ADMINISTRATIVE RECORD

1264388 - R8 SDMS

EPA Announces Plans for a Final Cleanup of East Helena's Residential Soils and Undeveloped Lands

East Helena Superfund Site (Operable Unit No. 2)

Lewis and Clark County, Montana

January 2007

1. Introduction

The United States Environmental Protection Agency (EPA), after consultation with the Montana Department of Environmental Quality (MDEQ), Lewis and Clark City-County Health Department, and East Helena City Council, announces its recommendations and plans for cleaning up remaining contaminated soils in residential areas and undeveloped lands within the East Helena Superfund site.

The EPA is required to issue a Proposed Plan to affected communities and other interested parties to facilitate public participation in the process of arriving at a final cleanup decision.

This Proposed Plan presents specific recommendations, statutory requirements, schedules and cost estimates for finalizing a community-wide cleanup of soils of existing, qualified residential properties. In addition, recommendations and requirements are presented for undeveloped lands that are impacted by emissions from the smelter.

It is anticipated that the cleanup of existing residential areas (yards, streets, alleys, lots) that qualify will be completed within two years after EPA issues a Record of Decision. A cleanup of large tracts of undeveloped lands will occur over a longer time, as land use changes are proposed by landowners or land developers for specific parcels of land.

The EPA urges residents living in or near East Helena to read this document carefully, attend a public meeting scheduled for the evening of January 25, and comment on this proposed plan and its recommendations.

Brief Description of the Preferred Cleanup Alternative

Although several cleanup alternatives were thoroughly examined, a Preferred Alternative is presented in this Proposed Plan for public consideration and comment. The major components of the Preferred Alternative are briefly summarized here, and discussed in detail later in this document.

- Continue the existing East Helena Lead Education and Abatement Program for as long as necessary to protect children from lead.
- Complete a cleanup of the existing, qualifying residential yards and vacant lots within two years after the Record of Decision is issued. (When any quadrant or section of a yard has soil lead greater than 1,000 parts per million (ppm), that yard qualifies for cleanup. Once a yard qualifies, all portions of the yard with soil lead greater than 500 ppm will also be cleaned up.)
- Complete a cleanup of unpaved streets, aprons and alleys in existing residential areas.
- Complete a cleanup of historic irrigation ditches and water spreading channels when they are located within or adjacent to residential areas.
- Clean up the portion of the railroad right-of-way that is adjacent to residential areas.

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- Establish institutional controls that will enable the Lewis and Clark City-County Board of Health and City of East Helena to adopt and enforce regulations needed to (a) prevent disturbances of contaminated soils that remain in and around East Helena and (b) prevent exposures to interior household dust (attics, unfinished basements, heating ducts, etc.) during remodeling or demolition.
- Define requirements and specifications for land use changes, such as when undeveloped lands are proposed for residential, recreational, or commercial development.
- Ensure that cleanup actions based on lead also protect against soil arsenic concentrations that are greater than risk-based levels for each specified use.

East Helena area residents will recognize that the preferred cleanup alternative recommended by EPA is patterned after the residential soil removal action that has been in place since 1991. EPA believes that the removal action has proven to be safe, effective, and protective of children's health. The preferred cleanup alternative will cause minimal disruption within the community and is significantly less costly than other cleanup alternatives examined. Thus, EPA's recommendations for a final cleanup decision formalize the previous several years of work conducted cooperatively by Asarco, EPA, MDEQ, Lewis and Clark County, City of East Helena, and owners of more than 700 individual properties.

The estimated cost for cleaning up yards of existing qualifying residences, unpaved streets and alleys, the railroad right-of-way and remaining irrigation channels and ditches adjacent to residences is $10 million. This figure represents the net present value for these actions. The estimated cost for cleaning up undeveloped lands is presented on a per-acre basis. This latter estimate is more uncertain because it may take many years or decades for undeveloped lands to undergo a change in land use and cleanup costs may not be incurred until then. Detailed cost information is included in Sections 5 and 6.

Lead and other metals in the area's soils cannot be entirely eliminated. Under any reasonable cleanup scenario, there will always remain some residual levels of lead. Therefore, EPA is required to review the final remedy no less than once every 5 years after the remedy is implemented. This requirement is designed to ensure continued, long-term protection of human health and the environment.

This document summarizes information that can be found in greater detail in the remedial investigations and feasibility study reports, risk assessment reports, removal action progress reports, national directives, and other documents contained in the Administrative Record file. EPA and MDEQ encourage the public to review these other documents to gain a more comprehensive understanding of the site and Superfund activities that have been conducted. These documents can be reviewed at the East Helena Lead Education and Abatement Program Office, 2 South Morton, East Helena, MT, or at EPA's Helena office, at 10 West 15th Street, Helena, MT.

EPA is issuing this Proposed Plan as part of its public participation responsibilities under Section 117 (a) of the Comprehensive Environmental Response, Compensation, and Liability Act 42 U.S.C. 9601 (CERCLA).

What is a Proposed Plan?

The purpose of this Proposed Plan is to:

- provide background information about site conditions, human health risks, and activities performed to date;
- identify the principal threat to human health and the environment;
- identify and describe the Preferred Cleanup Alternative being recommended by EPA that will reduce or eliminate the principal threat and therefore reduce risks to acceptable levels;
- describe the other remedial alternatives that were considered;
- provide information about how the public can be involved in the remedy selection process; and
- incorporate input from the East Helena community in the final remedial decision.

2. Site Background and Characteristics

The East Helena Superfund site consists of the smelter, all of the City of East Helena, nearby residential subdivisions, numerous rural developments such as farms and homes on small acreage plots, and surrounding undeveloped lands (See Figure 1).

The smelter operated from 1888 until April 2001. Asarco took ownership of the smelter in 1895 and continued to operate it until its closure in 2001. Asarco owns the smelter grounds and much of the undeveloped lands surrounding East Helena. During its operation the smelter produced lead bullion, but also recovered copper, gold, silver, and platinum for refining at other Asarco facilities. Ores and concentrates were shipped here for smelting from mines as far away as Indonesia and South America.

The former Anaconda Minerals Company constructed and operated a zinc plant from 1927 through 1972, producing zinc oxide from the lead smelting by-product slag. The American Chemet Corporation began producing zinc-based paint pigments in 1947. American Chemet continues to operate to this day, but has modified and upgraded its zinc and copper products lines numerous times over the years. Burlington Northern Railroad and Montana Rail Link also operate rail lines and own or lease property adjacent to the industrial complexes. All five of these entities have been named as potentially responsible parties at this Superfund site.

All of the operations associated with these five entities have contributed to contamination present at this site; however, the major contribution came from the lead smelting and zinc fuming operations. The prevailing paths of contamination that settled out over the landscape were to the north, northeast, and east. In addition, storm water runoff and Wilson Ditch (a major irrigation ditch) transported fine-grained concentrates and other contamination from the smelter to residential and undeveloped areas along Prickly Pear Creek and lands served by Wilson Ditch.

Investigations conducted as early as the mid-1980s (and continuing to the present) reveal substantially elevated levels of some 18 to 20 elements. All of these elements are found naturally in the Earth's crust, but generally at much lower concentrations. Many of these elements are classified as hazardous substances at the concentrations measured in soils on and around the smelter, and as far away as several miles downwind or downstream. Lead, arsenic, cadmium, copper and zinc are the elements of concern, with lead being by far the element of greatest concern, and lead in soils being the principal threat at the site. Figure 1 shows the outer limits of soils likely to have lead concentrations greater than 1,000 ppm. However, no clear boundary has been drawn because effects from 114 years of emissions vary depending upon land use, topography and other factors.

Beginning as early as 1975, and continuing throughout the late 1980s and early 1990s, studies involving children living in and around East Helena demonstrated elevated levels of lead in their blood. Two-thirds of children tested in 1983 had blood-lead levels greater than 10 micrograms per deciliter (µg/dL). Although children's levels have been reduced significantly over the years through cleanup efforts, education, and national reductions in leaded automobile fuel and interior and exterior paint, the cleanup is not complete.

Current land uses include established residential areas and commercial businesses, newer residential subdivisions and acreage home sites, agricultural lands and open spaces, and industrial facilities (mainly the former Asarco smelter and American Chemet's operating plant).

It is anticipated that future land use of existing residential properties will remain residential and that, based on historical growth patterns, new residential subdivisions will be developed on existing agricultural or undeveloped lands. Some of the agricultural lands will remain as

productive agricultural resources. Some lands, such as the East Fields, will be used as a soil repository and, consequently, future development may be restricted there.

The two primary modes of contaminant deposition in the East Helena soils are aerial and surface water deposition. The predominant wind direction in East Helena is toward the east and northeast. However, when there was little or no wind, air movement and deposition followed the Prickly Pear Creek watershed. These moving air patterns resulted in the highest concentrations of metals deposition in residential portions of East Helena and the East Fields area. All areas surrounding the smelter, however, were impacted to a measurable extent. Periodic flooding of Prickly Pear Creek also caused concentrates and sediments to be carried away from the smelter site, and then deposited in overflow areas within East Helena and downstream (north). Measurable metals and arsenic concentrations were found in Lake Helena, 7 miles downstream.

Information regarding the effects of the smelter's operations on air, ground and surface water, livestock, grains, fish and wildlife can be found in previously produced investigative documents. This Proposed Plan addresses only the effects of smelter operations on residential areas and undeveloped lands.

Scope and Role of this Response Action

In 1987, this large, diverse site was segregated into five operable units They were:

- Process Ponds and Fluids (including the process ponds and process fluids circuits; all physically located within the smelter property; however, effects on ground water migrated beyond the smelter property);
- Ground Water (beneath the smelter property as well as beyond);
- Surface Soils and Surface Water (including residential and agricultural soils, vegetation and livestock, fish and wildlife, Prickly Pear Creek, and Wilson Ditch);
- Slag Pile; and
- Ore Storage Areas.

EPA divided the site into operable units partly to begin work on the Process Ponds while continuing to study other parts of the site. A Record of Decision for the Process Ponds (Operable Unit No. 1) was issued by EPA in November 1989. Between 1990 and 1995, Asarco conducted the required remedial actions for the Process Ponds until another enforcement program under EPA's authority, the Resource Conservation and Recovery Act (RCRA) Program, became responsible for the process ponds, ground and surface water, the slag pile and former ore storage areas. The Superfund Program retained responsibilities only for residential soils and agricultural lands (Operable Unit No. 2).

Superfund Involvement

In September 1984, EPA listed the Site on the National Priorities List (NPL) pursuant to Section 105 of CERCLA. Asarco conducted numerous investigations to identify soil, groundwater, and surface water impacted by past smelter operations. EPA and MDEQ provided oversight and direction.

In March 1990, a comprehensive remedial investigation and feasibility study were completed by Asarco. These studies summarized all previous investigations conducted, and evaluated remedial alternatives for cleaning up contaminated areas. In March 1991, in response to EPA's request, Asarco produced a revised and more focused remedial investigation and feasibility study for residential soils, Wilson Ditch, and vegetation. In July 1991, EPA and Asarco entered into a formal agreement to conduct an expedited removal action for residential properties, parks and school playgrounds, unpaved streets and alleys, irrigation ditches and commercial areas.

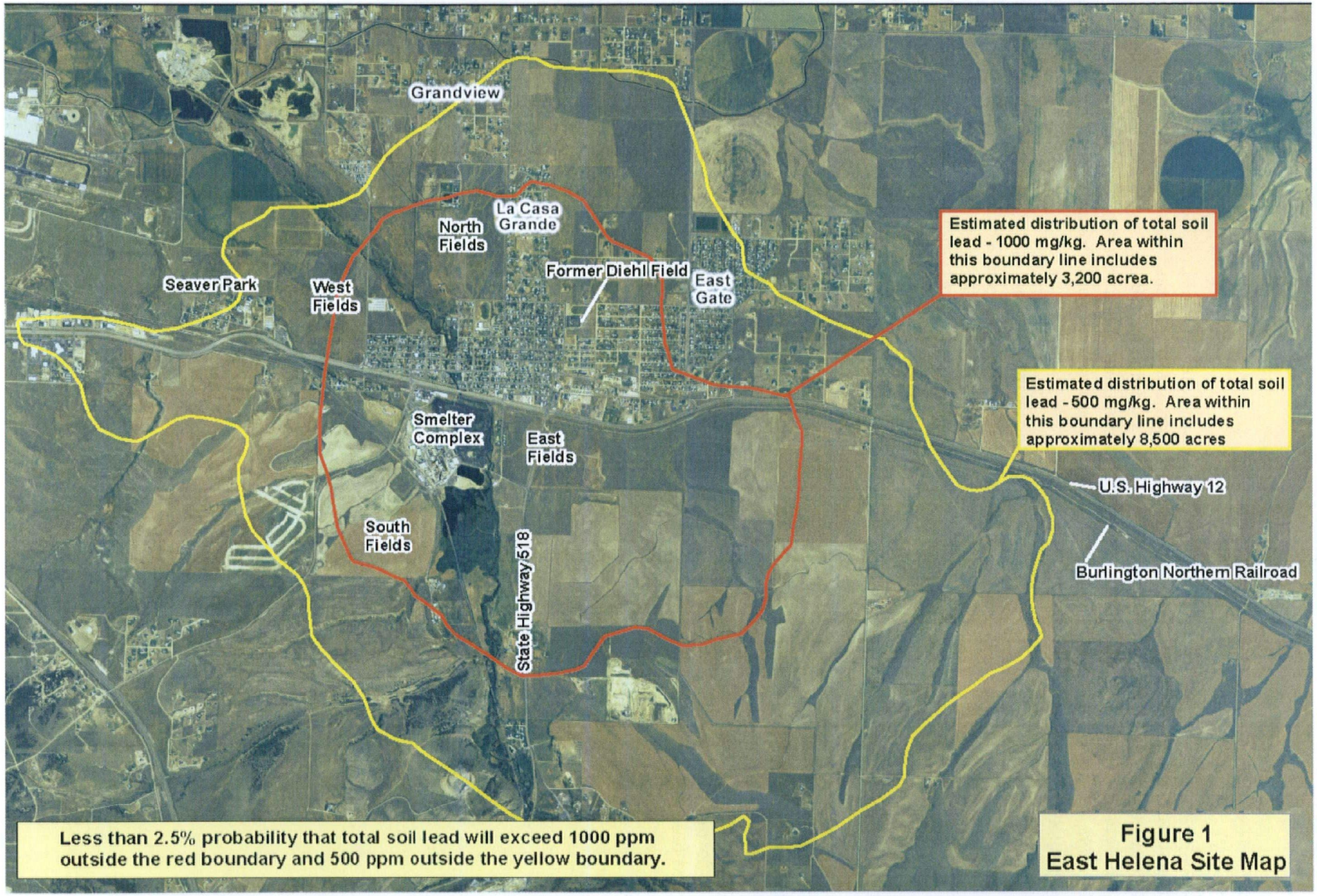


Figure 1
East Helena Site Map

Residential Soil Removal Action (1991 to Present)

Asarco, with EPA and MDEQ oversight and direction, has been removing soils with high concentrations of lead and other contaminants from residential yards, parks, roads, alleys, and street aprons since 1991. Figure 2 shows a typical residential yard during the cleanup process. Throughout the years, the direction and protocols have been changed and fine-tuned to reflect changing and updated information and to expedite the cleanup in a safe and protective, yet cost-effective manner. A number of innovative and experimental approaches to this project have been incorporated into the cleanup.

Since 1991, the removal action resulted in the cleanup of the following: 620 existing residential yards; 450 sections of alleys, roads, and road aprons; 6 public parks; 2 school playgrounds; 45 commercial and public areas; 4,200 linear feet of irrigation ditch; 150 flood channel and ditch sections; and 36 vacant lots. Figures 3 and 4 show a typical play area at a residential yard before and after cleanup.

FIGURE 2
Typical residential yard during cleanup

Lead Education and Abatement Program

The Lewis and Clark City-County Health Department provides staff for and administers the East Helena Lead Education and Abatement Program. The program was established in July 1995 and maintains an office in East Helena. It is a multi-pathway lead exposure prevention and risk abatement program. The program promotes environmental assessments in homes, including sampling of yard soil, interior dust, drinking water, and lead-based paint in order to identify all sources of and pathways for lead exposure.

The program provides broad-based education to the public, in homes, day-care centers and schools. Education efforts are focused on nutrition, personal hygiene, health monitoring (blood lead testing) of area children, "safe play" practices, and risk reduction and management. The program provides information to area residents on the need to avoid areas with elevated soil or dust lead levels and to maintain barriers inside and outside the house. It provides information to future purchasers and sellers of property, lending institutions, and realtors regarding both site-wide and individual property-specific conditions.

FIGURE 3
Play area before cleanup

FIGURE 4
Play area following cleanup

After a final remedy is selected and a Record of Decision is issued, the program will administer institutional controls and associated guidelines, and continue to work closely with the City.

Community Involvement

Since 1984, EPA's public involvement program has included multiple actions to educate local residents and government officials concerning site risks and to inform them about the progress of Superfund activities. Community involvement activities include:

- Regularly scheduled public meetings in East Helena to inform the public and to obtain public input;
- Meetings with the East Helena City Council and Lewis and Clark County Commissioners to provide updates;
- Informal meetings with affected residents concerning the cleanup of their yards;
- Meetings with the East Helena School Board, administrators and teachers, including classroom presentations;
- Regular meetings with two separate citizens' advisory groups;
- Preparation and distribution of fact sheets and educational materials;
- Assistance with blood lead screenings for area children; and
- Ongoing assistance to the Lead Education and Abatement Program.

As part of the community involvement program, a Proposed Plan for East Helena residential soils and undeveloped lands was previously issued in October 1997. However, a Record of Decision was, for several reasons, never finalized. As a result of the lapse in time, and in an effort to provide the community a renewed opportunity to participate in the selection of a final remedy, this new and revised Proposed Plan is being issued.

What Remains to be Cleaned Up Under Superfund?

- 100 -110 existing residential yards and 9 vacant lots
- 40 sections of road aprons or alleys
- approximately 7 acres of railroad track right-of-way
- approximately 1.8 acres of flood channels and ditches north of town
- undeveloped, privately-owned lands undergoing a change in land use

3. Summary of Site Risks

A comprehensive human health risk assessment was performed in 1995 to characterize risks to area residents from smelter-related contaminants in residential soils. Utilizing methods and approaches recommended by EPA for Superfund sites, the assessment began with a screening-level evaluation to identify chemicals of possible concern. This process indicated that lead and arsenic were a concern for residents, but other metals were not a health concern.

Exposure pathways that were evaluated in the 1995 risk assessment included:

- incidental ingestion of outdoor soil;
- incidental ingestion of indoor dust;
- inhalation of soil particles in air; and
- ingestion of vegetables grown in local gardens.

Risks from Exposure to Arsenic

Exposures to arsenic, at concentrations known to have been present in soils and dust prior to 1995, can increase risks of both non-cancer and cancer effects for individuals exposed.

Risks of non-cancer effects are described in terms of a Hazard Quotient (HQ), which is the ratio of the dose predicted to occur at the site divided by a Reference Dose (RfD) that is believed to be safe.

HQ = predicted dose from site divided by reference dose

If exposure occurs by more than one pathway, HQ values are summed to yield the Hazard Index (HI). If the HQ or HI value is 1 or less, it is concluded that the site-related exposure is not a concern. If the HQ or HI value exceeds 1, then there is a risk that non-cancer effects might occur, with the likelihood or severity of effects tending to increase as HQ or HI increases. Some non-cancer effects that may arise from extended exposures to arsenic in soils include persistent skin lesions or abnormal skin pigmentation.

Risks of cancer effects are described as the probability that an individual will develop cancer from the site-related exposure before the end of his or her lifetime. The risks arising from elevated levels of arsenic are termed "excess risk" because the exposed individuals also face cancer risks arising from other sources unrelated to, in this case, the smelter's emissions. Because the excess risks must be expressed in terms of probability, the value derived will always lie between zero and one.

Excess risks to a population of exposed individuals are often relatively low numbers, and they are customarily expressed in scientific format, as shown in Table 1. For example, a risk of 1 excess case of cancer per 10,000 individuals exposed is often expressed as 0.0001 or 1E-04. For sites such as East Helena, EPA frequently uses a risk of 1 in 10,000 (1E-04) as the upper-end of the acceptable risk range for cancer risks. However, the level of cancer risk that is ultimately deemed to be acceptable for a particular site is a decision for risk managers, based upon several site-specific factors, including a thorough knowledge of the community and good judgment.

Table 1. 1995 Estimates of Excess Cancer Risks Based on Reasonable Maximum Exposure to Arsenic

Exposure pathway	Non-cancer HI	Cancer Risk
Ingestion of soil and dust	0.2 – 0.5	3E-05 – 9E-05
Ingestion of garden vegetables	0.01 – 0.02	2E-06- 4E-06
Inhalation of soil in air	--[a]	7E-05 – 1E-04
Total	0.2-0.5	1E-04 – 2E-04[b]

[a]Not evaluated quantitatively
[b]The highlighted value exceeds EPA's acceptable risk range.

Based upon the levels of arsenic that were present in 1995 in residential soils and dust, estimates of both non-cancer and cancer risks were found to vary slightly (about 2- to 3-fold) among the different neighborhoods of East Helena (East Helena proper, Manlove Addition, Eastgate, La Casa Grande, Grandview area).

Non-cancer risks from arsenic did not reach a level of concern in any neighborhood (HI did not exceed 1.0). But, the total of all excess cancer risks, based on a reasonable maximum exposure scenario, did exceed EPA's upper limit of acceptable risk (1 excess risk of cancer in 10,000 individuals exposed, or 1E-04) in the La Casa Grande and Grandview neighborhoods. This total excess risk was attributable mainly to incidental ingestion of soil and dust, and also to inhalation exposure to soil particles in air. Risks from ingestion of garden vegetables were much lower and were not considered to be a cause for concern.

Supplemental Arsenic Risk Evaluation

From 1999 through 2001, a supplemental risk evaluation was performed by EPA. This re-evaluation of site risks associated with exposures to arsenic was conducted partly because more yards within the La Casa Grande and Grandview neighborhoods were cleaned up by 1999. Numerous irrigation channels that extend into the Grandview area, many of which were known to have transported concentrates from the smelter site during floods, had also recently been cleaned up. Also by 1999, significant reductions of air emissions from the smelter were believed to have reduced the importance of the inhalation of soil in air pathway.

In this follow-on evaluation, a human health risk-based preliminary remedial goal (PRG) value for arsenic in soil was calculated based on the most recent site data. The PRG value, 176 ppm arsenic in soil, was based on a maximum acceptable cancer risk of 1.499E-04. It was also based on the assumptions that (a) arsenic in dust was unlikely to be more than 50% of arsenic in soil, and (b) the relative bioavailability of arsenic in soil was not likely to be more than 50% of the bioavailability of arsenic in water.

Of 46 properties in the La Casa Grande and Grandview neighborhoods, where pre-cleanup soils were analyzed for arsenic, a total of two properties had one or more samples above the PRG value of 176 ppm. However, the average level of arsenic at these two properties did not exceed 176 ppm. Of note, both of these properties had lead levels above 1,000 ppm, the trigger for soil cleanups due to elevated lead contamination.

Conclusion Regarding Arsenic Risks

The most recent data and updated risk calculations support the conclusion that arsenic contamination remaining in the soils is not likely to be a source of concern in the East Helena community. Furthermore, elevated levels of soil arsenic that approach, or in rare cases exceed, the PRG value of 176 ppm are known to co-exist with soil lead levels which are above the EPA-recommended clean-up levels for lead.

Risks from Exposure to Lead in Soil

The 1995 comprehensive human health risk assessment indicated that lead was a concern for East Helena children. Long before 1995, however, there was strong evidence that lead in the yard soils, street dust, and household dust were major contributors to the high numbers and percentages of local children who then had elevated blood-lead levels.

Exposures to lead in soil, at concentrations known to have been present then, increase the risk of childhood lead poisoning.

For lead, risks are generally expressed as the probability that exposure from site sources, combined with normal background exposure, will result in a child's blood lead rising to levels that exceed the current national level of concern (10 micrograms per deciliter (ug/dl)). For convenience, this probability of exceeding a blood lead value of 10 ug/dl is referred to as P10.

Several years ago, EPA set a national goal that the value of P10 should not be higher than 5%. That is, no child should face a risk greater than a 5% probability that his or her blood-lead level would be above 10 ug/dl. Or, stated another way, in a population of children (generally children under age 7 years) no more than 5% of them should have a blood-lead level above 10 ug/dl.

Studies Conducted

Numerous studies of East Helena's children have been conducted in the past, reaching back into the 1970s. In addition to early blood-lead studies, soil lead studies, and the 1995 risk assessment, more recent studies have been undertaken to assure that the children of East Helena are as protected from lead as is reasonably possible.

For the purposes of this Proposed Plan, it would be very cumbersome to summarize all of the studies that have enabled EPA to assure protection and recommend a final cleanup plan. Instead, EPA has chosen to briefly highlight the findings of these numerous studies in this Proposed Plan, but also provide access to the studies and their findings for those readers who desire more detail regarding site risks and risk assessment. Those individuals desiring greater detail should contact EPA's Helena Office by telephone (406-457-5035) or e-mail (brown.scott@epa.gov).

Predictive Modeling Studies

In accordance with EPA guidance, risks from lead in soil were evaluated, first in 1995 and again in 2005, using EPA's Integrated Exposure Uptake Biokinetic (IEUBK) model. This lead model uses nationally-derived and site-specific data, including lead concentrations in yard soils and household dust, to estimate typical lead intake from soil, dust, air, water and the diet. The model then estimates the expected distribution of blood lead values in a population of exposed children by assuming a lognormal distribution with a specified geometric mean.

The 2005 evaluation utilized the most recent version of the model and it incorporated new site-specific data that were collected from East Helena as recently as 2003. Not all of the model's input data requirements, however, were site-specific data; some data were derived from national and regional statistics.

The updated (2005) evaluation includes a quantitative uncertainty analysis, which characterizes how the level of concern for lead-in-soil at East Helena would change if a series of reasonable alternative input values were used in the model. Therefore, several "model runs" were conducted using regional data, such as from the Butte and Anaconda Superfund sites. Different combinations of plausible geometric standard deviation values (GSD values) and lead-in-air concentration values were also evaluated. All of the alternative input values utilized were specifically requested by the risk management team and are deemed to be scientifically valid.

The model predictions enable EPA to determine the lead-in-soil concentration (or the range of concentrations) at which there is a 5% probability that an exposed child's blood-lead value will rise above 10 ug/dl. The model-derived predictions for East Helena were as low as 250 ppm lead-in-soil, to a mid-range of 520 to 1,200 ppm, to as high as 3,200 ppm, depending upon the various input data. The mean of the various model-derived predictions produced was about 990 ppm lead-in-soil. Table 2 shows the variation of model-derived predictions that were produced in 2005, using a series of reasonable alternative input values.

The choice as to which value (or values) may be most appropriate for consideration in the process of selecting a final soil cleanup level for East Helena is a risk management decision. The model-derived predictions are but one aspect, of several equal or more important aspects, that were considered by risk managers in arriving at the Preferred Alternative for a final cleanup level for lead in East Helena's soils.

Table 2. Alternative Levels of Concern for Lead in Soil

RBA	Soil Intake	Soil:Dust	Point Est = GM		Point Est = AM	
			GSD = 1.6	GSD = 1.4	GSD = 1.6	GSD = 1.4
71%	Default	0.7	340	460	400	500
71%	Default	0.17	520	710	610	760
71%	Default	0.17+271	250	440	340	500
71%	Anaconda	0.7	1200	1620	1420	1760
71%	Anaconda	0.17	1850	2520	2180	2690
71%	Anaconda	0.17+271	910	1550	1230	1750
60%	Default	0.7	400	540	470	590
60%	Default	0.17	620	840	720	900
60%	Default	0.17+271	350	560	460	630
60%	Anaconda	0.7	1440	1920	1680	2100
60%	Anaconda	0.17	2210	2980	2560	3200
60%	Anaconda	0.17+271	1250	2030	1620	2240

RBA—Relative bioavailability of lead
Soil Intake—Soil ingestion rate
Soil:Dust—Ratio of soil to dust

GM—Geometric mean
AM—Arithmetic mean
GSD—Geometric standard deviation

Blood Lead Studies and Observations

Blood lead levels of East Helena children have been studied extensively since 1975. In the past, average blood lead values were high and the occurrence of values well above 10 ug/dl was common. Over time, however, average levels and the frequency of values above 10 ug/dl have declined significantly. Table 3 summarizes blood lead data for children, ages 6-72 months, that have been gathered between 1975-2006 (see also Figure 5).

Blood lead data gathered through 1992, summarized in Table 3, showed a clear relationship between distance from the smelter and both the mean blood lead values and the frequency of values above 10 ug/dl. The majority of children who lived within one mile of the smelter, prior to that period, faced a high probability that their blood lead levels would be greater than 10 ug/dl. The 1995 risk assessment noted that this observation might have been influenced by factors such as the levels of lead in air and in paint, in addition to the levels of lead in soil. However, it is not disputed that, prior to the 1990s, yard soils and household dust were

Table 3. Blood Lead Levels of East Helena Children 6 to 72 Months of Age (1975-2006)

Year	No. of children tested	No. with lead-in-blood levels 10 ug/dl or greater	Average (µg/dl)
1975	90	90	28
1983	98[a]	67	14
1991-92	23	11	10.2
1993-94	36	2	5.5
1995-96	157	2	4.7
1997-98	185	7	4.2
1999-00	186	5	4.1
2001-02	130	0	2.6
2003-04	254	0	2.0
2005	10	0	1.7
2006	137	0	1.3

[a]Ninety-eight children residing within 1 mile of the smelter.

primary contributors to the elevated blood lead levels observed among East Helena children.

As shown in Table 3 and Figure 5, there has been a steady decline in East Helena children's blood lead levels. Since 2001, there has been no child, of 531 children tested, with a blood lead value that exceeded 10 ug/dl. Moreover, 98% of children tested since 2001 were at 4 ug/dl or below.

Relationship Between Soil Lead and Blood Lead

EPA conducted an analysis of the relationship between blood lead levels in children less than seven years old and the level of lead in the soil where the child lives or lived. This analysis indicates that blood lead levels in children residing at locations where soil lead is in the 500-1000 ppm range are not statistically different from children residing at locations where soil lead is less than 500 ppm.

The results of this analysis support the conclusion that the current levels of lead in soil in East Helena are sufficiently low that the contribution of soil lead, to children's blood lead levels, is too small to be detected.

Conclusions Regarding Lead Risks

Multiple lines of evidence support the following conclusions regarding risks from exposure to lead in East Helena:

1. High soil lead concentrations can be an important indicator of a high level of risk for children. Early site investigations (1980s and 1990s) revealed that lead levels in soils and household dust were highest in neighborhoods located within one mile of the smelter, where soil lead concentrations commonly exceeded 3,000 to 5,000 ppm. Children living within one mile of the smelter had the highest blood lead levels, and therefore faced the highest risks. More than one mile away, soil lead concentrations were lower, as were children's blood lead levels, but maximum soil lead values still would exceed 1,500 to 2,500 ppm.

2. Household dust levels with elevated lead concentrations increase risks of exposure, particularly for very young children (infants and toddlers). High or moderately high lead concentrations in yard soils and unpaved or unvegetated areas near homes contribute to high household dust lead levels. Also, home repairs or remodeling that open up attics, basements, heating ducts, or outside walls and windows contribute to household dust levels that increase risks of exposure to lead.

3. Children's blood-lead levels are an important indicator of the level of risk. East Helena children's blood-lead levels are significantly lower in recent years as compared to levels observed prior to the 1990s. Recent data indicate that East Helena children's blood lead levels are lower than national statistics.

4. Risk of exposure to lead has been reduced significantly in East Helena over the past decade. This reduction of risk is attributed to the community-wide soil removal action, intensive education and a responsive community, reductions of smelter emissions (eliminated upon closure in 2001), street sweeping over several years, and interruption of an important exposure pathway between smelter workers and their home environment.

5. The contribution of current levels of lead in residential soils and homes of East Helena appears to be sufficiently low as to be non-detectable by either of the two reliable measures of risk: long-term, representative blood-lead testing and applications of the integrated exposure uptake biokinetic model.

6. Exposures arising from the remaining yards and unpaved areas known to have high or moderately high lead concentrations (some portion of the yard greater than 1,000 ppm) are limited by the fact that children do not live or play there. Should that change (e.g., when a family with young children moves in), risks may increase.

7. Community-wide education programs and child blood-lead monitoring effectively reduce risks. These programs are vital for keeping risks low at a site such as this, where residual lead levels cannot be eliminated.

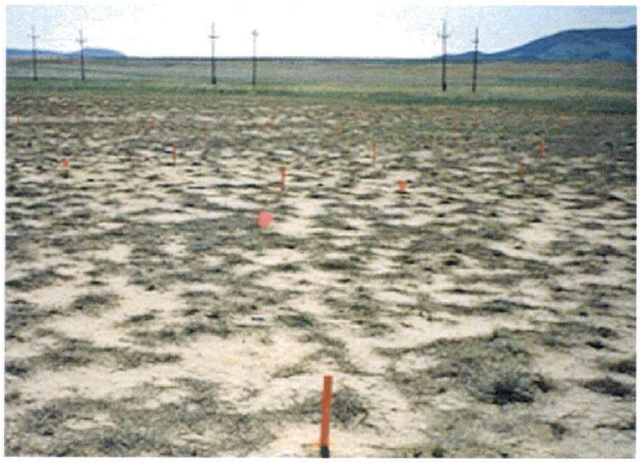
Ecological Risks

Risks to ecological receptors were first evaluated in a Comprehensive Endangerment Assessment in 1989. However, there were significant data gaps in the 1989 assessment. Therefore, in 2003, EPA collected additional ecological information and prepared a Supplemental Ecological Risk Assessment report, which was published in January 2005.

The recent assessment included evaluations of habitat and estimates of risk for aquatic receptors (fish and benthic invertebrates) in Lower Lake, Upper Lake, marsh areas southeast of the smelter, and Prickly Pear Creek. Terrestrial receptors (plants, soil invertebrates, livestock and wildlife) were also evaluated.

Risks to ecological receptors within the smelter site (including Lower Lake, Upper Lake, the marshes and Prickly Pear Creek) will be further evaluated under RCRA program authority. According to the evaluations thus far conducted, however, the following conclusions can be drawn:

- the risk of population-level effects to fish in Prickly Pear Creek is minimal to low;
- the risk of population-level effects to benthic invertebrates in Prickly Pear Creek is low;
- the reported levels of metals and arsenic in terrestrial soils were not sufficiently high to expect that there would be a widespread ecological impact on plants or soil invertebrates. Some areas of impact, however, do persist east and north of the smelter;
- insect-eating birds or small mammals may be adversely impacted in open and undeveloped terrestrial areas within one mile of the smelter. Elevated soil lead concentrations are the main concern. Adverse effects may also occur due to the ingestion of several metals, including lead, in the aquatic food chain. Ingestion of water from Prickly Pear Creek is not likely to adversely impact birds or mammals; and
- risks to livestock from ingestion of soil and plants, dermal contact with surface water, and inhalation of dust are believed to be the primary exposure pathways for livestock. Although exposures to livestock are noted in the assessment, and livestock were affected for decades prior to 1990, exposures are not currently causing observable adverse effects.



East Fields pre 1990.

East Fields in 2005 (10 years after treatment.)

4. Remedial Action Objectives

Remedial objectives and goals are the desired end of a cleanup action. The final cleanup of residential soils and undeveloped lands in and around East Helena requires a thorough reexamination of the objectives and goals that were originally established in 1991, as well as the more stringent objectives and goals developed over the course of events that have occurred since 1991.

Initial Objectives and Goals

When the residential soil removal action was initiated in 1991, the general, overarching objective was to reduce children's exposures to lead, which would in turn reduce their blood lead levels. A numeric goal was set: Reduce children's blood lead levels so that no more than 5 percent of the exposed children would be greater than 10 ug/dl and no child would be greater than 15 ug/dl. This was at a time when the majority of East Helena children were above 10 ug/dl and a third of them were above 15 ug/dl.

The goal was to be achieved through a combination of a soil removal action, health intervention and education, and reductions of smelter emissions.

For the soil removal action, a "trigger" level for removing and replacing yard soils was set at 1,000 ppm lead. A yard qualified for cleanup if at least one sampling unit (quadrant) had a soil lead concentration above 1,000 ppm. But, all other sampling units in the yard found to be greater than 500 ppm lead would also be removed and replaced. The goal for children's blood lead levels (less than 10 ug/dl) and the range established for cleanup (500 to 1,000 ppm lead) were both consistent with EPA's national guidance.

By 1995 and 1996, Asarco's contractors had built up a full head of steam in removing and replacing soils, first where children lived or played. Education and intervention efforts by EPA, MDEQ and the Lewis and Clark County Health Department (since named City-County Health Department) had intensified and smelter emissions were being significantly reduced by Asarco. A community-wide street sweeping effort was initiated. Three large areas that were previously undeveloped, with high lead levels, were treated in place and prepared for residential or recreational use. Of 157 children tested in 1995 and 1996, only 2 children (1.3%) had blood lead levels above 10 ug/dl. Over the next four years, 1997 to 2000, of 371 children tested only 12 children (3.3%) had blood lead levels above 10 ug/dl.

The initial goal was achieved. In fact, it was surpassed. But, the newly-established Lead Education and Abatement Program, housed in East Helena, together with Asarco, EPA, MDEQ and a small group of local resident advisers, began to consider that a new goal was within reach: Reduce exposures further, to the point where no child in East Helena would have a blood lead value above 10 ug/dl and the majority of them would be below 4 ug/dl.

The removal action proceeded into 2001 and beyond. Over its course, several modifications were made, and as a result the community-wide average levels of lead in soils have been markedly reduced as shown in Figure 5. Where children reside today, soils with high lead concentrations are gone. At the same time, the education and intervention program has become increasingly effective. School administrators and teachers opened their doors to the program. Day-care operators opened their doors. Thus, from 2001 through 2006, of 531 children tested, no child had a blood lead value above 10 ug/dl. And, 98% of the children tested since 2001 are at 4 ug/dl or below.

The second set of goals, more protective than the first, was achieved.

East Helena children's blood lead levels have been reduced to levels that surpass all goals established locally, as well as national goals for lead sites. Nevertheless, EPA, MDEQ and the

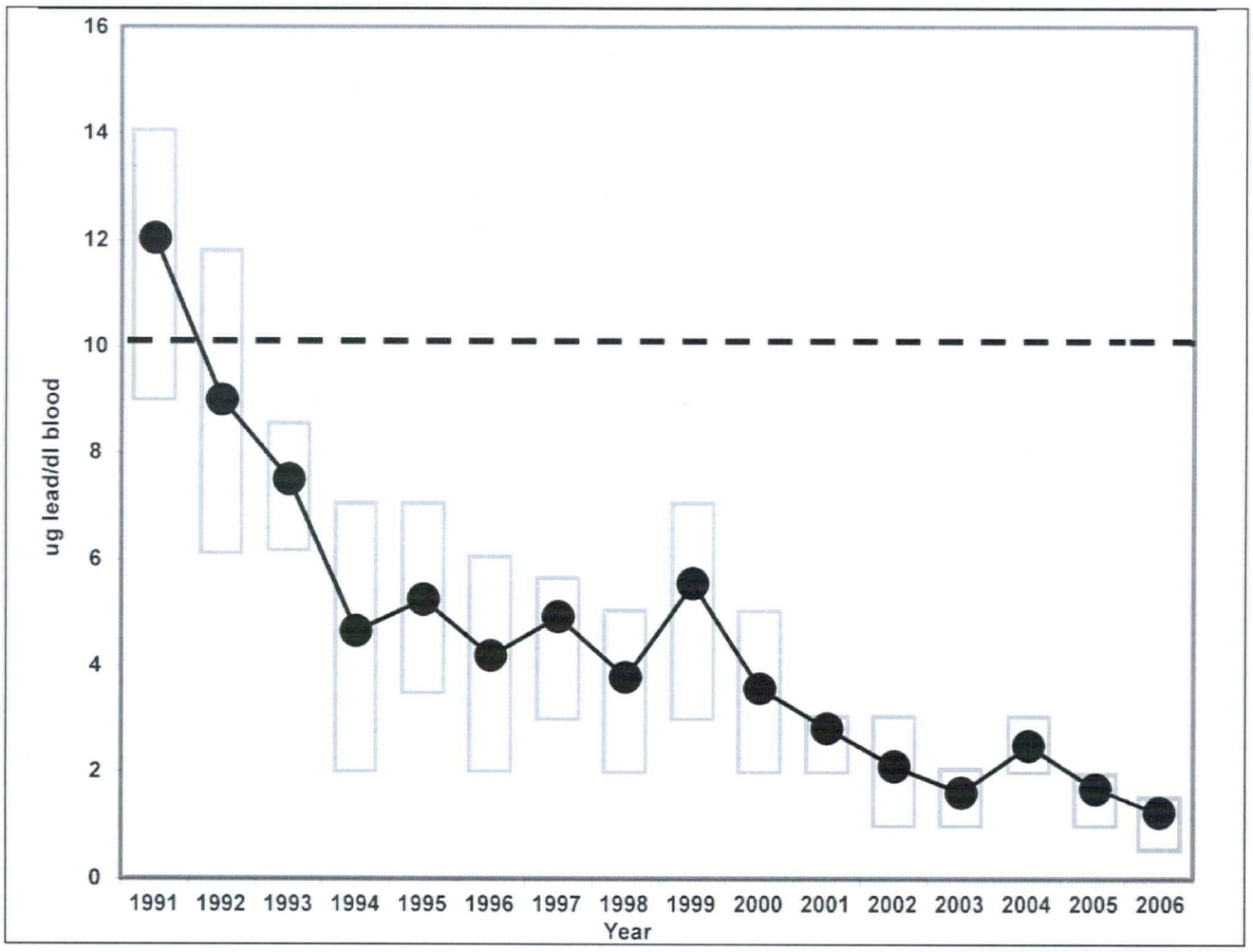


Figure 5. Children's average (•) blood lead concentrations from 1991 through 2006. Rectangles represent the central 50% of the concentration data

Lewis and Clark City-County Health Department believe that yet another, more stringent and protective set of objectives and goals may be achieveable by implementation of the Preferred Remedy recommended in this Proposed Plan.

Proposed Final Remediation Objectives and Goals

Soil lead levels of an estimated 100 - 110 existing residential yards and their adjacent unpaved street aprons and alleys, as well as large tracts of surrounding undeveloped land, continue to exceed levels deemed safe for children in residential settings. Although children do not currently reside at these locations, property ownership changes and development of undeveloped lands are occurring at a rapid pace. Children will sooner or later reside at these locations. Accordingly, the following revised and updated remediation objectives and goals are proposed as final:

- Maintain the average blood lead concentration for area children at a level less than the national average for children less than 7 years old;
- Continue to have no child in the East Helena area exhibit a blood lead concentration greater than 10 ug/dl and maintain 90 percent or more of the children at or below 4 ug/dl;
- Continue the Lead Education and Abatement Program and continue to seek ways to improve its effectiveness and outreach;
- In existing residential areas, prevent exposure by children and pregnant women to

soils or household dust with a lead concentration exceeding 1,000 ppm. Ensure that, once a yard qualifies for cleanup, all sampling units of that yard with a lead concentration exceeding 500 ppm are also cleaned up;

- Ensure that cleanup actions based on lead also protect against exposures to a yard average arsenic soil concentration greater than 176 ppm;
- Prevent recontamination of areas already cleaned up, such as from undeveloped areas that have not been cleaned up, or from buried soils or remodeling debris with residual lead levels above risk-based concentrations;
- Maintain and encourage best management practices on agricultural lands, thus minimizing wind-borne migration of lead into residential areas and minimizing exposures to livestock and wildlife;
- For undeveloped areas that are proposed for development in the future, ensure that soil lead and arsenic concentrations do not exceed risk-based concentrations for the proposed new use; and
- Recent risk calculations establish risk-based concentrations of lead and arsenic in soils for undeveloped lands that may be used by workers (farmer, rancher, irrigator, commercial retailer, etc.) or recreational visitors. For lead, calculations are based on achieving or maintaining blood lead concentrations below 4 ug/dl. Soil lead levels of no greater than 1,300 ppm for workers and no greater than 2,800 ppm for recreationists will meet this remedial objective. For arsenic, calculations are based on limiting cancer risk. Soil arsenic levels no greater than 270 ppm for workers and no greater than 1,000 ppm for recreationists will meet this remedial objective.

Property post-excavation and awaiting backfill. Properties qualify for a cleanup whenever any quadrant or section exceeds 1,000 ppm; then all other quadrants or sections exceeding 500 ppm lead are also removed.

These revised, final remediation objectives are protective of existing residential areas by providing continuing cleanup of qualified properties, such that there can be full use of all existing residential areas with minimal risk to the area's residents, mainly young children. The remediation objectives are protective of the surrounding undeveloped lands, such that the current uses (primarily agricultural) can continue with minimal risk to humans as well as livestock and wildlife. In addition, the remediation objectives and goals are protective of potential future residential development on currently undeveloped lands, such that the risks from lead contamination in these soils can be reduced, if necessary, to acceptable levels prior to development for any anticipated use, including residential, recreational and commercial uses.

5. Summary of Cleanup Alternatives

The cleanup alternatives presented in this Proposed Plan are modified versions of the alternatives that were developed in site feasibility studies. All of the cleanup alternatives presented herein are, with the possible exception of the No Further Action alternatives, well suited to current site conditions and capable of reducing site risks to acceptable levels.

Cleanup Alternatives for Existing Residential Areas

Cleanup alternatives for residential areas were originally developed in the 1990 remedial investigations and feasibility study reports and a 1991 engineering evaluation and cost analysis report. Many of the alternatives developed at that time, however, are no longer considered viable; due principally to the substantial amount of cleanup that has since occurred. Therefore, EPA developed new alternatives that incorporate many of the features of the original alternatives, but are relevant for current conditions. The remedial alternatives for existing residential areas are:

- Alternative 1R—No Further Action
- Alternative 2R—Selected Soil Removal (1,000/500 ppm lead), Continuing Community Education, and Institutional Controls
- Alternative 3R—Selected Soil Removal (500 ppm lead), Continuing Community Education, and Institutional Controls

Each of these alternatives is described below, along with an approximate time frame for implementation, and the estimated cost. Net present value costs are presented so that each alternative can be compared against all other alternatives on equal footing. Capital costs and net present value costs are presented in greater detail in Table 5 at the end of Section 6.

Alternative 1R—No Further Action

Cost—$ 284,000 (net present value)

Time to Implement—0 year

Under this alternative, no further action would be implemented, other than continuation of blood lead monitoring for children and limited environmental monitoring. Existing conditions would remain as they are, and the Lead Education and Abatement Program may or may not be kept intact, depending upon the availability of funds from other sources and a determination of need. This alternative is required by EPA regulations to be used as a comparison against the alternatives that require action.

Alternative 2R--Selected Soil Removal (1,000/500 ppm lead), Continuing Community Education, and Institutional Controls

Cost—$ 10 million (net present value)

Time to Implement—2 years after EPA issues a Record of Decision

Under Alternative 2R, the remedy would consist of completing the residential soil cleanup according to protocols that are currently in place for the ongoing removal action. All remaining residential yards, vacant lots near residences, and unpaved areas such as streets and alleys within residential areas, that qualify under current protocols for the ongoing residential soil removal action, would be cleaned up. The county-administered, community-wide education program, designed to monitor and protect children against exposures to residual lead, would be continued for as long as necessary. And, institutional controls would be developed and administered by local government to protect against recontamination of areas cleaned up and assure that protective regulations and policies are adhered to.

Under Alternative 2R, yards and other properties within residential areas would qualify for

cleanup whenever any one (or more than one) sampling section, or quadrant, is above 1,000 ppm lead. Once a yard qualifies, all other sections (or quadrants) that are above 500 ppm lead would also be cleaned up.

The following details further define how Alternative 2R would be implemented, and how continuing education and institutional controls play a vital role in the overall cleanup.

- Where soil sampling indicates that any section or quadrant of a residential property qualifies that property for cleanup (i.e., at least one section greater than 1,000 ppm lead), all sections greater than 500 ppm lead would be excavated, placed into dump trucks that can be covered, hauled to the East Fields soil repository and disposed of by means of land application over ground that was severely impacted by past smelter emissions. Qualified yards where young children reside receive first priority each construction season.
- Unpaved roads, alleys and aprons that are adjacent to qualified properties would be excavated at the same time, under the same protocols.
- Soils would be excavated to a depth of 18 inches, or until all remaining lead concentrations, after excavation, are less than 500 ppm, whichever occurs first.
- Clean topsoil, generally mined from farmlands in the Helena Valley, would be used to backfill the areas from which soils are removed. Sod or reseeding, replacement of shrubs, and other actions would be implemented in order to restore the property to its pre-response action condition.
- Whenever blood lead tests of a child and a follow-up environmental assessment of a home by health professionals demonstrate that exposure to lead in the soils of that yard is responsible for a blood lead level above 10 ug/dl, then that yard qualifies for immediate remedial action irrespective of the yard soil lead concentration.
- In the unlikely circumstances where a yard average soil arsenic concentration exceeds 176 ppm, but the yard does not otherwise qualify (e.g., no quadrant above 1,000 ppm lead), then the yard qualifies for remedial action.

An estimated 100 - 110 residential yards and 9 vacant lots, as well as their adjacent unpaved roads, aprons and alleys, are known to qualify for cleanup under Alternative 2R. It is anticipated that approximately 2 years would be required to clean up all remaining qualifying residential properties after EPA issues a Record of Decision.

Continuing Community Education

Under Alternative 2R , the Lewis and Clark City-County-administered Lead Education and Abatement Program will continue to operate within the community for as long as needed to protect children from exposures to residual levels of lead. The program provides broad-based education to the public, in homes, day-care centers and schools.

The focus of education is on nutrition, hygiene, continued health monitoring (blood lead testing) of the area's children, "safe play" programs, and continued risk reduction. The program provides education to area residents on the need to avoid areas with elevated soil lead levels and to maintain soil and sod barriers. The program provides information to future purchasers and sellers of property, lending institutions, and realtors regarding both site-wide and individual property-specific conditions. The program will, after a final remedy is selected and a Record of Decision is issued, administer institutional controls and associated guidelines.

The program promotes environmental assessments in homes, including soil, dust, water and paint sampling to identify all sources of and pathways for lead exposure.

Institutional Controls for Residential Areas

Institutional controls for residential areas are measures necessary to provide long-term

protection of the remedy. These measures, in turn, protect against exposures to residual levels of lead. Thus, education efforts and institutional controls administration go hand-in-hand and the two functions often overlap. Under Alternative 2R, local governments would:

- Adopt and administer local regulations designed to reduce opportunities for recontamination of areas already cleaned up;
- Adopt and administer regulations that require, or policies that encourage, coordination of planning and zoning efforts (East Helena city government, Lewis and Clark County Health Board, L&C County Planning and Zoning Commission);
- Continue to provide oversight of cleanup activities and monitor areas previously cleaned up; and
- Administer restrictions and requirements at the EPA-approved soils repository.

Alternative 3R—Selected Soil Removal (500 ppm lead), Continuing Community Education, and Institutional Controls

Cost—$38 million (net present value)

Time to Implement—5 to 7 years after EPA issues a Record of Decision

Under Alternative 3R, the remedy would consist of completing the residential soil cleanup according to revised, more stringent protocols than are currently in place for the ongoing removal action. All remaining residential yards, vacant lots, and unpaved areas such as streets and alleys, that would qualify under the revised protocols, would be cleaned up. The county-administered, community-wide education program, designed to protect against exposures to residual lead, would continue for as long as necessary. Institutional controls would be developed and administered by local government to protect against recontamination of areas cleaned up and assure that protective regulations and policies are adhered to.

Under this alternative, yards and all other properties, including unpaved streets, alleys and open areas within residential areas, would qualify for cleanup whenever the property average lead concentration is above 500 ppm. Once a property qualifies under this alternative, the entire property would be cleaned up.

The following details further define how Alternative 3R would be implemented, and how continuing education and institutional controls play a vital role in the overall cleanup.

- Where soil sampling indicates that a parcel of residential property has an average soil lead concentration greater than 500 ppm, all soils of that property would be excavated, placed into dump trucks that can be covered, hauled to the East Fields soil repository and disposed of by means of land application over ground that was severely impacted by past smelter emissions.
- All unpaved roads, alleys, aprons, commercial areas, and vacant residential lots or open areas within residential areas, that have an average soil lead concentration above 500 ppm, would be cleaned up.
- Soils would be excavated to a depth of 18 inches, or until all remaining lead concentrations are less than 500 ppm, whichever occurs first.
- Clean topsoil, generally mined from farmlands in the Helena Valley, would be used to backfill the areas from which soils are removed. Sod or reseeding, replacement of shrubs, and other actions would be implemented in order to restore the property to its pre-response action condition.
- Whenever blood lead tests of a child and a follow-up environmental assessment of a home, performed by health

professionals, demonstrate that exposure to lead in the soils of that yard is responsible for a blood lead level above 10 ug/dl, then that yard qualifies for immediate remedial action, irrespective of the yard soil lead concentration.

- In the unlikely circumstances where a yard average soil arsenic concentration exceeds 176 ppm, but the yard average soil lead concentration does not exceed 500 ppm, then the yard qualifies for remedial action.

It is estimated that approximately 900 yards, lots, and open areas would qualify for remedial action under Alternative 3R. This estimate has some associated uncertainty because all existing residential properties within a radius of approximately 2.5 miles from the smelter would require pre-sampling. (See Figure 1 and note the probability of locating properties with soils greater than 500 ppm lead.) Extensive additional pre-sampling and the estimated number of properties that are likely to qualify under Alternative 3R result in an estimated time of construction of 5 to 7 years, after a Record of Decision is issued by EPA.

Under Alternative 3R, continuing community education and institutional controls would be necessary for all the reasons that they are necessary under Alternative 2R. Although more areas would be cleaned up under this alternative, extended construction times and the same concerns regarding residual levels of lead that exist for any of the other alternatives also exist for Alternative 3R (remaining lead at depth, wind-blown dust from undeveloped lands, residual levels of lead in attics and roof shingles, soil beneath ground structures, lead-based paint, etc.). See the discussion of the education and institutional controls components above, in the details regarding Alternative 2R; they apply equally to Alternative 3R.

Undeveloped Lands Surrounding East Helena and the Smelter

The former smelter, City of East Helena and neighboring subdivisions are surrounded by undeveloped lands. They are mainly agricultural lands. Although 18 to 20 elements are elevated in the soils, lead, and to a lesser extent arsenic, are the elements of concern for future residential development. Current risks to grazing livestock and wildlife are low. Careful land management—best management practices—provide adequate protection from overgrazing, which in turn prevents or reduces wind-blown erosion and over-exposure to grazing animals.

Undeveloped lands are being developed, and proposed for development, in the vicinity of East Helena. As these lands become developed, particularly for residential purposes, the levels of lead become a matter of concern. Much of the undeveloped land shown in Figure 1, within the outer isopleth, would likely require some remedial action prior to being developed for residential purposes. Remedial action may or may not be necessary if the proposed new land use is recreational or commercial.

No one can accurately predict which undeveloped lands may be developed next; when they might be developed; or what the new use might be. Therefore, the cleanup alternatives for undeveloped lands were assembled in recognition of that uncertainty. They were also developed in recognition of features unique to undeveloped lands. The following features are defined in order to guide remedial decisions that will be consistent with the current or possible future use:

- Farm or range lands and open spaces, generally within 2 to 3 miles of the smelter, which may be developed in the future. The majority of these lands around East Helena produce grain crops or are used for livestock grazing, but are being developed for residential purposes at a rapid rate;

- Areas generally north of East Helena, within the Prickly Pear Creek flood zone, where

water-conveying ditches and channels are common. High concentrations of lead and arsenic found in these ditches and channels are thought to have been transported, during floods, from outdoor piles of concentrates on the smelter grounds. Residences have been constructed, and will continue to be constructed, on or near these ditches and channels. While many were cleaned up during the mid-1990s, many more will require some remedial action as residential development continues in this area. Cleanup of this area will be decided on a case-by-case basis, depending upon sampling results, proximity to residences, and the estimated risk of exposure under current conditions;

- Areas along the railroad right-of-way, particularly between the tracks and the nearby residences of Manlove Addition. Sampling along the railroad right-of-way revealed comparatively high levels of lead and arsenic, indicating that concentrates were spilled or unloaded here. The right-of-way and adjacent areas are not likely to be developed for other purposes in the future. However, they are believed to pose risks for children who ride bicycles or play between the Manlove Addition and the tracks (in spite of the more immediate dangers);

- The rodeo grounds. The East Helena rodeo grounds are located immediately west of the smelter. The property is owned by Asarco and includes the rodeo arena and approximately 20 acres of surrounding, undisturbed land that is used primarily for parking. The rodeo grounds are used occasionally in the summer, typically less than 10 days per year. Sampling revealed soil lead levels from 1,144 ppm to 5,304 ppm. The rodeo grounds are not likely to be developed for other purposes in the future. Because of the very limited seasonal use patterns, EPA believes that the human health risks are minimal. Therefore, cleanup of this area is not planned. However, this area and others similar to it are illustrative of the need for continuing community education and institutional controls, as it is simply not practical to eliminate all sources of and pathways for lead exposure from this large site; and

- The East Fields soil repository. The East Fields are located east of the smelter and are owned by Asarco. They encompass an area of approximately 160 acres and have been used since 1991 as a repository for soils excavated as part of the removal action. It is anticipated that the East Fields will continue to be used as a repository. Cleanup of this area is therefore not planned. Their long-term management requires institutional controls.

Cleanup Alternatives for Undeveloped Lands

Remedial alternatives for undeveloped lands were originally presented in 1990 site feasibility studies. Many of these alternatives are no longer considered viable. EPA has developed new alternatives that incorporate many of the features of the original alternatives, but are relevant for current conditions. The alternatives for the undeveloped lands are:

- Alternative 1U—No Further Action
- Alternative 2U—Soil Removal and Replacement
- Alternative 3U—Capping
- Alternative 4U—In-Place Treatment

The cost and time to implement each of the alternatives can be estimated only for specific undeveloped areas—particularly the areas with ditches and channels and the railroad right-of-way. It is not possible to estimate costs or time to implement cleanups for the majority of undeveloped lands, which may or may not be developed in the future. This is because the specific lands that will be developed, the type of development that will occur, and the time when development might occur are unknown. Therefore, present worth costs have been estimated only for the ditches and channels and for the railroad right-of-way. The estimated costs

for developing all other lands are presented on a per-acre basis, and at 2006 prices. Costs for each of the cleanup alternatives for undeveloped lands are summarized in Table 5 at the end of Section 6.

Alternative 1U—No Further Action

Estimated Cost—$ 118,000 (net present value)

Under this alternative, no further action would be implemented. Existing conditions would remain as they are on undeveloped lands. There would be no requirement to sample undeveloped lands or to evaluate whether or not a cleanup may be needed before development. It is possible that local or state government could impose restrictions on future land use changes, or not allow development at all on these mainly agricultural lands and open spaces.

Alternative 2U—Soil Removal and Replacement

Estimated Costs for Water-Spreading Ditches and Railroad Right-of-Way—$ 1.5 million (net present value)

Estimated Cost for Future Developments—$ 40,700/acre (capital cost)

Cleanup of undeveloped lands under Alternative 2U would consist of excavation, generally by means of heavy equipment, such as large scrapers or dozers and track hoes. Excavation would continue at depth until all surface or near-surface soils are less than the cleanup goals for the proposed new use. (See Table 4.) For proposed residential development, for example, it is expected that 8 to 12 inches of soil would need to be removed in order to reduce lead concentrations to below 500 ppm. The removed soils would be loaded into haul trucks that can be covered, then taken to the East Fields repository for land-application. Clean replacement topsoil, mined from farmlands in the Helena Valley, would be hauled to the site and stock-piled until the new developments are ready for backfill.

In certain, limited cases, such as for new commercial developments, lesser amounts of replacement soil or possibly no topsoil would be needed. Replacement fill other than topsoil may, in commercial developments, be more cost-effective and produce fewer environmental consequences than topsoil as backfill.

Cleanup along the railroad right-of-way and ditches and channels under this alternative would consist of removal of 12 to 18 inches of surface and near-surface soil, with disposal at the East Fields. Clean replacement topsoil, mined from farmlands in the Helena Valley, would be used as backfill. The mean lead concentration of topsoil mined from the north Helena Valley is about 60 ppm. Revegetation would follow.

Cleanup would not be required at the rodeo grounds or the East Fields.

Following development, institutional controls and monitoring would be implemented and administered by the Lewis and Clark County Planning and Zoning Commission and the Lead Education and Abatement Program, similar to the institutional controls identified for the existing residential areas.

Alternative 3U—Capping

Estimated Costs for Water-Spreading Ditches and Railroad Right-of-Way—$ 1.2 million (net present value)

Estimated Cost for Future Developments—$ 36,400/acre (capital cost)

Under Alternative 3U, cleanup of undeveloped lands in the future would consist of a cap, or cover, over surfaces that do not meet remedial goals for the intended new use. Caps do not reduce the concentrations of metals or arsenic in the soil; however, they do provide a barrier to exposures that would otherwise occur. Caps may be a layer of soil, or gravel, or pavement placed over the surface of the undeveloped area. The pathway for exposure is therefore interrupted.

Capping can be a cost-effective alternative and can be protective when the intended new use is industrial, commercial, or recreational. In these cases, because exposure is limited, the thickness of the cover material can be as little as a few inches to provide a barrier. Soccer fields or baseball and softball fields could be constructed over some

undeveloped lands surrounding East Helena with little preparation but leveling and a few inches of cover soil and vegetation. Capping reduces or eliminates the need for extensive alteration of the land and hauling removed soils to a soil repository.

Capping is rarely used in areas where the intended new use is residential. The few known examples of capping for future residential areas require a cap that is at least 24 to 48 inches thick. That usually results in capping becoming more costly than other alternatives suited to the future use. Capping is also not a suitable alternative in areas that are subject to periodic erosion by flooding, such as in or near an active flood plain or along drainage ditches or water conveyance channels.

Cleanup would not be required at the rodeo grounds or the East Fields. However, if use of the rodeo grounds increases significantly in the future, capping and revegetation may be an alternative worthy of consideration.

Following development of lands capped, or covered under Alternative 3U, institutional controls and monitoring would be implemented similar to Alternative 2U.

Alternative 4U—In Place Treatment

Estimated Costs for Water-Spreading Ditches and Railroad Right-of-Way—$ 1.3 million (net present value)

Estimated Cost for Future Developments—$ 4,800/acre (capital cost)

Under Alternative 4U cleanup of undeveloped lands undergoing a change in use in the future would consist of deep tillage of the surface and near-surface soils and simultaneous application and incorporation of lime and other soil amendments. Highly specialized plows that mix, rather than turn over the soil, are used in this innovative technique. Multiple, perpendicular passes of the plow ensure mixing and incorporation of the amendments. This technique is also known as in-situ treatment of soils.

In-place treatment can be most successfully applied when the surface soil (0 to 4 inches) concentrations of lead or arsenic are above acceptable levels for a new use, but the subsurface soil (6 to 24 inches or greater) concentrations of the same elements are significantly lower or near natural levels. This remedial alternative does not remove contaminants from the soil, but reduces their concentrations to levels that are safe and protective for the new use.

Amendments, such as lime, organic matter, phosphorus, and fertilizers can be incorporated into the soils at the time of deep tillage. These amendments render lead less mobile in the soil and less bio-available. In some soils, lime enhances arsenic mobility. However, the concentrations of arsenic found in soils of undeveloped lands that are likely to be changed to residential development are low under existing conditions.

Under Alternative 4U, neither excavation nor replacement of soil is required. Therefore, there is no need for large numbers of haul trucks or heavy equipment. There is no need for a repository because no soil would be excavated. And, there is no need for mining large areas of productive farmland topsoil to be used as replacement fill. Implementation costs are a fraction of the implementation costs required for other remedial alternatives.

Most undeveloped lands that are likely to be developed in the future for residential and commercial uses, near East Helena, are well-suited to in-place treatment. The after-treatment lead concentrations of most of these lands would be in the range of 100 to 300 ppm.

Elements Common to All Action Alternatives for Undeveloped Lands

The following are elements common to all of the alternatives for undeveloped lands, with the exception of Alternative 1U—No Further Action.

Cleanup Goals

On undeveloped lands proposed for development in the future some remedial action would be required if lead or arsenic levels in soils exceed the concentrations shown in Table 4.

The soil lead cleanup level for new residential development on formerly undeveloped land is proposed as 500 ppm. This is a slight departure from the lead cleanup action level for existing residential areas, and there are three principal reasons for the departure:

1) sampling protocols in undeveloped areas are less intensive than in existing residential areas, which means that isolated "hot spots" may be missed in the sampling effort;

2) the locations and density of residences where children may live and play in the future cannot be known prior to development; therefore, the exposure areas and exposure scenarios are less certain until they are delineated and platted out; and

3) all alternatives for undeveloped lands can be implemented in less time and at less cost, as compared to alternatives being implemented in congested, existing residential areas. For example, in-place treatment (4U), which is not feasible in congested residential areas, can readily be implemented in large open areas being prepared for residential development. Post-treatment soil lead concentrations as low as 100 to 300 ppm lead can be readily achieved by means of in-place treatment, at a cost that is approximately one-tenth the cost of other alternatives for undeveloped lands and less than one-tenth the cost of cleaning up yards in existing residential areas.

Institutional Controls for Agricultural Lands

All of the alternatives would include institutional controls for existing agricultural lands until such time as these lands are developed for other purposes. Institutional controls would focus on maintaining and improving appropriate management practices by means of Best Agricultural Management Practices (BAMPs). The best management practices program would be primarily an educational program and would be implemented in concert with the residential Lead Education and Abatement Program. Because best management practices would be different for farmlands than for rangelands, the program would have two different educational components.

Table 4. Cleanup Goals for Undeveloped Lands

Type of Development	Cleanup Level for Soil lead	Cleanup Level for Soil Arsenic
Residential	500 ppm	176 ppm
Commercial/ Industrial	1,300 ppm	270 ppm
Recreational	2,800 ppm	1,000 ppm

The majority of the farmlands around East Helena are planted in grain, primarily wheat and barley. The education program for these lands would encourage the following, primarily to reduce the production of fugitive dust:

- Minimum tillage practices—rather than tilling with standard plows and discs, till with chisel bars and only a single tillage pass. The chisel bars till soil only about 1 inch deep and reduce the disturbance of the soils; and
- Minimize autumn burning and tilling—rather than burning or turning under the stubble after the autumn harvest, allow the stubble to remain in the fields over the winter. This will tend to hold the soil and reduce winter dust production. For winter wheat (which requires autumn tilling) minimize the time between tilling and planting to encourage plant cover as soon as possible in the autumn.

For rangelands, the following practices would be encouraged, primarily through the avoidance of overgrazing:

- Maintain or promote adequate amounts of vegetative cover, including standing plant material and litter, to support infiltration, maintain soil moisture storage, and stabilize the soils;

- Maintain or promote subsurface soil conditions that support permeability rates appropriate to climate and soils; and
- Promote the opportunity for seedling establishment of appropriate plant species when climatic conditions and space allow.

An integral part of the BAMP program would be periodic inspection of the range and farmlands to identify areas where improvements in management practices are possible. The inspection program would consist of the following:

- An on-the-ground inspection by a team of agricultural specialists, including soil scientists, range scientists, farm scientists, and regulatory personnel;
- Contact with the owners of any properties where management practices can be improved; and
- Encouragement of improvement in management practices and distribution of educational materials.

Institutional Controls When Undeveloped Lands are Proposed for Development.

- Requirements for coordination between the Planning and Zoning staff and Lead Education and Abatement Program to assure that the developers and their contractors understand the requirements of the regulations governing development in areas with elevated lead and arsenic;
- Requirements and protocols for sampling soils prior to development to determine the extent and concentrations of lead and arsenic in soils;
- If sampling indicates unacceptable levels of lead or arsenic in the soils of the area to be developed, requirements for cleaning up the affected areas would be defined prior to development; and
- Requirements and protocols for sampling soils after cleanup to assure that the cleanup was effective and that development can proceed.

A new middle school and large housing development were recently constructed on lands treated in place by deep tilling and incorporation of lime.

Developers or landowners seeking to change the use of undeveloped land, such as from agricultural to residential, recreational or commercial, will be required to meet all requirements and specifications for the new use and will bear all associated cleanup costs.

Community Education and Institutional Controls Following Development

After areas are developed for residential, commercial, or recreational uses, community education and institutional controls would be extended to these areas. This would include blood lead screening for children, promotion of environmental assessments, enforcement of ordinances regarding displacement of soils, and public education.

6. Evaluation of the Remedial Alternatives

EPA requires an evaluation of remedial alternatives against nine specific criteria. These criteria are summarized below. The first two criteria, overall protection of human health and the environment and compliance with regulations (called ARARs), are considered threshold criteria. Threshold criteria must be attained by the action selected for implementation, unless they cannot be met and a waiver is justified. The next five criteria are considered balancing criteria. Balancing criteria (see below) permit tradeoffs to achieve the best overall solution in terms of risk reduction and cost-effectiveness. The last two criteria, state and community acceptance, are modifying criteria. They are last, but not because they are least important. Rather, comments by the state and affected communities are important; EPA can modify a preferred remedy based on state and community input. Final selection of a remedy by EPA takes place in a Record of Decision, after the Proposed Plan and a public review are completed.

Overall Protection of Human Health and the Environment

The No Further Action Alternatives (1R and 1U) ultimately would not provide overall protection of human health. As residential properties change hands, it can be reasonably assumed that families with small children will move into residences with yards that have not yet been cleaned up. Likewise, many undeveloped areas surrounding East Helena have elevated levels of lead, and in some instances arsenic. As these areas are developed over time, it can be assumed that families with small children will move into areas where the soils have not been cleaned up. In addition, the elimination of the Lead Education and Abatement Program, should that occur, would lower the awareness of residents, who may revert to behaviors that increase the risks from residual levels of lead.

For existing residential areas, all of the action alternatives would reduce the potential of lead exposure by lowering surface soil concentrations. Alternative 3R might normally be considered more protective of human health and the environment because all remaining yards with average soil lead levels greater than 500 ppm would be cleaned up, as compared to Alternative 2R, where soil lead levels between

Evaluation Criteria for Superfund Remedial Alternatives
Overall Protection of Human Health and the Environment examines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering, treatment, or combinations.
Compliance with ARARs examines whether the alternative meets federal and state environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.
Long-term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.
Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
Short-term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.
Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
Cost includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value.
State/Support Agency Acceptance considers whether the state agrees with the EPA's analyses and recommendations.
Community Acceptance considers whether the local community agrees with EPA's analyses and recommendations. Comments received on the Proposed Plan are an important indicator of community acceptance.

500 ppm and 1,000 ppm would remain in place. However, recent site data do not support that Alternative 2R would be more protective than Alternative 3R. In addition, the ongoing Lead Education and Abatement Program, which is essential to any course of action selected, gives added protection such that Alternatives 2R and 3R are, by all known measures, equivalent in terms of overall protection of human health and the environment.

For the undeveloped areas, Alternative 2U may be more protective for future residential use because soils with lead concentrations greater than 500 ppm would be removed and replaced. Alternative 4U may be less protective than Alternative 2U for future residential use, but only if in-place treatment cannot achieve after-treatment lead concentrations significantly less than 500 ppm. Alternative 3U, capping, is the least protective of the alternatives because high concentrations of lead remain beneath the cap. In all three cases, residual levels of lead will remain in the soils above natural levels.

Depending upon the type and location of non-residential future use of undeveloped lands, such as for commercial, recreational, or industrial use, any of the three action alternatives (2U, 3U, 4U) can provide adequate protection of human health.

Compliance with ARARs

EPA evaluated the alternatives in terms of compliance with ARARs. All of the action alternatives can be implemented in ways that would meet federal and state regulations and requirements.

Long-term Effectiveness and Permanence

The No Action Alternatives (1R and 1U) would not be effective in the long term. As existing residences change ownership, or as development occurs on undeveloped lands, families with small children will enter the picture and they would risk being exposed to elevated lead concentrations. The possible elimination of the Lead Education and Abatement Program would lower the awareness of residents, who may revert to behaviors that increase the risks from the remaining lead and arsenic.

For existing residential areas, Alternatives 2R and 3R are rated essentially equivalent in terms of long-term effectiveness and permanence, since soil removal and replacement has proven effective in congested residential areas.. Alternative 3R would normally be considered more effective and permanent because all remaining yards with average soil lead levels greater than 500 ppm would be cleaned up, as compared to Alternative 2R. Under Alternative 2R, some soil lead levels between 500 ppm and 1,000 ppm would remain in place. However, recent site data do not support that a cleanup under Alternative 3R would be any more effective than a cleanup under Alternative 2R. These data include residual lead levels in sources other than soils, pre- and post-cleanup exposure unit average soil lead levels, community-wide long-term blood lead data, and correlation analysis of soil lead concentrations and matched blood lead concentrations. Additionally, implementation of institutional controls would reduce recontamination of areas cleaned up, and the ongoing Lead Education and Abatement Program would assure long-term effectiveness of either alternative, such that Alternatives 2R and 3R are considered essentially equivalent in terms of effectiveness and permanence.

For undeveloped lands being proposed for a change in use from agricultural to residential, Alternative 2U is rated highest. Removal and replacement (2U) would be more permanent than either capping (3U) or in-place treatment (4U). In all cases, however, residual levels of lead will remain above natural levels. Depth of removal and replacement must be sufficient to achieve levels less than 500 ppm lead, whereas in-place treatment can achieve levels significantly less than 500 ppm lead. Still, the surface soils (backfill) of removed and replaced areas will have lower lead concentrations than surface soils of treated areas.

Long-term effects associated with the removal/replacement and capping alternatives include the environmental consequences of mining, or stripping farmland topsoil from the north Helena Valley. As the area and depth of removal increases, so does the area and depth of

removing high quality topsoil from productive agricultural areas. These mined areas become more prone to weed infestations and prone to the loss of remaining subsoil due to erosion. Thus, in-place treatment is rated higher than either removal/replacement or capping in terms of land disturbances and associated environmental consequences.

Reduction of Toxicity, Mobility, and Volume

The No Action Alternatives (1R and 1U) for both the residential areas and the undeveloped lands would do nothing to reduce toxicity, mobility, or volume of hazardous substances at the site.

For existing residential areas, removing and relocating the soils with elevated lead and arsenic to the East Fields, as described under Alternatives 2R and 3R, would reduce—but not eliminate--the toxicity, mobility, and volume of metal contaminants available for human exposure. These alternatives are rated essentially equivalent against this criterion, but with Alternative 3R reducing a greater volume than Alternative 2R.

For undeveloped areas, Alternative 2U (removal and replacement) is rated higher than the other alternative because it would reduce toxicity, mobility, and volume of lead and arsenic more than the others. Alternatives 3U and 4U would reduce toxicity and mobility, but not the volume, materially. Capping would render the volume of affected soils virtually inaccessible. In place treatment would significantly reduce the volume of soil that is greater than risk-based concentrations.

Short-term Effectiveness

The No Action Alternatives (1R and 1U) would provide some limited effectiveness in the short term, since most of the residential yards of the at-risk population have been replaced and because the exposure risk in undeveloped areas is currently low. However, as the population distribution changes over time, more families will likely move into areas requiring a cleanup, which may increase the risk of elevated blood lead levels among those children.

For residential areas, Alternative 2R is rated highest for short-term effectiveness because the cleanup would be completed in the shortest time and would pose the least safety risk to local residents and workers during construction. Alternative 3R is down-rated for this criterion because the time required for completing a cleanup would be significantly longer, which increases safety risks and extends the disruption period.

For undeveloped areas, Alternatives 3U and 4U are rated highest for short-term effectiveness because they would pose the least safety risks and disruption to residents and workers during construction. Alternative 2U is down-rated because it would generate more construction traffic, greater disruption, and more short-term environmental consequences, both at the construction sites and the areas from which topsoil would be mined.

Implementability

All of the alternatives are considered implementable. Technologies and equipment for each method of cleanup are well-developed and are currently widely used in Montana as well as across the Unted States.

Cost

The No Action Alternatives (1R and 1U) would be the least costly, requiring only costs associated with environmental monitoring and the Lead Education and Abatement Program.

For existing residential areas, Alternative 2R is less costly than Alternative 3R. Under 2R, approximately 180 yards and adjacent unpaved areas remain to be completed at an estimated cost of $10 million over 2 more years. Under Alternative 3R, approximately 960 yards and substantial areas that are unpaved (streets, open areas, etc.) remain to be completed at an estimated cost of $38 million over 5 to 7 more years.

For undeveloped lands, the cost breakdown for the railroad right-of-way and water-conveying ditches and channels is based on the assumption that these areas can be cleaned up within two

years. Therefore, a net present value is presented. For the majority of undeveloped lands, however, which may or may not undergo a change in land use from agricultural to residential, recreational, or commercial, costs are estimated only on a per-acre basis and at 2006 prices.

Alternative 2U would be the most costly because it involves removal and replacement of very large volumes of soil. Alternative 3U (capping) is slightly less costly than Alternative 2U because capping requires little or no excavation (some ground leveling may be needed). But, approximately an equivalent volume of imported soil, as required for Alternative 2U, would be required for a soil cap, or cover (Alternative 3U). Alternative 4U is, by a substantial margin, the least costly because it involves no removal or importation of topsoil for backfill.

Estimated costs for implementing each of the alternatives are summarized in Table 5.

State Acceptance

After consideration of public and local government concerns and comments, MDEQ will present formal comments to EPA.

Community Acceptance

The East Helena City Council has expressed support for the Preferred Alternative. The council supports current cleanup protocols and a continuation of the Lead Education and Abatement Program. The council emphasizes that the combination of the residential soil cleanup, as conducted to date, and the education and abatement program, have more than met goals set for protection of East Helena's children. The council further emphasizes that all cleanup options described in the proposed plan, for future development of undeveloped lands surrounding East Helena, must be retained and made available for landowners and developers. Otherwise, the city will remain "land-locked," unable to expand its much-needed tax base.

The Lewis and Clark City-County Board of Health has expressed support for the continued protection of human health, at the most reasonable cost, and with the least disruption to the community.

The residents of East Helena and surrounding subdivisions and rural communities will have an opportunity to review and comment on the Proposed Plan during the public comment period.

Table 5. Estimated Costs for Remedial Alternatives

Alt. No.	Description	Capital Costs	Annual Costs	Present Worth Costs	Capital Costs for Lands to be Developed in the Future (per acre basis)
	Residential Areas				
1R	No Further Action	$0	$18,500	$284,000	
2R	Selected Soil Removal and Disposal (1,000/500 ppm lead), Continuing Education and Institutional Controls	$8,078,400	$175,800	$10,035,000	
3R	Selected Soil Removal and Disposal (500 ppm lead), Continuing Education and Institutional Controls	$41,826,800	$175,800	$38,085,000	
	Undeveloped Lands				
1U	No Action	$0	$7,700	$118,000	$0
2U	Soil Removal and Disposal	$1,126,900	$28,200	$1,457,000	$40,700
3U	Capping	$814,900	$28,200	$1,174,000	$36,400
4U	In Place Treatment (Deep Tilling and Amendments)	$970,800	$28,200	$1,315,000	$4,800

7. Preferred Alternative and Rationale for EPA's Recommendation

The preferred cleanup alternative recommended by EPA is a combination of remedial strategies designed to reduce risk from the remaining principal threat, which is lead contaminated soils and dust. The preferred alternative is comprised of strategies for both existing residential areas and undeveloped lands, and is described in detail as follows:

- For contaminated soils in existing residential areas, Alternative 2R—Selected Soil Removal (1,000/500 ppm Lead), Continuing Community Education and Institutional Controls—is recommended for acceptance and implementation. The components of Alternative 2R have already proven to be protective and cost-effective in achieving significant risk reduction as measured by declining blood lead levels of children in the East Helena area. Alternative 2R will meet the more stringent, final Remedial Action Objectives and Goals, including: (a) maintaining the average blood lead level for area children at levels less than the national average; (b) assuring that no child in the East Helena area will have a blood lead concentration greater than 10 ug/dl; and (c) maintaining at least 90% of the children at 4 ug/dl or lower.
- For currently undeveloped areas that require remedial action before being developed, Alternative 4U—In-Place Treatment—is recommended for acceptance and implementation. This alternative consists of in-place treatment of currently undeveloped lands that have soil lead concentrations, and possibly soil arsenic concentrations, above risk-based values for new, future development. Continuing community education and institutional controls are also necessary components of Alternative 4U. The treatment of contaminated soils satisfies EPA's statutory preference for treatment as a principal element of the remedy. This alternative is most cost-effective and the environmental consequences associated with its implementation are minimal.

The major components of the preferred cleanup alternative include:

1. Continue the existing East Helena Lead Education and Abatement Program for as long as necessary to protect children from lead. This vital program has been in existence since 1995 and is administered by the Lewis and Clark City-County Health Department. Health professionals maintain an office in the East Helena community and their education programs, carried out in homes, day-care facilities and schools, are a major reason why children's blood-lead levels in this area have more than met national and local goals;
2. Complete a cleanup of the existing, qualifying residential yards within two years after a Record of Decision is issued. When any quadrant or section of a yard has lead-in-soil greater than 1,000 ppm, that yard qualifies for cleanup. Once a yard qualifies, all portions of the yard with lead-in-soil levels greater than 500 ppm will also be cleaned up. In accordance with a 1991 agreement between Asarco and EPA, more than 700 individual properties have been cleaned up. An estimated 100 - 110 yards and 9 vacant lots remain to be cleaned up under the protocols agreed upon and herein recommended. No children currently reside at these residences. Although all have at least one portion of the yard with lead in soil greater than 1,000 ppm, the majority of remaining yards have an average lead concentration that is significantly less than 1,000 ppm. The community-wide average lead in soil concentration is already well below 500 ppm. After the cleanup of all remaining qualified yards and vacant lots is

completed, the community-wide average lead-in-soil concentration will be further reduced;

3. Complete a cleanup of unpaved streets, aprons and alleys in existing residential areas. Most unpaved streets, aprons and alleys were cleaned up during the mid-1990s. The remaining qualified unpaved areas are adjacent to yards and vacant lots that have not yet been cleaned up. As work proceeds in yards, these adjacent unpaved areas will also be cleaned up. Some small commercial lots located near residences may be included in the final cleanup;

4. Complete a cleanup of contaminated soils within historic irrigation ditches and water-spreading channels when they are located within or adjacent to residential areas. Wilson irrigation ditch, which passes through the Manlove Addition, and many irrigation ditches and water-spreading channels that extend north of the City were cleaned up in the mid-1990s. However, numerous extensions of these channels and ditches reach into nearby residential developments.

5. Clean up contaminated soils along the portion of the railroad right-of-way that is adjacent to residential areas. The railroad right-of-way along the south side of the tracks, adjacent to Manlove Addition, is known to have high levels of lead and arsenic. These high levels are believed to be the result of spills or intentional temporary storage of unprocessed ores or concentrates. Although it is unsafe to play near tracks, children can be seen riding bicycles here;

6. Establish institutional controls that will enable the Lewis and Clark City-County Board of Health and City of East Helena to adopt and enforce regulations needed to (a) prevent disturbances of contaminated soils that remain in and around East Helena and (b) prevent exposures to interior household dust during remodeling or demolition of attics, unfinished basements, heating ducts or exterior walls and windows. Institutional controls are necessary components of any long-term remedy for sites with residual lead contamination. Institutional controls are best administered and enforced by local governments, such as county and city governments;

7. Define requirements and specifications for land use changes, such as when undeveloped lands are being proposed for residential, recreational, or commercial development. Most undeveloped land surrounding East Helena, in its current state, is unsuitable for residential development. Some land may be unsuitable for recreational or commercial development. In order to encourage safe, orderly redevelopment, that will be protective of future residents, recreationists or workers, requirements and specifications for new uses must be developed. The EPA-recommended preferred alternative lays out fundamental requirements. However, it also recognizes that because redevelopment may not occur for decades into the future, reasonable flexibility must be incorporated. County and City governments, which will ultimately be responsible for reviewing, approving and overseeing future developments on these lands may choose to modify the requirements and specifications over time. Future costs associated with redevelopment of currently undeveloped lands will be incurred by the owners or developers of the land; and

8. Ensure that cleanup actions based on lead also protect against residential exposures to yard average soil arsenic concentrations greater than 176 ppm. The human health risk-based concentration of arsenic in soil, as determined by EPA's modifications to the baseline risk

assessment for East Helena, is 176 ppm. This value and all lesser values are deemed by EPA to be within an acceptable range of risks. As arsenic concentrations in soil rise above that value, however, long-term exposures (lifetime) present risks that may be unacceptable. It is noteworthy that all of the remaining 100 to 110 yards and nine vacant lots that are known to qualify for a cleanup (based upon their lead levels) have an average arsenic concentration well below 176 ppm. The majority of them are below 80 ppm. Due to the cleanup already conducted, the community-wide average arsenic-in-soil concentration is now near natural levels.

The preferred cleanup alternative recommended by EPA is patterned after the residential soil removal action that has been in place since 1991. EPA believes that the removal action has proven to be safe, effective, and protective of children's health. The preferred cleanup alternative will cause minimal disruption within the community and it is significantly less costly than other cleanup alternatives examined. Thus, EPA's recommendations for a final cleanup decision formalize the previous several years of work conducted cooperatively by Asarco, EPA, MDEQ, Lewis and Clark County, City of East Helena, and owners of more than 700 individual properties.

The preferred cleanup alternative specifically addresses the principal threat by removing lead contaminated soils in residential areas and by reducing lead levels, and arsenic levels if needed, of lands that are undergoing a change in use from agricultural to residential, recreational or commercial.

The preferred cleanup alternative calls for completing a cleanup of all residential yards, water-conveying ditches and channels, and the railroad right-of-way adjacent to residential areas. After the final remedy is implemented, no residential yard within East Helena or its adjacent subdivisions will have soil lead levels greater than 1,000 ppm. Equally important, the community-wide average of soil lead will be reduced to well below 500 ppm. Thus, the preferred cleanup alternative will be protective of human health and the environment and will comply with all applicable or relevant and appropriate requirements, unless a waiver of a regulation is justified.

The preferred cleanup alternative specifies requirements and regulations for undeveloped lands surrounding residential developments. Under current land uses, livestock, wildlife, and vegetation on undeveloped lands are deemed by EPA to be minimally affected by the levels of contamination present in the soils.

As undeveloped lands come under consideration for changes in land use, however, requirements and regulations are necessary to ensure that the levels of lead, and possibly arsenic, do not exceed safe levels for the new use. In many cases, undeveloped lands surrounding East Helena will not safely support residential or recreational development. They may, with careful planning, support commercial or industrial uses. Thus, some cleanup, or remedial action, may be needed before a change in land use could be approved. The preferred cleanup alternative provides for orderly, cost-effective development of these lands, with administration and enforcement of the regulations by Lewis and Clark County.

Although the preferred remedy for undeveloped lands to be developed in the future is generally Alternative 4U, it is emphasized that circumstances in the future may allow implementation of one or more of the other alternatives described and evaluated. For example, EPA has determined that Alternative 2U—Soil Removal and Replacement—is the preferred alternative for water-conveying ditches and channels and for the railroad right-of way. The combination of removal, proper disposal, and replacement of soils in areas such as these, with particularly high concentrations of lead and arsenic on the surface, or with lead and arsenic reaching to depths greater than about 18 to 24 inches, has been shown to be more effective and

permanent, albeit more costly, than in-place treatment or capping.

As another example, Alternative 3U—Capping—may eventually prove to be a more effective and cost-effective strategy than other strategies for some undeveloped lands. A large tract of undeveloped land may in the future be proposed for strictly commercial development. In this instance, commercial buildings, parking lots and landscaped areas would all require some ground preparation, earth moving, and leveling. It is conceivable that, given the proposed use and the levels of contamination currently known at some of the undeveloped tracts, a more cost-effective remedy—still adequately protective of the proposed use—may be minimal excavation and disposal, followed by a cover or cap (such as pavement or sidewalks) in selected areas.

Therefore, in respect to selection of a remedy that may be decades into the future, any of the four alternatives for undeveloped lands, either singly or in combinations, should be kept viable and may prove to be appropriate depending upon the proposed use, the physical and chemical properties of the particular parcel of land, and the role of institutional controls in place at that time.

In most circumstances known to exist currently, however, the combination of remedial strategies involving Alternative 2R and Alternative 4U best satisfies EPA's required criteria, as compared to the other alternatives or strategies considered. This combination will continue to be protective of children's health and will satisfy applicable or relevant and appropriate legal requirements (ARARs). The preferred cleanup alternative will continue to be effective in terms of reducing to minimal levels the principal threat of lead in soils, and it will represent a cost-effective approach to cleanup with the least amount of disturbance or environmental consequence.

The preferred alternative has already been shown to be implementable and has more than met remedial action objectives initially established. A continuation of these successful cleanup approaches will meet the more rigorous remedial objectives and goals specified in Section 4. The preference for in-place treatment of lands scheduled for development will reduce toxicity and mobility of the principal threat, while allowing for the implementation of other strategies so that risk is limited to acceptable levels depending on the end land use and associated risk-based concentrations of lead and arsenic.

EPA has concluded that the Preferred Alternative will satisfy the statutory requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), notably Section 121, subsection (b), and will:

(1) Be protective of human health and the environment;

(2) Comply with applicable, or relevant and appropriate requirements (ARARs);

(3) Be cost-effective;

(4) Utilize permanent solutions and alternative technologies to the maximum extent practicable; and

(5) Satisfy the preference for treatment as a principal element.

This Proposed Plan is being presented to the East Helena community with the understanding that, following a public-review period and receipt of written and oral comments, new information may cause EPA, in consultation with the State, County, and City of East Helena, to accept , modify, or reject the preferred alternative before rendering a final decision.

Since 2001, no East Helena child has tested above 10 ug/dl lead in blood, and 98% are at 4 ug/dl or less.

8. Public Involvement

Tell Us What You Think

EPA, in consultation with MDEQ, Lewis and Clark County, and the City of East Helena, will select a final remedy for the site, but only after the public comment period has ended and all information submitted by the area's residents has been reviewed and considered. After that, EPA is required to prepare and issue a Record of Decision before the remedy can be implemented.

Documents pertaining to the East Helena Superfund site can be found at the following locations:

EPA Records Center, 10 West 15th Street, Suite 3200, Helena, Montana.

MDEQ Records Center, 1100 N. Last Chance Gulch, Helena, Montana.

East Helena Lead Education and Abatement Program office, 2 South Morton, East Helena, Montana. For more information, call the office at (406) 227-8451.

For more information about this Proposed Plan or the East Helena Superfund site, contact the Montana Office of EPA at 406-457-5000.

Public Involvement in the East Helena Decision Process

EPA will conduct a formal 60-day public comment period from January 16, 2007, and ending March 16, 2007. Written comments should be sent to Scott Brown at:

USEPA, Federal Building
10 West 15th Street, Suite 3200
Helena, Montana 59626

In order to provide information about the Proposed Plan prior to submission of comments by the public, EPA will hold a public meeting on Thursday, January 25, 2007, 6:30-8:00 p.m., at the East Helena Fire Hall.

EPA will hold a second public meeting on Thursday, March 1, 2007, 6:30-8:00 p.m., also at the East Helena Fire Hall. Individuals may provide oral or written comments; oral comments will be recorded.

EPA will respond to public comments, both written and oral, in a Responsiveness Summary. EPA may modify the Preferred Cleanup Alternative or select another response action presented in this Proposed Plan, based on new information or public comments.

A summary of the final cleanup decision will be published in the Independent Record and EPA will provide copies of the decision summary after the Record of Decision is signed.

Public Comment Period: January 16, 2007 to March 16, 2007