitoring in Hill Creek indicates that contaminated materials continue to be imposed on Hill Creek in spite of efforts to cover flue dust piles and to cover Smelter Hill with clean fill materials. EPA therefore maintains that a moderate potential exists for recontamination from annual arsenic deposition of contaminated upwind areas.

7. Comment: ARCO has provided numerous comments regarding their disagreement with EPA's decision to disallow subdividing land use between high, medium, and low with respect to the development of remedial alternatives. (ARCO)

Response: It has been and continues to be EPA's position that the basic assumption underlying the land use division -- that ARCO will hold title to the land in Hill Creek in perpetuity -- is specious. EPA fully understands ARCO's rationale for developing the range of alternatives that it did. EPA's position is that current land use does not reflect realistic land use at the conclusion of the remedial action let alone one or two years after that. It is reasonable to assume that after remediation is completed the lands would be sold by ARCO. This is consistent with ARCO's current practice. EPA's mandate from Congress for permanence (CERCLA 121(d)) requires EPA to consider the likelihood of different land owners for the site. To that objective, EPA feels that without any effective institutional controls available, ARCO cannot assume limited future use of the area. The use of fencing is not in and of itself a permanent remedy. Fencing is

used merely to limit access during the establishment of a vegetative cover.

8. Comment: ARCO states that changes requested by EPA regarding the qualification of a stratified land use result in biased analyses slanting the preferred alternatives to either permanent relocation or complete excavation. (ARCO)

Response: EPA disagrees with ARCO's contention that the results are biased. The addition of qualifying language clarifies to the public that EPA does not accept ARCO's position that remediation should be conducted on an ownership basis rather than a contamination level basis. EPA's request was to develop a range of excavation alternatives based upon concentration of contaminant and depth due to the extremely tenuous nature of their future land ownership.

9. Comment: ARCO is unaware of a requirement for a State-FEMA cooperative agreement, and the state requirement to assure provision of adequate off-site disposal facility. (ARCO)

Response: A Memorandum of Understanding (MOU) between EPA and FEMA dated April 8, 1985 outlines procedures for establishment of cooperative agreements between States and FEMA concerning State assurances, roles and responsibilities in permanent relocation actions.

In a fund-financed state-lead remedy, EPA would also enter into a cooperative agreement or contract with Montana in which CERCLA 104(c)(3) assurances would have to be agreed to. This includes 104(c)(3)(B) which would require Montana to provide off-site disposal facilities if they are necessary. This provision becomes effective in December 1989. Based upon current schedules this assurance may not be relevant. The selected remedy includes not only acquisition of property but the demolition of structures as well which implies

on-site temporary disposal facilities. If, however, appropriate on-site temporary disposal facilities are not available, the off-site location may be necessary although not expected at this time.

10. Comment: A commentor expressed concerns that as part of the remedial action at Hill Creek, no contaminated soils should be moved in order to prevent any airborne contamination. (Public)

Response: EPA acknowledges that there is the potential for contaminated dust to be released during house demolition or site stabilization procedures. Best management practices will be implemented to minimize releases of dust. This short term effect is considered acceptable given the benefit of the risk reduction which would result from the remedial action.

11. Comment: The risk numbers presented in the Hill Creek Feasibility Study are inconsistent with the early December, 1986 CAG meetings. (Public)

Response: Hill Creek Endangerment Assessment and the Feasibility Study have been revised to be consistent with the October 1986 Draft Arsenic Risk Assessment Forum Report.

3.5 TECHNICAL ISSUES

1. Comment: Activity patterns of people living within the site boundaries should be evaluated to determine a time-weighted average exposure. (ARCO)

   Response: EPA does not accept ARCO's recommendation to use a time-weighted exposure assessment. This approach does not support the objective of the RI/FS for cleanup alternatives to permanently protect human health within the boundaries of Hill Creek. The potential exists for homes to be constructed throughout the confines of the community and children may roam widely during play activities. A clearly delineated boundary between high use and outlying areas would be arbitrary and of doubtful validity. This position was previously stated in Robert L. Duprey's letter to Dr. Richard Krablin dated October 31, 1987.

2. Comment: It is unrealistic to use the maximum values for each medium in calculating the worst case risk estimate. (ARCO)

   Response: EPA has revised the Endangerment Assessment to include all applicable environmental data collected in the Hill Creek area. The worst case risk estimate is based on the highest concentrations of contaminants in each medium to which residents could potentially be exposed.

3. Comment: One of the sources of uncertainty in the risk assessment model is due to the accuracy and precision of analytical data for the various environmental media. (ARCO)

   Response: Analytical data collected as part of the Hill Creek RI/FS was subjected to strict quality control and quality assurance (QA/QC)

procedures. Only those data that met or exceeded all of the QA/QC criteria were used in the risk assessment model. Although some error may occur due to variation in analytical results, the error in the data base upon which the risk assessment was based was sufficiently low to minimize the uncertainty due to analytical variability. Refer to EPA's detailed comments concerning data utilization, transmitted to ARCO in an August 27, 1987 letter to Jack Davis.

4. Comment: Another source of uncertainty in the model is the human activity patterns in low use non-residential areas. (ARCO)

   Response: EPA's goal is long term protection of public health in Hill Creek. Because of the potential for uture changes in land use and the widespread nature of the contamination, EPA felt that it was appropriate to include data on contamination levels in adjacent non-residential areas in the risk assessment model.

5. Comment: The Montana Water Quality Act anti-degradation policy is not applicable because non-point sources are not considered to be degradation if reasonable land, soil, and water management practices are applied. (ARCO)

   Response: Although the State's nondegradation policy for surface water was identified as a State ARAR by Montana and is set forth at MCA Section 75-5-303 and ARM Section 16.2.701(1) the nondegradation policy will not apply. The only potential sources of discharge into the stream of Hill Creek are non-point sources and these will be adequately addressed by best management practices. See EPA's ARARs analysis.

6. Comment: If the water quality anti-degradation policy were considered relevant and appropriate, land in Hill Creek would have to be managed such that no exceedances of water quality standards occurred. (ARCO)

Response: ARCO's comment does not accurately reflect the State requirements. The State's nondegradation policy is set forth at MCA section 75-5-303 and ARM section 16.20.701(1). Subparagraph 16.20.701(1)(b)(1) states that, "Changes in surface water quality, or ground water quality whether or not applicable ground water standards for dissolved substances are violated, resulting from nonpoint source pollutants from lands where all reasonable land, soil, and water management or conservation practices have been applied are not considered degradation." See EPA's ARARs analysis.

7. Comment: The state's ground water standard is not more stringent than the applicable Federal standard, and, therefore, need not be considered. (ARCO)

Response: It is EPA's opinion that the state's nondegradation policy is not applicable. See EPA's ARARs analysis.

8. Comment: The State's 24-hour standard for total suspended particulates is not applicable because actions in Hill Creek would not be considered "stationary sources" or major stationary sources. (ARCO)

Response: The State's total suspended particulate standard is applicable to any ambient air accessible to the public. For applicability of the State's TSP standard as an ARAR see EPA's ARARs analysis and response to Comment #14 in Section 3.2.2.

9. Comment: Air quality permits are not required for remedial actions under Superfund. (ARCO)

Response: Permits are not required for on-site actions taken under CERCLA. However, these actions must comply with applicable, relevant and appropriate standards, guidelines, and criteria of State and Federal environmental laws.

10. Comment: The costs for temporary relocation presented in the RI/FS report supplement lack sufficient detail to allow accurate comparison of the cost of temporary relocation with the cost of permanent relocation and buyout (Alternative 1A). (ARCO)

Response: Additional detail on the costs for temporary relocation have been incorporated into the Final RI/FS for the Mill Creek.

11. Comment: When costs such as for relocation of residents back to Mill Creek and common response actions such as house cleaning, water supply replacement, and road paving are included with the temporary relocation option, the cost for temporary relocation for only one year is roughly equivalent to that for permanent relocation with buyout. (ARCO)

Response: A detailed comparison of cost for temporary and permanent relocation is included in the Final RI/FS.

12. Comment: The cost of complete buyout may eventually be included under the temporary relocation option if permanent relocation of Mill Creek residents were determined to be an appropriate action following completion of the Smelter RI/FS. (ARCO)

Response: EPA agrees.

13. Comment: The Potential Failure Ranking Matrix presented on page 5-140 of the FS report fails to present an objective evaluation of the remedial action alternatives. (ARCO)

Response: EPA feels that the Potential Failure Ranking Matrix does present an objective evaluation of the long term effectiveness of remedial action alternatives. Comments #14 and #15 address specific concerns regarding this matrix.

14. Comment: Changes made by EPA in the public health screening summary table (Table 4.4-1) in the FS report misrepresent the preliminary screening of remedial action alternatives. (ARCO)

Response: EPA feels the original analysis was satisfactory. However, the RI/FS health screening table was changed due to additional analysis/data.

15. Comment: The matrix indicates that the potential for change in land use would be greater for Alternative #12. Land uses have a roughly equal potential to change regardless of the alternative considered. (ARCO)

Response: Alternative #12 was added to evaluate conditions that would result if institutional controls were ineffective. It was not EPA's intent to indicate that the potential for land use changes would be greater or less for Alternative #12 than for other alternatives. The Potential Failure Ranking Matrix in the Final FS, reflects this intent and indicates that Alternative #12 has potential for changes in land use in accord with the other alternatives.

16. Comment: The potential for failure of institutional control for Alternative #12 is inconsistent with the definition of Alternative #12, which assumes institutional controls will not be effective. (ARCO)

Response: EPA agrees. The potential failure of institutional controls for Alternative #12 is listed as "High" in the Potential Failure Ranking Matrix in the Final FS.

17. Comment: It is incorrect to assume a high potential for failure of vegetation simply because 18 inches of clean fill material would not be provided under some alternatives. (ARCO)

Response: Available information on the soils of the Hill Creek site provides substantial evidence that arsenic and trace metals are present at concentrations greatly exceeding background levels and that arsenic and metals in these soils may limit the suitability of these materials as a plant growth medium. It is therefore correct to assume, at the FS stage, a high potential for failure for alternatives which would not provide a suitable plant growth medium within an adequate root zone. During the remedial design phase, it will be appropriate to evaluate available materials for their suitability as a plant growth medium at this site.

Existing field data and evidence available in the literature suggests that plant productivity and cover may be affected by arsenic, metals, and other soil suitability factors. The erosion protection afforded by vegetation may be affected by soil factors since these factors have been shown to influence the establishment and maintenance of an effective vegetation cover. To be effective, a soil and vegetation cover must prevent re-exposure of the contaminated soils which would result from wind and water erosion in the absence of such a cover.

EPA recognizes that soil or plant growth medium suitability evaluations should include laboratory soil analysis of plant available arsenic and metals and should also encompass additional variables. As an example of applicable suitability criteria, Shafer (1979) provides suitability criteria for land capability classes which include, for a Capability Class IV soil, root zone depth greater than 50 cm, vfsl to sicl texture, less than 35 percent lithic rock fragments, greater than 3.5 in. available water holding capacity, a range of drainage classes, slope less than 15 percent, no erosion hazard to moderate erosion hazard, electrical conductivity less than 4 millimhos/cm, sodium adsorption ratio less than 20, pH 4.5 to 9.0, and climatic

considerations. The draft Montana Department of State Lands topsoil and subsoil suitability criteria also provide useful guidance in this area.

18. Comment: An annual arsenic deposition rate estimate of 0.05 to 1.5 mg/kg in the upper 1 inch of soil represents a low or low to moderate potential for recontamination, not a moderate potential for recontamination as indicated in footnote 22 (page 5-14). (ARCO)

Response: EPA agrees that the modeling results indicate that the short-term potential for recontamination is low. However, EPA's goal is long term protection of public health. If deposition continued over several decades, as has occurred previously, significant recontamination of Mill Creek soils could result. Also, it is EPA's understanding that modeling was based on average wind speeds and average wind direction for the area. There is a potential for significant recontamination to occur during periods of high winds, especially if highly contaminated materials such as flue dust were transported under these conditions. For these reasons, EPA feels that a moderate potential for recontamination exists.

19. Comment: Comparison of vegetation cover class and surficial soil arsenic concentrations indicates that arsenic concentrations vary greatly for all vegetation classifications. (ARCO)

Response: EPA agrees. However, no conclusion regarding vegetation responsive to soil contamination can be substantiated by this observation. The comment references mapping of vegetation which is comprised of broadly defined mapping units (cover classes) delineated on the basis of species composition and structure of the vegetation. Each unit includes variation in species composition, structure, productivity, vegetation cover, associated soils, land use history, and other variables. Because of this inherent variation it is inappropriate to suggest that vegetation is indifferent to arsenic or

other metal concentrations based on the occurrence of wide variation in surface arsenic concentrations within each cover class.

20. Comment: The EPA conclusions regarding cause-and-effect relationships between soil concentrations of arsenic, copper, lead, and zinc, and the lack of vegetation in Hill Creek were obtained using erroneous reasoning and the inappropriate use of data. (ARCO)

Response: The EPA Remedial Investigation/Feasibility Study Report Supplement appropriately identifies arsenic and metal contamination as a factor limiting the suitability of Hill Creek soils as a plant growth medium. While not definitive on this question, the Hill Creek Remedial Investigation Report (ARCO, 1986) also concludes that arsenic and metals contamination may have caused barren areas at the site: "In addition to the above-mentioned reasons for poor vegetation cover, phytotoxicity resulting from elevated soils metals concentrations may play a role." The EPA and ARCO appear to be in concurrence that the Hill Creek soils have elevated concentrations of arsenic and metals and that elevated concentrations of arsenic and certain metals may cause phytotoxic effects.

21. Comment: Because phytotoxic soil concentrations cannot be inferred from literature, and are not known from field sampling, no conclusions should be made regarding the cause of sparse vegetation in the Hill Creek area. (ARCO)

Response: The field observations reported in the Hill Creek Remedial Investigation Report (ARCO, 1986) include sparse vegetation (Dry meadow/Bare Areas) in areas east and south of contaminant source areas. Arsenic and certain metals have been shown in the scientific literature to inhibit plant growth or to be phytotoxic. Therefore, EPA's conclusion that arsenic and metals may occur at Hill Creek at concentrations unsuitable for a plant growth medium is entirely justified.

22. Comment: A more thorough evaluation of the existing soil should be conducted before complete topsoil replacement is prescribed. Furthermore, an analysis of methods to reduce plant-available heavy metal and arsenic concentrations in existing soil should be conducted. (ARCO)

Response: If the remedial alternative selected includes topsoil replacement, additional soil sampling will be conducted to further define the nature and extent of contamination. Although the toxicity of metals to plants is of concern to EPA, the primary focus of the Mill Creek RI/FS is protection of public health. Mitigation of environmental impacts in the Mill Creek area will be addressed as part of the Anaconda Smelter RI/FS.

23. Comment: If rooting depth is the critical variable, revegetation species could be restricted to sod-forming grasses which require a rooting depth shallower than 18 inches. (ARCO)

Response: Use of sod-forming (rhizomatous) grasses will not reduce the depth of suitable material needed for an adequate rooting zone. Roots which develop from the grass rhizomes of a sod may occupy as much soil volume as the roots of caespitose (non-rhizomatous or short rhizomatous) grasses (Weaver 1958). Characteristically shallow-rooted plant species include both rhizomatous and non-rhizomatous grasses. Shallow rooted plant species should not be selected for reclamation because they are inferior for soil stabilization purposes; they yield greater run-off, as a result of reduced absorption, and produce a higher erosion risk. Revegetation species should be selected to help provide a permanent, diverse, and effective vegetation cover. Species selected should be perennial and should have a demonstrated ability to reproduce, by seed or other means, in a similar environment.

24. Comment: EPA's conclusion that the current distribution of bare and vegetated areas on the Hill Creek site is determined by concentrations of arsenic and heavy metals in soils is not justified and should be eliminated from the RI/FS. (ARCO)

Response: See response to Comment #20 in Section 3.5.

25. Comment: Without an analysis of other factors that may control plant distribution (e.g., available soil water, soil pH, available nutrients, or soil structure), it cannot be concluded that high soil concentrations of metals preclude the establishment of plant cover. (ARCO)

Response: Soils which are barren of vegetation occur in the Hill Creek area. Available information indicates that the suitability of these soils as a plant growth medium may be limited by the concentration of arsenic and heavy metals. It is not necessary to demonstrate that the existing soils are unsuitable for revegetation purposes. Rather, it will be necessary to demonstrate in the remedial design that materials proposed for a plant growth medium at the site will meet accepted suitability criteria including depth, physical characteristics, and chemical characteristics.

26. Comment: The X-MET data are inappropriate for characterization of contaminant distributions and evaluation of potential public risks. (ARCO)

Response: Analysis of variance calculations have demonstrated the capability of X-MET analyses to distinguish between different contaminant levels (As, Pb, Cu, and Zn) given the high sample variance present at the Hill Creek site. X-MET data were used for screening purposes and not for evaluation of public risk.

27. Comment: The X-MET data often indicated (especially for arsenic) concentrations of several hundred ppm when concentrations were actually at or near background. (ARCO)

Response: Concentration ranges between background and 300 ppm are very close to the analytical detection limit of the X-MET instrument and subject to uncertainty. Because concentrations within this range are much lower than anticipated action levels they are considered insignificant from a screening standpoint.

28. Comment: X-MET data for lead and copper often indicated undetected concentrations when concentrations were actually several hundred ppm. (ARCO)

Response: See response for Comment #27 above.

29. Comment: In the concentration range between about 1 to 10 times the X-MET detection limits, the X-MET exhibited sporadically wide positive and negative deviations from results obtained via approved U.S. EPA methods. (ARCO)

Response: In most cases, X-MET results within this range were within ±20 percent of the CLP results. The X-MET exhibited optimum precision within this range, which is likely to include the contaminant action levels. This is considered adequate for screening which was the goal of the analysis.

In addition, the two methods are different; the results are not expected to agree perfectly. X-MET analysis is a "total" analysis, whereas the CLP method is an HNO_3/H_2O_2 digestion.

30. Comment: For concentrations above about 10 times the X-MET detection limits, the X-MET data tended to be substantially lower than results obtained via approved EPA methods. (ARCO)

Response: Concentrations above 10 times X-MET detection represent substantially contaminated samples regardless of precise agreement with CLP values. The X-MET technique was not designed to optimize the precision at highly contaminated levels but, rather, it was designed to accurately indicate when a sample was highly contaminated. In this regard, the X-MET technique did not fail to recognize contamination above 10 times background.

31. Comment: Columbia Scientific Instruments (CSI) concluded based on an evaluation of EPA X-MET, quality assurance data and CSI data that the X-MET 840 had been improperly calibrated by EPA during the Nill Creek investigation. (ARCO)

Response: The X-MET instrument was calibrated according to standard procedures outlined by CSI in their operating manual and by personnel trained by CSI. The calibration technique employed for this study has since been verified by Stan Piorek (X-Ray Laboratory Manager at CSI). The EPA X-MET data agrees very well with the data determined independently by CSI, "thus confirming the correctness of the approach" (Stan Piorak, personal communication).

32. Comment: The EPA X-MET soils data lacks sufficient accuracy and precision to be used for the elucidation of contaminant distribution for the evaluation of risk levels. (ARCO)

Response: Calculations of analytical precision indicate that the X-MET technique is capable of distinguishing between contaminant levels for the range of As, Pb, Cu, and Zn concentrations present at the site. The X-MET screening technique was meant to identify areas for further study and not for health risk evaluation.

33. Comment: It is doubtful if the house cleaning measures described in the Feasibility Study could adequately purge a home of toxic dusts by washing and insulation replacement. (Public)

Response: The results of professional house cleaning of selected households as part of a Centers for Disease Control (CDC) investigation in Hill Creek were inconclusive. Measures in addition to house cleaning that may be necessary include, but are not limited to the following: replacement of attic insulation; painting of interior walls; caulking of windows; cleaning of heating ducts; and replacement of carpeting.

34. Comment: If an alternative is selected allowing Hill Creek residents to remain in their present locations, a serious indoor sampling effort should be done to assess the risks. A full disclosure of the ECOLOGY AND ENVIRONMENT, INC. indoor studies should be made. (Public)

Response: A description of the indoor studies conducted for EPA by Ecology and Environment, Inc. (E&E) is included in a memorandum from David Pranzen (E&E) to Mike Bishop (EPA), titled "Preliminary Results of the Residential Dust and Soil Sampling in Anaconda, Montana and Surrounding Communities" (12/2/85). A copy of this memorandum is included in the Administrative Record for the Hill Creek RI/FS and is available for inspection by the public. If residents were to remain in Hill Creek, additional indoor sampling would be conducted to ensure that public health goals were met. Consideration of the selected alternative, relocation of all residents, removes the necessity for indoor sampling.

35. Comment: Run-off waters are known to be important causes of on-going land contamination and livestock loss at the East Helena Superfund site and should be investigated further in Hill Creek. (Public)

Response: Unconfirmed reports of livestock and house pet loss due to drinking of contaminated waters have been reported in the area. However, analyses of surface waters conducted as part of the Hill Creek RI/FS do not indicate significant potential for recontamination of land or potential for livestock loss from runoff water. Additional measures to protect livestock and wildlife will be evaluated as part of the Anaconda Smelter RI/FS. Run-off control measures will also be considered to prevent recontamination of the Hill Creek area.

36. Comment: Considerable soil data have been collected but data are not readily comparable due to differences in sample design. (Public)

Response: Several different studies have been conducted to characterize the nature and extent of soil contamination in the Hill creek area. Although sampling methods and analytical techniques have differed somewhat from study to study, the studies yield consistent results and indicate widespread contamination of soils in the Hill Creek community.

37. Comment: Quality assurance information in the RI/FS is lacking. (Public)

Response: Extensive quality assurance and quality control (QA/QC) procedures were implemented for all steps in the collection, transport, analysis, and data reduction of samples collected in support of the Hill Creek RI/FS. The QA/QC data for the Hill Creek RI/FS data base is included in the Administrative Record which is available for inspection by the public. In addition, detailed comments concerning data utilization was transmitted to ARCO in an August 27, 1987 letter to Jack Davis.

38. Comment: Soils metal data appear to be inconsistent because data described as total elemental analyses presented in Clement (1986) are

generally less in concentration than corresponding extractable metal data included in the RI/FS report. (Public)

Response: The digestion procedure used for soil samples collected for the Hill Creek RI/FS was a nitric acid/hydrogen peroxide extraction solution. This method yields the total extractable metals concentration. The analyses reported in Clement (1986) and the RI/FS were performed using the same extraction procedure and should be referred to as "total extractable metals". This discrepancy has been corrected in the Final RI/FS.

39. Comment: The gradient in arsenic levels in community soils suggest that the flue dust storage area was and is the main source of Hill Creek soil arsenic. (Public)

Response: The elevated soil concentration near the flue dust storage facility does suggest that this source contributed to the contaminant levels in the Hill Creek area; however, much of the soil contamination in the Hill Creek community is the result of historic smelter emissions.

40. Comment: Other potentially toxic elements, in addition to arsenic, lead, and cadmium, can be emitted from non-ferrous smelting operations. Analyses for these elements should be performed. (Public)

Response: Area soils, including samples from Hill Creek, have been analyzed for the following parameters: antimony, arsenic, cadmium, copper, chromium, iron, lead, manganese, mercury, and zinc. Of these potential contaminants, only arsenic, lead, and cadmium are present at levels sufficiently high to pose a threat to human health.

41. Comment: Future recontamination from surface waters and fugitive dust could jeopardize the safety of small children and pets and could contaminate garden vegetables. (Public)

Response: Prevention of recontamination by surface waters and fugitive dust will be included in the remedial action for Mill Creek and in the Anaconda Smelter RI/FS. Consent agreements between ARCO and EPA have been implemented to reduce fugitive emissions from potential sources of recontamination such as the flue dust storage facility and road dust.

42. Comment: Air quality contamination in 1984 and 1985 are not as elevated as those from historic data (e.g., 1961). (Public)

Response: Recent air quality contamination (1984 and 1985) was not as elevated as historic contamination because the smelter has been decommissioned. The focus of the Mill Creek RI/FS is to evaluate existing and future risk and to determine means of reducing that risk. Historic data was useful for assessing the source of contamination but is not a factor in estimating risk or evaluating potential remedies.

43. Comment: The one-in-three day samples collected in 1984-85 collected only one third of the available particulates, i.e., two-thirds of the dust episodes associated with flue dust handling, smelter demolition, etc. were not measured. (Public)

Response: It is standard procedure to operate a high-volume air sampler for a 24 hour period every 3 or 4 days. Some dust episodes would be missed during this period; however, continued monitoring over a period of years will provide data that are representative of existing conditions.

44. Comment: Observations at the Kellogg, ID Superfund site indicate that cadmium migrates upward rather than downward within the soil profile. (Public)

Response: Numerous factors affect the rate and direction of metal migration in a soil profile. Normally, the net movement of metals in a soil profile is in a downward direction. It is possible that evapotranspiration at the soil surface could create a "wicking" effect causing the net movement of metals to be in an upward direction. No evidence of net upward movement of metals has been demonstrated in the Mill Creek area.

45. Comment: The Mill Creek residents, lots and soil were negatively impacted by airborne contaminants emitted from Smelter operations during the operation of the Anaconda Smelter (1902-1980). (Public)

Response: EPA agrees.

46. Comment: The location of meteorological stations are not clearly defined in Figure 3. (Public)

Response: A figure that clearly shows the location of the meteorological stations in the area has been included in the Final RI/FS.

47. Comment: The location of existing meteorological stations do not represent Mill Creek air patterns. A meteorological station should have been installed during the 1984-1986 time period. (Public)

Response: If residents remain in Mill Creek as part of the selected remedy, a meteorological station will be installed to continuously monitor wind speed and direction.

48. Comment: The 10 square miles of highest soil contamination should be plotted on a map. This large area of contaminated soil could be a potential source of future contamination for the Mill Creek area. (Public)

Response: Soil sampling collected during Stage I of the Anaconda Smelter RI/FS and from previous sampling efforts indicate that the soil contamination is extensive. Additional sampling is proposed to further define the nature and extent of this contamination. The selected remedies for the Anaconda Smelter RI/FS will address this potential source of recontamination.

49. Comment: Any reduction in stack emissions due to installation of the baghouse occurred after 1975. (Public)

Response: EPA agrees.

50. Comment: It would be more meaningful to lay people if the content of As, Cd, and Pb in the flue dust was reported in percent. (Public)

Response: EPA agrees. Table 6 in the Final RI/FS has been revised to express the flue dust concentrations of arsenic, cadmium, and lead in percentages, rather than parts per million.

51. Comment: The Federal Primary Drinking Water Standard for As is 0.050 mg/l, not 0.050 ug/l. (Public)

Response: This typographical error has been corrected in the Final RI/FS.

52. Comment: Wells listed in Table 12 should be located on a map in the report. (Public)

Response: Well locations are shown on a map of approximate scale and are referenced in the text and in Table 12 in the Final RI/FS.

53. Comment: Soil sampling should focus on the fine soil fraction (e.g., minus 325 mesh) which is more representative of potential exposure due to airborne dust inhalation and soil ingestion than the total fraction. (Public)

Response: EPA agrees that the fine soil fraction would be more subject to airborne transport than larger fractions and therefore, more likely to be inhaled. Soil sampling methods used by EPA represent the standard procedure for chemical analysis of solid materials such as soils. The analytical results obtained by using fine soil fraction fell within the same range as EPA's data and support EPA findings. For the soil ingestion route, however, ingestion would not be restricted to the fine soil fraction. Therefore, the standard methods used by EPA are more inclusive and appropriate.

54. Comment: Contaminated soils in the area of Hill Creek will act as future sources of airborne and waterborne contamination for the Hill Creek area. (Public)

Response: EPA agrees. Methods of reducing exposure to contaminated soils in the area will be addressed in the Anaconda Smelter RI/FS.

55. Comment: Even though EPA approved fiberglass filters were not used prior to March 1984, these air quality data are usable and should be reported. (Public)

Response: One of the objectives of the RI for Hill Creek is to evaluate the existing and future risk to public health. Air quality data collected since smelter shutdown in 1981 are representative of existing conditions and have been incorporated into the Final RI/FS.

56. Comment: Historic air quality sampling data collected prior to cessation of smelting activities should have been reviewed and analyzed. (Public)

Response: The Hill Creek RI/FS focuses on existing and future risk to public health. Because data collected prior to smelter shutdown are not representative of existing or future conditions, they are not used to evaluate existing or future risk to public health.

57. Comment: A weather station for gathering data on wind speed, wind direction, and measurable precipitation should have been installed along with the Hill Creek Park air sampling station in April, 1984, when a review of the Hill Creek area indicated a potential health problem from arsenic and heavy metals. (Public)

Response: Initially, data collected at other weather stations in the area were thought to be representative of conditions in Hill Creek. Further analysis of data suggested that wind direction and possibly wind speed may be somewhat different in Hill Creek than that at the existing weather stations. Therefore, if residents were to remain in Hill Creek as part of the selected remedy, a meteorological station would be installed to monitor wind speed and direction. It is EPA's opinion that regional precipitation data are representative of conditions in Hill Creek.

58. Comment: The air quality data collected during the Hill Creek Park construction period is a good indicator of air quality that would occur during soil removal and replacement and sodding. It should be presented. (Public)

Response: EPA agrees. These data were used to evaluate potential risk to human health during soil cleanup activities.

59. Comment: The predicted annual increase in soil arsenic concentration appears to be very small compared to annual arsenic deposition that occurred in the past. (Public)

Response: Annual arsenic deposition has decreased significantly since smelter shutdown. However, due to the risk associated with arsenic exposure, one of EPA's goals is to reduce the potential for future recontamination and exposure to the extent possible.

60. Comment: The removal of soil (partial or complete) and the simultaneous protection of the residents' health will be extremely difficult to accomplish. (Public)

Response: It would have been necessary to temporarily relocate the residents if soil cleanup activities were to be conducted in the Hill Creek community. EPA considered a plan to relocate residents only from the areas where active soil cleanup would be underway in order to minimize the period of temporary relocation for the affected residents. Public health concerns were the primary consideration in choosing the selected alternative, permanent relocation of all residents.

61. Comment: The endangerment assessment states that most of the arsenic is in the form of arsenic pentoxide (not arsenic trioxide). (Public)

Response: Determination of the oxidation state of arsenic is difficult. Data indicated that most of the arsenic in smelter emissions and in flue dust is arsenic trioxide. Oxidation of trioxide to arsenic pentoxide may occur in the soil. It appears that both forms are present in the soils in Hill Creek. Both oxidation states of arsenic pose a significant risk to human health.

62. Comment: A weather station should be installed in Mill Creek Park. Ambient air sampling and analysis should be continued to define the source and quantity of contaminants entering the area. (Public)

Response: See response to comment #47 in this section.

63. Comment: Excavation of 42 inches of material should not be considered if adequate clean borrow material to replace this excavated material is not available. (Public)

Response: If the selected remedy included excavation of 42 inches of material, the Remedial Design would have included an investigation to identify additional sources of clean borrow material.

64. Comment: A diversion ditch with sediment traps should be designed and constructed to divert the 100-year precipitation event around the Mill Creek site. (Public)

Response: Considering that the selected alternative is the permanent relocation of all residents of Mill Creek such issues as controlling the transport of contaminated sediments are not addressed in the remedy for this operable unit. Environmental issues may be considered in remedies for other operable units at the Anaconda Smelter NPL.

65. Comment: The proposed boundary of the area excavated is unrealistic. An irregular boundary incorporating a buffer zone of 300 to 500 feet away from any homesite should be incorporated. (Public)

Response: The primary objective of the Mill Creek RI/FS is to reduce exposure and resulting risk to arsenic and other contaminants. Effective means for controlling exposure and future recontamination from areas adjacent to homesites was addressed by EPA in the Final RI/FS.

66. Comment: If any Hill Creek homes are to continue as living quarters (on-site or off-site), the interiors of some may have to be gutted and completely refinished if they are to be sufficiently purged of toxic contaminants. Ordinary cleaning of the homes will not be effective. (Public)

Response: Studies conducted by EPA indicated that conventional house cleaning was relatively ineffective in reducing the concentration of contaminants in house dust in Hill Creek. More comprehensive measures such as replacement of ceiling insulation, carpeting, painting of walls, and others were considered in the selection of the preferred alternative.

67. Comment: Why is there an option for soil removal, soil fill, and revegetation on ARCO property under Alternative #12 (page 5-24, paragraph 1)? This doesn't agree with Alternative #12, top of page 5-49. (Public)

Response: Alternative #12 assumes that institutional controls would be ineffective in the future and residents would have ready access to adjacent properties currently owned by ARCO. Under this alternative, soil removal, soil fill, and revegetation on adjacent ARCO property would be implemented to ensure adequate protection of public health.

68. Comment: The cost of installing and/or operating a weather station and air sampling station(s) in the Hill Creek area should be included in the appropriate alternatives. (Public)

Response: These costs will be included for all remedial alternatives where residents would remain in Hill Creek during and following implementation of the selected alternative.

GENERAL INFORMATION

69. **Comment:** Additional sampling and evaluation of the brick piles located about 1/4 mile SE of the Hill Creek study area and immediately adjacent area should be conducted to determine the level of hazard presented and protective action that should be taken. (Public)

Response: A screening study was conducted in August 1986 to sample and evaluate potential "hot spots" such as the brick piles described above. If these studies or other surveys indicate that these potential "hot spots" pose a potential threat to human health, activities will be undertaken to effectively reduce this potential threat.

4.0 HEALTH ASSESSMENT

Comments provided in the Health Assessment (HA), February 5, 1987, by ATSDR to EPA Region VIII on the evaluation of the April 1986 Hill Creek EA and the draft RI/FS are identified and responded to in the discussion below.

1. Comment: The PHA in the RI does not explicitly indicate whether the sites for soil sampling were selected in a random or stratified random fashion. The risk assessment uses representative soil samples derived from a summation of weighted concentrations. A summation of weighted concentrations is valid only for randomly collected samples. Therefore, the Health Assessment (HA) states that there is not enough information available to evaluate the accuracy of this procedure. (ATSDR)

   Response: Although the soil sampling has not been randomly performed, there is a consistency between soil sampling results conducted by various investigators that provides assurance that the soil contamination levels are representative and descriptive of Hill Creek. Much of the sampling has been conducted in a nonrandom fashion in order to best characterize the soil contamination in yards, gardens, and play areas, i.e., those areas most likely to contribute to exposures to residents.

2. Comment: The RI classifies Hill Creek as suitable for drinking, culinary use, food processing, bathing, swimming, and the growing and propagation of fishes and associated aquatic life. However, the report does not characterize the extent of use of Hill Creek water for these purposes nor does the report state whether use of Hill Creek water for any of these purposes would significantly contribute to the total ingestion of arsenic or cadmium. (ATSDR)

Response: The focused nature of the RI on the contaminated soils of the Hill Creek community precluded extensive characterization of the relative contamination of the stream or of its contribution to the total contaminant exposures at Hill Creek. Such an evaluation may be conducted as part of future remedial efforts involving surface waters in the Anaconda Smelter area, but preliminary studies have indicated that the creek plays a minor role in the exposures of residents to contaminants.

3. Comment: The RI states that the sex-specificity of the carcinogenic potency factor for males leads to an overestimation of the risk. The HA finds this statement dubious, since the risk must be calculated to protect the most sensitive subpopulation and a risk calculated for the population as a whole may fail to protect the male subpopulation adequately. (ATSDR)

Response: To calculate cancer risks for contaminants that have different carcinogenic potency factors for various subpopulations, the evaluation should be performed so as to protect the most sensitive subpopulation.

4. Comment: The HCL for arsenic was derived without consideration of carcinogenicity, and is currently under revision. Therefore, comparison of calculated excess skin cancer risk from ingestion of arsenic at Hill Creek to a similarly calculated risk for ingestion of water with arsenic at the HCL is questionable. The RI attempts to justify this approach by pointing out that "comparative risk estimates based on regulatory thresholds for noncarcinogenic toxic effects are considered appropriate in the case of arsenic because it is potentially an essential trace element in the human diet." (ATSDR)

Response: The comparison of total ingested arsenic dose in Hill Creek to the HCL and the proposed HCL(G) at Hill Creek as inappropriate. See response to Comment #11 in Section 3.1.2 Toxicology.

In addition, the Risk Assessment Forum has recently concluded that data supporting arsenic as an essential nutritional element are insufficient. See response to Comment #1 in Section 3.1.2 Toxicology.

5. Comment: The HA reasons that the tap-water samples from the 2-day sampling periods, which showed levels above the MCL, are probably not representative of the concentrations in ground water. These samples were taken from older, hand-dug wells, which tend to be wider and more exposed than bored wells; therefore, the elevated contaminant levels in these wells most likely represent surface soil contamination that has fallen into the water sampled. (ATSDR)

   Response: Much of the well water used by Hill Creek residents comes from older, hand-dug wells that are more susceptible to contamination. Therefore, the tap water samples showing elevated levels of contaminants are appropriate for calculating additive exposures. The possible contamination of ground water in the Anaconda Smelter area will be evaluated as part of another operable unit. See pp. A-15 through A-18 of ARARs analysis.

6. Comment: The RI should explicitly state that the contribution of soil contamination to surface water contaminant levels was considered and determined to be noncontributary, since the contribution of soil contamination to surface water contaminant levels subsequent to adverse weather events or flooding is not likely to be significant in a semi-arid region. (ATSDR)

   Response: See response to Comment #23 in Section 3.1.3 Exposure.

7. Comment: Known exposure to drinking water with arsenic levels above the MCL and accompanying elevated urinary arsenic levels do not straightforwardly translate into corresponding abnormalities of peripheral nerve function parameters for the following reasons:

(a) EPA (1986) reported that infants exposed to acutely toxic arsenic doses in powdered milk are susceptible to CNS disorders.

(b) Baker et al. (1977) described the difficulty of extrapolating from chronic arsenic exposure in infants with elevated urinary arsenic concentrations to acute CNS disorders.

(c) Southwick et al. (1983) compared peripheral nerve function parameters of residents in an area with known exposure to arsenic (above the MCL) in drinking water to a control community and found no differences.

(d) Vallentine (1982) showed that most measurements of peripheral nerve function in residents of high arsenic exposure communities were sufficiently different from such measurements in residents of control communities. However, the former were still within the range of normal limits.

(e) Urinary arsenic concentrations for children in Hill Creek were reported in the RI to be within the range of values for Hillard, Utah, and high arsenic exposure communities from the U.S. cross-sectional studies. (ATSDR)

Response: See response to Comment #16 in Section 3.1.3 Exposure.

8. Comment: The risk assessment in the RI for inhalation of arsenic showed a lung cancer risk for Hill Creek in excess of that for the control community but less than the risk from exposure to background-level concentrations. It is not made clear in the RI how concentrations that ostensibly represent background can yield a higher risk than risk for a community in which indoor air concentrations are sometimes elevated. (ATSDR)

Response: Levels of arsenic in the air of Hill Creek are above background. See response to Comment # 1 in Section 3.1.3 Exposure.

9. Comment: The HA concludes that the control community seems to be poorly chosen if it has a calculated excess lung cancer risk from inhalation of cadmium in excess of the risk for Hill Creek. (ATSDR)

Response: See response to Comment #8 above.

10. Comment: In terms of air sampling, the RI did not explicitly state whether sampling adequately represent the effects of possible increases in winds on airborne concentrations, whether such increase was too small to warrant consideration, or whether it was otherwise incorporated into the calculations. (ATSDR)

Response: Air samplings were taken on set schedules so as to avoid any biases imposed by episodic or periodic changes in wind patterns. Additionally, samplers were operated during different seasons of the year in order to assess seasonal changes in wind patterns.

11. Comment: It is not clear how levels ostensibly chosen to represent background, or a community chosen as a control, can have a higher risk from ingestion of cadmium than a community where children from 9 months to 5 years of age are assumed to ingest soil with elevated cadmium concentrations. (ATSDR)

Response: It is difficult to identify a control Montana community, since many communities in Montana may have higher than normal levels of various contaminants found at smelter sites due to past mining or smelting activities. The calculated risks associated with cadmium ingestion in Hill Creek children would probably be commensurately higher if all potential sources of cadmium ingestion were identified.

12. Comment: The statement was made in the RI as to whether such factors as fish ingestion should be considered. (ATSDR)

Response: It was felt that fish ingestion would be a relatively minor source of contaminant exposure to Hill Creek residents, and specific information about ingestion of locally caught fish was not available.

13. Comment: No mention is made of any assessment of exposure to radon daughter that have been found in other communities in the area as an apparent result of the ARCO operation. There is some question whether ARCO actually sampled soil for mercury at Hill Creek. (ATSDR)

Response: See response to Comment #5 in Section 3.1.1 Risk Assessment.

14. Comment: No mention is made of any assessment of exposure to mercury which have been found in other communities in the area as an apparent result of the ARCO operation. (ATSDR)

Response: The focused assessment dealt with the contaminants found in the soils of Hill Creek that were previously documented through various CDC studies of biological samples obtained from residents. To gather radon data would have delayed the process, contributing to increased risks to residents. Additionally, relatively few Hill Creek houses have basements where radon would accumulate to dangerous levels.

15. Comment: The EP dismissed consideration of the toxic effects of zinc and copper as insignificant because, for each, the AWQC is based solely on organoleptic properties (Clement Associates, 1986). The HA states that a review of literature suggests possible significant toxicity from excessive exposure to copper and zinc or from effects of metals in combination (ATSDR). (References are provided in the HA).

Response: See response to Comments #31, 32, 33 in Section 3.1.2 Toxicology.

16. Comment: If alternative 1, "relocation of all residents" were selected, all public health risks would be maximally reduced and no further assessment of "inadequately" addressed questions in the RI report would be necessary. (ATSDR)

Response: EPA has chosen "relocation of all residents" as the selected alternative. However, it is EPA's position that the assessment in the RI/FS was adequate to select the remedial action for the first operable unit and further evaluation may be required prior to selection of the final remedy to address contamination in Hill Creek.

17. Comment: A comprehensive health assessment should be done after the Record of Decision (ROD) is submitted. (ATSDR)

Response: Although additional evaluation may be required, EPA preferred to conduct a health assessment during the RI/FS prior to the ROD in order to help in the remedy selection.

18. Comment: ATSDR agrees with the conclusion that a public health risk exists at Hill Creek if the CAG is valid. (ATSDR)

Response: EPA has reviewed the CAG model and has endorsed it as relevant and appropriate for use in risk assessments. The CAG potency factor has been adjusted based upon the 1986 draft Risk Assessment Forum report. See response to Comment #1 in Section 3.1.2 Toxicology for a more detailed discussion.

19. Comment: The following flaws in the study of Tseng et al. (1968) most likely result in inaccuracy in the calculation of the actual risk:

Flaw 1. Tseng et al. (1968) assumed that arsenic laden well water was the only exposure route for arsenic ingestion in Taiwan. The effects of rice, fish, pest control compounds were not considered.

Flaw 2. Tseng assumed that Taiwan background arsenic exposure was the same as that in the U.S. Later studies show a four or twelve times higher background of blood arsenic in Taiwan than in the U.S. (Heydorn, 1970).

Flaw 3. Racial and nutritional deficiencies between Taiwan and the U.S. were not considered.

Flaw 4. Biovailability of arsenic ingested in soil (Hill Creek) may not be the same as that of arsenic ingested in drinking water (Taiwan). (ATSDR)

Response: Flaw 1. Other sources of arsenic are an uncertainty that cannot be answered definitively because the information is simply not available. This uncertainty has been considered by the Risk Assessment Forum draft report October, 1986. The Forum calculated that the dose-response may have been over-estimated by as much as 30% if a man in the study population ate one cup of dry rice and two pounds of potatoes per day and that the amount of water (arsenic contaminated) required to cook the rice and potatoes was about 1.0 liter. But it must be emphasized that such speculations are not supportable by data, and are, therefore, not adequate for risk assessment purposes.

Flaw 2. The Heydorn (1970) data are of limited use because of the small sample size (less than 20) and because the sampling protocol is unknown. Without more data or independent verification, it is inappropriate to make the assumption that all Taiwanese have higher background blood arsenic levels than do U.S. residents.

Flaw 3. See response to Comment #2 in Section 3.1.2 Toxicology.

Flaw 4. See response to Comment #12 in Section 3.1.3 Exposure.

20. Comment: Flaws in the EPA risk assessment model for arsenic ingestion are apparently reflected in the discrepancy between expected and observed incidence of skin lesions in U.S. subpopulation in areas which known high drinking water arsenic concentrations. (ATSDR)

Response: None of the proposed populations of U.S. residents exposed to elevated arsenic meet the conditions required to see a statistically significant elevation in skin cancer rates. The background levels of skin cancer are sufficiently high enough in the U.S. that elevations of rates due to arsenic will only be clinically or epidemiologically apparent when: 1) there is a large enough population; 2) there is a high level of exposure over a long period of time; and 3) the population is not mobile. Given the long latency period for skin cancer induced by arsenic, it may take 20 or more years to see the first cases.

5.0 REMAINING CONCERNS

Several concerns have been raised that remained unanswered during the RI/FS period. The Agency's proposed plan to address them is summarized below.

1. Concern: Are there health risks associated with contaminated soil that may have been brought into the City of Anaconda?

   Response: Migration of contaminated soil is one area of concern for EPA. This issue will be addressed under separate operable units at the Anaconda Smelter NPL site.

2. Concern: What are the effects of soil and water contamination on local agricultural units, especially ranchers? What actions will EPA take if contamination is found?

   Response: This issue is not directly related to human health; it is an environmental issue and will have to be addressed under the long-term remedial action. The problems in the Deer Lodge Valley are far-reaching and cannot be resolved quickly. However, soil and water sampling and effects on cattle will be examined during the RI/FS remedial investigation. Possible responses would include clearing the soil of contamination or not allowing grazing cattle in those areas if problems are identified.

   It would be unlikely that ranchers in the valley would be compensated for economic loss associated with livestock loses under Superfund. At other Superfund sites across the country livestock owners have taken up such issues with the party or parties believed to be responsible for creating the contamination problem. Superfund is responsible for cleanup and data collection, but not for compensation to individuals for losses of livestock and crop production. The data that EPA

collects are public, however, and could be used by private individuals in pursuit of compensation from other sources. To the extent that money is allocated to Superfund and to the extent that the issues relate to problems of health and the environment, EPA will attempt to address such problems.

APPENDIX A

LIST OF COMMUNITY RELATIONS ACTIVITIES

FOR THE HILL CREEK OPERABLE UNIT

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LIST OF COMMUNITY RELATIONS ACTIVITIES FOR THE HILL CREEK OPERABLE UNIT

1. Established information repositories at the Hearst Free Library and the Metcalf Senior Citizen's Center in Anaconda (October 1984.

2. Provided community relations (CR) assistance to CDC in coordinating urinary arsenic study (July 1985, October 1986).

3. Held public meeting to discuss results of urinary arsenic study (July 9, 1985).

4. Prepared and distributed question-answer fact sheet on Superfund activities related to Hill Creek (December, 1985).

5. Held public meeting on Superfund activities related to Hill Creek. Representatives of EPA, CDC, the City and County of Anaconda - Deer Lodge, the Environmental Advisory Committee (EAC), AMC and its consulting contractor, the Montana Air Quality Bureau, the local media, and the public -- a total of approximately 80 persons (December 10, 1985).

6. Distributed CDC letter to Hill Creek residents regarding house-cleaning (December 22, 1985).

7. Provided assistance during public comment period regarding the EPA administrative order on flue dust (December 1985 0 January 1986).

8. Held public meeting to announce emergency removal actions at Hill Creek (January 13, 1986).

9. Held BAC meeting to discuss removal options (January 28, 1986).

10. Held public meeting to discuss considerations regarding emergency responses; i.e., capping and sodding (March 29, 1986).

11. Held public meeting announcing decision to relocate (May 1, 1986).

12. Developed community Relations plan for the Anaconda Smelter site (May 1986).

13. Held public meeting with the BAC to coordinate FEMA actions (May 29, 1986).

14. Held BAC meeting updating area residents on Mill Creek activities (July 24, 1986).

15. Provided for community relations specialist to attend Mill Creek Resident's Association meeting to listen to concerns and coordinate with EPA and FEMA (September 17, 1986).

16. Developed a Community Relations Plan for the Mill Creek Operable Unit: Supplement to the Community Relations Plan for the Anaconda Smelter Site (October, 1986).

17. Provided for community relations specialist to continue personal contact with Mill Creek residents regarding progress and assistance with concerns and problems. The community relations specialist was available 24 hours a day from April, 1985.

18. Attended monthly or quarterly BAC meetings since early 1984, and preparation of CR summaries since April 1985.

APPENDIX B

LIST OF COMMENTORS

APPENDIX B

LIST OF COMMENTORS

Anaconda - Deer Lodge County, Montana

Arrowhead Apiaries

Aspholn, Audrey, Anaconda Community Relations Specialist

Atlantic Richfield Company

Citizens of Anaconda Montana

- A Concerned Citizen
- Jane B. and Allen P. Dudack
- Edwin J. Hamel
- Kimberly A and Larry D. Hancock
- Timothy L. Harris
- Leslie O. Johnson
- Vennie Johnson
- Helen Meyer
- Richard Meyer
- Sara Weinstock - results of telephone survey

Citizens of Hill Creek, Montana

- Helen and Sylvester Haus

Knight, Dahood, McLeon and Everett - law firm representing Hill Creek Residents, including Floyd C. Bossard and A. David Haughan

Montana Department of Health and Environmental Sciences

Montana Department of Health and Human Services

AN_Work3/37

ATTACHMENT II
STATEMENT OF FINDINGS
FLOODPLAINS AND WETLANDS

Executive Order 11988 requires Federal agencies carrying out their responsibilities to consider the potential effects of their actions on floodplains and wetlands in order to secure the beneficial values of these areas and to minimize the impact of floods on human safety, health, and welfare. The remedial action selected by BPA at Hill Creek, Alternative 1 involves activities located on the floodplain of Hill Creek. This Statement of Findings regarding Floodplains and Wetlands has therefor been prepared in compliance with Executive Orders 11988 and 11990.

Alternative 1, relocation of all Hill Creek residents, involves buyout of all property owners in the town of Hill Creek, demolition of structures, grading of the surface, establishment of vegetation to stabilize the surface, fencing, and posting as an interim remedial measure. Because the structures to be demolished are located within the floodplain, there is no practicable alternative which would not be located in a floodplain. Since the regrading would not affect the surface elevations or contours in the floodplain, flood flow characteristics are not anticipated to be changed within the floodplain of Hill Creek. Establishment of vegetation on the regraded surfaces will minimize potential sedimentation.

The Riparian Woodland/Shrubland vegetation unit described in the Hill Creek Remedial Investigation meets criteria as a wetland. While demolition and regrading work would take place near these areas, no direct disturbance of wetlands is anticipated. Erosion of soils into wetland areas is anticipated to be minimized by the establishment of vegetation.

Compliance with State Floodplain Protection Standards

The State identified the Montana Natural Streambed and Land Preservation Act as a State ARAR (MCA Section 76-5-101 et seq.; ARM Section 36.15.101, et seq.) The purpose of the State Floodway management regulations is to prevent development within the floodplains which could cause a flood hazard or erosion hazard. Since no structures are proposed to be constructed and appropriate erosion control measures will be implemented, the proposed action will be in compliance with the State Floodplain Protection Standards.

ATTACHMENT III

CONFIDENTIAL ENFORCEMENT ANALYSIS

The Atlantic Richfield Company (ARCO) has been identified by EPA as the primary potentially responsible party (PRP) for contamination on and around the Anaconda Smelter site including contamination in Hill Creek, Montana. ARCO conducts its business at this site under the name Anaconda Minerals Company ("Anaconda" or AMC). Anaconda is now a unit of ARCO Coal which is in turn a division of ARCO. A notice letter was sent to ARCO on April 29, 1986 pursuant to 122(e) of CERCLA. Special notice was given September 3, 1987.

A Section 106 administrative order on consent to conduct an RI/FS on the entire smelter site was signed with ARCO on October 22, 1984 (Docket No. CERCLA VIII-84-08). A preliminary endangerment assessment prepared to support this order identified significant skin cancer risks from soil contaminated by arsenic from past smelter emissions. This contaminated soil is found over a several square mile area including the community of Hill Creek. In the course of RI/FS work conducted under the above-referenced order, it was found in July 1985 that soils in Hill Creek were highly contaminated by lead, arsenic, and cadmium.

One of the sources of the contamination in Hill Creek is from fugitive emissions of flue dust off Smelter Hill, which overlooks Hill Creek. Flue dust is the most highly contaminated waste on Smelter Hill. On December 20, 1985 (Docket No. CERCLA VIII-85-09), EPA entered into a second Section 106 administrative order on consent with ARCO to conduct an initial remedial measure. This order required ARCO to inventory flue dust storage piles located on Smelter Hill (immediately west of Hill Creek), temporarily stabilize and maintain the piles, and control fugitive emissions of flue dust during movement or transport.

On April 19, 1986, Robert L. Duprey, Director, Waste Management Division, EPA Region VIII, signed an action memorandum initiating a removal action to

temporarily relocate families with children or other sensitive individuals and initiating a road dust suppression program in Mill Creek. On April 29, 1986, a PRP notice letter was sent to ARCO describing its potential liability under subsection 107(a)(3) of CERCLA as a generator of stack and fugitive emissions from the Anaconda Smelter which contaminated Mill Creek and offering ARCO the opportunity to conduct the temporary relocation and road dust suppression programs described in the action memorandum. In a response dated May 2, 1986, ARCO declined the opportunity to conduct the temporary relocation and accepted the opportunity to conduct the road dust suppression program.

On June 9, 1986, EPA entered into a third Section 106 administrative order on consent with ARCO requiring specified road dust suppression measures (Docket No. CERCLA VIII-86-06). In a fund-financed effort, 14 families were temporarily relocated by the Federal Emergency Management Agency (FEMA).

On July 1, 1986, EPA entered into a fourth Section 106 administrative order on consent with ARCO requiring a special, expedited RI/FS addressing Mill Creek alone (Docket NO. CERCLA VIII-86-07). The draft Mill Creek RI/FS was released for public comment in December of 1986 with the public comment period closing on February 4, 1987. EPA received numerous comments from the residents of Mill Creek as well as ARCO. ARCO's comments were voluminous and raised many technical and legal issues. Consistent with their previous position, ARCO continued to dispute all aspects of the EPA risk assessment. EPA has responded to all public comments in the responsiveness summary.

The EPA Office of General Counsel has indicated that the Agency can compel ARCO to conduct a permanent relocation pursuant to Section 106 of CERCLA. Negotiation of a judicial consent decree pursuant to Section 106 is anticipated in the near future. Cost recovery under Section 107 of CERCLA of EPA expenses associated with Mill Creek will be deferred to a later action. If negotiations of a consent decree fail, a fund financed permanent relocation may be preferable to a unilateral judicial action.