

**Response Action
Contract**

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**Human Health Alternatives
Technical Memorandum
Coeur d'Alene Basin, Idaho
Public Comment Draft
Executive Summary**

October 2000

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in association with
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**HUMAN HEALTH ALTERNATIVES
TECHNICAL MEMORANDUM
COEUR D'ALENE BASIN, IDAHO**

PUBLIC COMMENT DRAFT

EXECUTIVE SUMMARY

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1 INTRODUCTION

The public review draft of this technical memorandum evaluates human health alternatives that are being considered as part of the Coeur d'Alene Basin Remedial Investigation/Feasibility Study (RI/FS). The overall RI/FS process for the Basin evaluates both human health and ecological risk exposures; however, because of the complexity of this project and the different exposure mechanisms for ecological and human health risks, this technical memorandum addresses only human health elements. A separate related report, the ecological feasibility study, addresses the ecological risks and alternatives in the Basin. A feasibility study that combines both the human health and ecological alternatives will be released later this year, and after extensive stakeholder input is considered, the United States Environmental Protection Agency (EPA), in conjunction with the State of Idaho, will prepare the Proposed Plan. Following the public comment period for the Proposed Plan, EPA will prepare the Record of Decision, which will summarize the remedial alternatives selected for the Basin.

The RI/FS focuses on environmental concerns resulting from historic mining operations in the Basin (Figure ES-1), which released tailings, mine waste rock, and mine drainage that contained potentially elevated metals concentrations. Flood waters, wind, waste storage, and other human activities have spread these materials throughout the Basin. Environmental and human health monitoring studies conducted in the 1970s and 1980s resulted in EPA designating the Bunker Hill Superfund Site in 1983 for further investigation and remediation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This listing on the National Priorities List encompassed mining releases throughout the Coeur d'Alene River Basin.

Since the mid-1980s, EPA, the Coeur d'Alene Tribe, and the State of Idaho have studied the potential contaminant sources, environmental fate and transport, and potential environmental and human health impacts throughout the Basin. Early actions were conducted within the Basin to address immediate human health needs associated with some of the higher-risk exposures. In 1999, EPA initiated a remedial investigation (RI) that characterized the extent of ecological contamination in the Basin outside Bunker Hill. Concurrent with this Basin-wide RI, human

health and ecological risk assessments were begun to evaluate the level of risk in the Basin and to determine the need for remedial actions.

This human health alternatives technical memorandum is based on the results of the RI and the Public Comment Draft of the Human Health Risk Assessment (HHRA; TerraGraphics 2000), which has been released for public review. This technical memorandum identifies and evaluates remedial alternatives that would protect human health from mining-related metals contamination.

1.1 Purpose and Scope

The purpose of this technical memorandum is to support risk management decisions on remedies to mitigate human health risks caused by mining-related contamination in the Basin. Remedial technologies were identified, screened, and some eliminated, based on their applicability, effectiveness, implementability, and relative cost (USEPA 1988). Using the remaining technologies, alternatives were developed and compared in terms of their achievement of human health and environmental goals.

This human health technical memorandum is being prepared for early release for public comment, and is a portion of the Basin's feasibility study document that is currently being prepared. The overall feasibility study will be released later this year and will address possible alternatives for both ecological and human health risk exposures.

The State of Idaho has developed a document referred to as the "State Plan" which includes brief descriptions of technologies that the State would like to see incorporated into the overall remedy selected for the Basin. The human health-related technology options in the alternatives presented in this technical memorandum are contained within the State Plan. In light of the overlap between the alternatives summarized herein and State Plan, EPA and the State decided that it was not necessary to present the State Plan as a separate alternative.

The mining companies involved in the Basin have also presented a human health-related alternative. This alternative is essentially a community health intervention program that has been referred to as "Kids First." It includes general community education, voluntary blood lead screening, follow-up and intervention to identify sources of elevated blood lead levels. These health-related components of the mining companies' alternative are also included in both the EPA and State approaches to human health mitigation, have been shown to be effective, and will be carried forward during the alternatives' evaluation phase of the FS. The mining companies' program, however, does not proactively conduct remediation of contamination sources unless elevated blood levels have been documented. The mining companies' alternative was included as a technology option and evaluated for effectiveness as part of this study.

1.2 Feasibility Study Process

This technical memorandum was conducted in accordance with *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final* (USEPA 1988).

In the first steps of the FS process, available data is evaluated. Potential applicable or relevant and appropriate requirements (ARARs), the basic standards by which aspects of a hazardous substance cleanup are measured, are then evaluated (see Chapter 2 of the technical memorandum for details). Next, the potential remedial technologies are screened (some are eliminated) in two steps: first, based on their technical applicability; and second, in terms of their effectiveness, implementability, and relative cost (Chapter 2). Alternatives are then developed from the majority of the retained remedial technologies. The retained technologies that were not included in specific alternatives are considered as potentially viable options that may be used in site-specific cases as appropriate.

Remedial alternatives represent a range of approaches that could be used to mitigate various human health exposure risks related to metals contamination. For this project, the remedial alternatives are not mutually exclusive choices; rather, they represent a framework within which to evaluate various approaches that may be used to address the multiple contaminated media (soil, interior dust, drinking water, homegrown vegetables, and fish). The assembled alternatives are screened based on effectiveness, implementability, and relative cost (Chapter 3). The alternatives that are not eliminated during this screening step are evaluated in a detailed process (Chapter 5) that considers the following criteria:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness
- Reduction of toxicity, mobility, or volume
- Short-term effectiveness
- Implementability
- Cost

After the alternatives have been evaluated in detail, they are compared to each other to evaluate their relative performance in terms of each specific evaluation criterion (Chapter 6). The results of the screening and evaluation process for human health alternatives in the Coeur d'Alene Basin are summarized below.

1.3 Site Description

The Coeur d'Alene Basin is a large hydrologic drainage network located in the Panhandle region of northern Idaho, in Kootenai and Shoshone Counties east of Spokane, Washington (Figure ES-1). It includes the watershed of the Coeur d'Alene River. This study focuses on a

portion of the Basin adjacent to the South Fork of the Coeur d'Alene River from the town of Mullan near the eastern border of the Idaho panhandle westward to the mouth of Lake Coeur d'Alene.

For the purpose of this study, the Basin was divided into the Upper and Lower Basins. The Upper Basin is contained in steep mountain canyons of the South Fork of the Coeur d'Alene River and its tributary gulches. The Lower Basin includes 11 lateral chain lakes and extensive wetlands in the Coeur d'Alene River's floodplain. Lake Coeur d'Alene and the citizens of Coeur d'Alene were not included in this study, based on low risk exposures.

The population in the area of the Basin studied is approximately 10,500. Brief descriptions of individual communities, including numbers of residences, population, and other characteristics, are included in Appendix A of the technical memorandum. The reservation of the Coeur d'Alene Indian Tribe, located adjacent to the southern portion of Lake Coeur d'Alene, is included in this human health technical memorandum. The Coeur d'Alene Basin is the Tribe's ancestral home.

The area of the Basin studied was further divided into eight areas of investigation based on potential human health exposure (Figure ES-2):

- Mullan—the community of Mullan and the uppermost portion of the South Fork of the Coeur d'Alene River and its tributaries from Wallace to the headwaters of the river
- Burke/Ninemile —the lower portion of Canyon Creek, and Ninemile Creek
- Wallace—the community of Wallace, located at the confluence of Canyon and Ninemile Creeks with the South Fork of the Coeur d'Alene River
- Silverton—the community of Silverton, located along the South Fork about 3 miles downstream from Wallace
- Osburn—the community of Osburn, located along the South Fork adjacent to Silverton
- Side Gulches—Moon Creek and Gulch, a portion of the South Fork watershed, residential areas of the Big Creek watershed, Montgomery, Nuckols, and Terror Gulches, Sunny Slopes, Twomile, and Elk Creek
- Kingston—portions of the Pine Creek, South Fork, and North Fork watersheds
- Lower Basin—Coeur d'Alene River west of Cataldo to Lake Coeur d'Alene

1.4 Affected Media and Human Health Exposure Pathways

As a result of natural dispersion processes, high concentrations of metals in mine tailings, mine waste, and mine drainage have been transported to adjacent groundwater, surface water, sediment, soil, and dust. The primary media of concern for this study are:

- Soil in home yards, street rights-of-way, commercial and undeveloped properties, and common areas, and airborne dust generated at these locations
- Contaminated house dust
- Drinking water from local wells or surface water
- Contaminated fish
- Homegrown vegetables

People in the Basin can be exposed to contaminants of potential concern by ingesting soil, breathing dust, drinking water, and eating contaminated fish or homegrown vegetables.

One of the documents that provided source data for this technical memorandum, the Human Health Risk Assessment (HHRA; TerraGraphics 2000), identified contaminants of potential concern (COPCs) in the Basin by comparing detected concentrations of chemicals with established screening values. The COPCs identified in each medium include:

- Seven metals in soil: antimony, arsenic, cadmium, iron, lead, manganese, and zinc
- Seven metals in house dust: antimony, arsenic, cadmium, iron, lead, manganese, and zinc
- Five metals in groundwater: antimony, arsenic, cadmium, lead, and zinc
- Five metals in surface water: arsenic, cadmium, lead, manganese, and mercury
- Two metals in tap water: lead and arsenic

Fish and vegetables were not screened for COPCs; however, indicator metals were selected for these based on toxicity and presence in the Basin. The selected indicator metals for fish consumption were cadmium, lead, and mercury, and for vegetables were arsenic, cadmium, and lead. A more detailed discussion of COPCs and contamination in the Basin is presented in the HHRA (TerraGraphics 2000). Although not considered a primary medium of concern in the HHRA, interior and exterior lead-based paint was considered to be a contributor to lead concentrations in yard soil and house dust. These are important sources that need to be addressed on a case-by-case basis.

1.5 Human Health Risk Summary

1.5.1 Non-Cancer Health Risk

In the HHRA, major population groups were quantitatively evaluated for a variety of exposure pathways, media, contaminants, and geographical areas. For metals other than lead, the HHRA concluded that an unacceptable level of non-cancer health risk existed for certain scenarios, considering the maximum exposure that can reasonably be expected (reasonable maximum exposure condition, or RME). These included children and adults exposed to arsenic, iron, cadmium, and zinc in yard soil, drinking water, homegrown vegetables, and fish consumption as a result of a subsistence lifestyle.

Lead health surveys conducted in the Basin area by State and local health authorities have noted excessive levels of lead in the blood of children, with only minor problems among adults. The source of greatest lead exposure for a theoretical average child is the home (Figure ES-3). In this home environment, house dust and yard soil contribute the most lead to children's exposure (Figure ES-4). House dust is generated largely by tracking contaminated soil into residences. Drinking water and diet contribute relatively little to the average child's lead exposure in the home.

Figures ES-5 and ES-6 graphically show lead concentrations in yard soil and house dust in the eight areas of investigation. These data were obtained from the HHRA (TerraGraphics 2000).

1.5.2 Cancer Health Risk

The RME risk of cancer from metals other than lead exceeded 1×10^{-6} in all areas, and the most typical exposure scenario (central tendency, or CT) exceeded 1×10^{-6} in most areas. However, the RME cancer risk exceeded the EPA target range of 1×10^{-6} to 1×10^{-4} only in the Side Gulches investigation area. Arsenic was the only carcinogenic COPC evaluated in the study area.

For residents overall, yard surface soil contributed the most to cancer risk; drinking water also contributed significantly to cancer risk for residents in the Side Gulches. Although drinking water was not the primary contributor to cancer risk for residential scenarios, RME cancer risk estimates for drinking water did exceed 1×10^{-6} in all investigation areas, due almost entirely to select high concentrations of arsenic in scattered private wells. The private wells exceeding 1×10^{-6} are believed to be drawing water from shallow aquifer zones.

2 REGULATORY ISSUES AND REMEDIATION GOALS

A number of regulatory issues govern environmental cleanup projects, including laws and regulations that must be complied with, as well as cleanup levels for contaminants. Related to this are the goals that the remedial action is intended to achieve, and the general approach to achieving those goals. These issues are discussed briefly below.

2.1 Summary of Potential ARARs

Applicable or relevant and appropriate requirements (ARARs) are basic standards by which aspects of an environmental remediation cleanup are measured. ARARs include promulgated environmental requirements, criteria, and other standards. Other factors to be considered (TBCs) in selecting a remedy might include unpromulgated standards, criteria, and advisories; however, TBCs are not evaluated using the formal process required for ARARs and are not legally binding. ARARs of federal, state, and tribal governments must be complied with during response actions. Local ordinances with promulgated criteria or standards are not considered ARARs but could represent TBCs.

This technical memorandum includes only ARARs and TBCs for the metals that are considered COPCs for human health for residential and recreational soil, drinking water, house dust, and fish and homegrown vegetable consumption: antimony, arsenic, cadmium, iron, lead, manganese, mercury, and zinc (TerraGraphics 2000). Appendix C of the technical memorandum summarizes the potential federal and state chemical-specific, location-specific, and action-specific ARARs and TBCs for the Coeur d'Alene Basin.

2.2 Remedial Action Objectives and Preliminary Remediation Goals

In addition to ARARs, remedial action objectives (RAOs) are established that ensure that conditions after remediation are safe or of limited risk to human health. Preliminary remediation goals (PRGs) are then established as desired endpoint concentrations or risk levels that are considered protective once achieved..

The preliminary RAOs for human health are listed in Table ES-1. For lead, remedial action objectives are focused on lead concentrations in affected media that will result in acceptable blood lead concentrations for children. Preliminary PRGs for soil and drinking water are listed in Tables 2-2 and 2-3 of the technical memorandum. RAOs and PRGs for homegrown vegetables and fish consumption were not developed; however, actions taken for other media will protect food chain exposures.

2.3 General Response Actions

General response actions (GRAs) are general approaches that can be used to achieve RAOs. GRAs encompass a broad range of remedial technologies and process options. The general GRAs considered for the human health exposure risks in the Basin include the following:

- No Action
- Access and Use Modification
- Containment
- Treatment
- Volume Reduction
- Disposal

Monitoring alone was not considered as a GRA; however, it was considered to be potentially applicable with all technologies to determine whether or not a technology is achieving RAOs, and to evaluate long-term effectiveness.

3 SCREENING OF REMEDIAL TECHNOLOGIES

As a starting point in determining how to address human health exposure risks in the Basin, a list of potential remedial technologies and process options for soil, drinking water, and house dust was compiled. These were then evaluated solely on the basis of technical implementability, and some were eliminated. The technologies and process options that remained were then evaluated in terms of their effectiveness, implementability, and relative cost. The results of this evaluation are listed in Table ES-2. The table notes whether a technology or process option was retained or not retained. The retained options were carried forward to form the basis for remedial action alternatives.

4 REMEDIAL ALTERNATIVES

4.1 Screening of Alternatives

The retained technologies and process options were then assembled into remedial alternatives for soil, house dust, drinking water, and fish consumption. (Risk from eating homegrown vegetables is addressed by the yard soil alternatives). Alternatives for each medium were assembled independently of the other media to allow maximum flexibility in future decision-making. However, alternatives are not considered to be mutually exclusive; rather, cleanup at a particular site could consist of several alternatives based on the type(s) and concentration of contaminated

media present. Not all retained process options were necessarily incorporated into alternatives; process options could be removed or added to an alternative in the future as a result of new data, stakeholder input, or other considerations.

Each alternative was evaluated against three general screening criteria (effectiveness, implementability, and comparative cost), and alternatives that were judged unacceptable were eliminated. The alternatives retained after this screening are described below and compiled in Table ES-3. Tables ES-4 through ES-7 list the technologies and process options that make up each alternative.

4.2 Description of Retained Alternatives

4.2.1 Soil Alternatives

Soil Alternative S1—No Action. This alternative would leave contaminated soil in place with no change in existing conditions. It would not remove contaminated soil from residential yards and gardens in the Basin, provide no information, education, or counseling for residents with contaminated yards, and would not monitor blood lead levels to evaluate the impacts of continued exposure.

Soil Alternative S2—Information and Intervention. This alternative would include deed notices, pamphlet distribution, press releases, public meetings, publicly posted notices, and advisory signs in public areas to both inform the public of risk mitigation and new risk information, and to solicit public input and involvement. This alternative would also include a program similar to the Panhandle Health District's Lead Health Intervention Services, which provides personal health and hygiene information to help mitigate exposure to contaminants. Services also include biological monitoring, yard and home sampling, and nursing follow-up services. An institutional controls program which would include local construction regulations (developed and implemented in conjunction with local zoning, building, or planning commissions) may also be considered in certain areas if risk conditions warrant.

Soil Alternative S3—Information and Intervention and Access Modifications. In addition to information and intervention, this alternative would include constructing fences or other barriers around certain areas and providing maintenance to prevent or limit access to certain areas where risk level and persistency warrant. This alternative is not intended for use at residential properties.

Soil Alternative S4—Information and Intervention and Partial Removal and Barriers. In addition to information and intervention, this alternative would include removing a limited amount of contaminated soil and placing clean barriers. Contaminated yards would be excavated to an assumed depth of about 1 foot. Garden areas would be provided with a minimum of 2 feet of clean fill. In order to mitigate potential exposure pathways, the excavated areas would be

backfilled with clean soils and/or capped. Where appropriate, exteriors of structures would be pressure-washed before remedial measures are performed, to reduce the potential for recontamination from lead-based paint. Risk would be further reduced by installing visual markers to delineate the limits of soil removal. In addition to residential yards, common use areas such as streets, alleys, rights-of-ways, and playgrounds would also be candidates for remediation if soil contamination and exposure risks warrant. This alternative would also include revegetation and interim dust control during soil excavation. For recreational areas this alternative would include site improvements to reduce exposure risks. These would be specific to individual recreational areas and, in addition to partial soil removal and access restrictions, could include stabilizing river banks, constructing paved boat ramps and parking areas, excavating or capping day-use and overnight camping areas, and providing picnic tables.

Soil Alternative S5—Information and Intervention and Complete Removal. In addition to information and intervention, this alternative would attempt to completely remove from properties and dispose soil that exceeds action levels. The depth of contaminated soil is expected to vary considerably within the Basin, but complete removal is considered to be excavation of residential yard and garden areas to a depth of 4 feet. If warranted, exteriors of structures would be pressure-washed to reduce the potential for recontamination from lead-based paint. This alternative would include backfilling the properties with clean soil to reestablish site grades and revegetating the reclaimed ground surface. It would also include interim dust control during soil excavation. This alternative is not envisioned for recreational areas.

4.2.2 Drinking Water Alternatives

Drinking Water Alternative W1—No Action. This alternative would leave contaminated drinking water sources in place with no changes in existing use. It would take no action to prevent exposure to COPCs in drinking water, and would provide no information or education to exposed residents.

Drinking Water Alternative W2—Public Information. This alternative would include: pamphlet distribution, press releases, public meetings, and publicly posted notices to inform the public of risk mitigation and new risk information, and to solicit public input and involvement. Because this alternative would require an ongoing effort, it is considered primarily for use at the community level and is considered generally not feasible for individual residences except for raising general awareness of risks.

Drinking Water Alternative W3—Public Information and Residential Treatment. In addition to public information, this alternative would include wellhead filtration (if applicable) and point-of-use filtration. Filters would be placed at each tap or other point of use in residences. If possible, a single filter would be placed on the main residence service line to avoid potential confusion and change-out costs for multiple filters. A change-out program would be required to ensure that filters are changed on the required schedule.

Drinking Water Alternative W4—Public Information and Alternative Source, Public Water Utility. In addition to public information, this alternative would include permitting and constructing drinking water conveyances from public water utilities to residences or common-use areas. Information programs would be used to better inform residents about lead risks from in-home plumbing.

Drinking Water Alternative W5—Public Information and Alternative Source, Groundwater. For properties currently supplied by contaminated water wells or other unregulated sources this alternative would include (in addition to public information) permitting and constructing new wells into a suitable alternative aquifer, installing necessary appurtenances, and abandoning existing contaminated wells. The suitability of the alternative aquifer (for example, water yield and quality) would need to be evaluated before drilling any new wells. After well construction, groundwater sampling would be conducted to verify that new wells supply water capable of achieving the RAOs. Subsequent monitoring would also be conducted to ensure continual achievement of RAOs. Information programs would be used to better inform residents about lead risks from in-home plumbing.

Drinking Water Alternative W6—Public Information and Multiple Alternative Sources. This alternative would include public information plus one of the above-described alternatives, depending on geographic issues. For areas inside water districts, the assumed alternative would provide individual residences or common areas with a hookup to the existing public conveyance system. For areas outside water districts (mostly in the tributary gulches), it is assumed that public water utilities will not be able to provide an alternative water source because of the annexation and engineering issues of constructing distribution systems; therefore, the assumed alternative for these areas would be to provide either point-of-use treatment or new groundwater wells. Alternative W6 would include a survey of residences during remedial design to determine whether they were served by public water utilities, and to determine residences at which COPCs in drinking water exceed maximum contaminant levels.

4.2.3 House Dust Alternatives

House Dust Alternative D1—No Action. The No Action alternative would leave contaminated house dust in place and would not change existing conditions. It would take no action to prevent exposure, and provide no information or education to exposed residents.

House Dust Alternative D2—Information and Intervention and Vacuum Loan Program/Dust Mats. This alternative has three major components. First, information and intervention for house dust would include pamphlet distribution, press releases, public meetings, and publicly-posted notices to inform the public of remedial actions and to provide exposure education. In addition, public input and involvement would be sought. This program has been administered as part of the Panhandle Health District's Lead Health Intervention Program at the Bunker Hill 21-square-mile area for approximately 15 years and throughout the Basin since

1996. The second component of this alternative would be expansion of the Vacuum Loan Program initiated at Bunker Hill, which allows residents to use a heavy-duty vacuum cleaner equipped with high efficiency particulate air (HEPA) filters. The third component would be free dust mats for entryways, which would be provided to residents to reduce tracking exterior dust into the home. Monitoring would also be conducted to ensure continued achievement of RAOs.

House Dust Alternative D3—Information and Intervention, Vacuum Loan Program/Dust Mats, Interior Source Removal, and Capping/More Extensive Cleaning. In addition to the components of Alternative D2, this alternative would include interior cleaning, and removing and replacing some household items that are either difficult to clean effectively or which provide a source for recontamination. Interior cleaning would include a one-time cleaning of hard surfaces and heating and cooling systems and removal and replacement of major interior dust sources such as carpet and some soft furniture. These activities would occur only after exterior sources of contamination had been permanently remediated, to ensure cost-effectiveness and prevent recontamination. Based on observations from yard remediation in the Bunker Hill area, once exterior yard soil is cleaned up, relatively few homes are expected to require the extensive interior cleaning provided by Alternative D3. In addition, this alternative would consider crawl spaces, attics, and basements. Contaminated crawl spaces would be capped with a sand or synthetic cover to prevent dust generation and tracking soil into the home. Accessible attics and basements would also be cleaned. The exact scope of this alternative will dependent on the conditions of each residence. Temporary relocation of residents might be required during cleaning to protect their safety. Monitoring would also be conducted to ensure that RAOs continue to be achieved.

4.2.4 Fish Consumption Alternatives

Fish Consumption Alternative F1—No Action. This alternative would take no action to address the potential human health risk to residents and Tribal members of eating contaminated fish. It would take no action to prevent exposure, and provide no information or education to people likely to consume contaminated fish.

Fish Consumption Alternative F2—Information and Intervention. In addition to the information and intervention efforts of other alternatives, this alternative would educate fishermen and other recreationists of the potential health risk of consuming contaminated fish caught in waterways and wetlands. All printed materials, press releases, and public meetings developed to inform the public of basin metals issues would include information about the fish risks, how to reduce exposure, prevention, and other pertinent issues. Fish hazard information programs would be expanded to the Coeur d'Alene Indian Reservation communities as appropriate to ensure that Tribal members are kept informed. Targeted community education programs would be implemented in Benewah, Kootenai, and Shoshone Counties. A well-maintained signage program to educate fishermen and other water users of metals hazards would be implemented at all river/lake access sites and common use areas, including the Coeur d'Alene

River Trail system corridor. Idaho Fish and Game, Idaho State Parks, U.S. Forest Service, and BLM field personnel who regularly contact basin fishermen and recreationists would be trained in metals risk management and supplied with appropriate pamphlets and signs.

Fish Consumption Alternative F3—Information and Intervention and Monitoring. This alternative would build on the efforts of informing and educating fishermen of fish/metals risks in Alternative F2. An effort to gain more fish metals load data from all each of the lateral lakes, the South Fork, lower Coeur d'Alene River and Lake Coeur d'Alene is the keystone of this alternative. The current limited fish flesh data from three lateral lakes would be expanded so that lake-specific recommendations and intervention can be accurately provided to the public. Waters and fish species that are totally free of metals risks would be identified and highlighted. As basin cleanup and mitigation efforts proceed, periodic resampling would provide valuable effectiveness monitoring data for biological response to cleaner waters, sediment, and upstream soils. A trained seasonal “River Ranger” program would be instituted to make daily contacts with fishermen and boaters to inform and educate them of metals hazards and prevention methods. Fishermen can be directed to lakes or rivers where fish metals risks are known to be the lowest.

5 DETAILED EVALUATION OF ALTERNATIVES

5.1 Site-Specific Considerations

The number of media, the number of alternatives, and the large extent of the Coeur d'Alene Basin RI/FS make it an intricate and complex project. One of the most important factors in the human health portion of the study is the variation in the communities in the Basin. Different communities have different geographic and demographic situations, which result in different concerns and requirements for remedial alternatives—what is applicable or appropriate for a given community may not be suitable elsewhere in the Basin. It is clear that the concerns of individual communities must be addressed, and every effort will continue to be made to do so. Descriptions of the communities considered in this study, including numbers of residences, population, and other characteristics, are included in Appendix A.

Although a community approach was used for a general evaluation of alternatives, it is not the intent of the memorandum to exclude the use of specific alternatives for remediation of individual residential yards. Considerable variability is expected within communities and it is the intent of this analysis to allow a broad range of technologies and process options to be used during remedial actions.

In addition to community-specific concerns, it was necessary to make certain assumptions when evaluating the alternatives, and these may affect the conservativeness, cost, and selection of

preferred alternatives for different media in different locations. The community- and site-specific considerations and assumptions that were made are described in detail in Chapter 4 of the technical memorandum. A brief summary of these considerations and assumptions is provided below.

Soil

- Number of residential yards to remediate
- Location of homes or communities with respect to floodplains
- Potential for recontamination of yards
- Difficult access to yards
- Amount and condition of exterior lead-based paint
- Unpaved streets and drainage
- Availability of soil repositories
- Number and locations of recreation areas needing remediation

House Dust

- Absence of regulatory guidance or PRG for lead in house dust
- Number of home interiors needing remediation
- Potential for recontamination of home interiors
- Source of lead in the home: exterior soil vs. lead-based paint
- Trends in residential dust lead over time

Drinking Water

- Number of residences requiring drinking water remediation
- Availability of suitable alternative aquifer for groundwater supply
- Distance to existing drinking water infrastructure
- Type of unregulated drinking water source used in a home
- Extent of available data on groundwater contamination

Fish Consumption

- Extent of data on lead levels in fish tissues
- Quantity of fish in the diet
- Whether fillets or whole fish are eaten

5.2 Detailed Evaluation of Alternatives

The next step of the feasibility process involved a detailed evaluation of each alternative to determine whether all alternatives satisfy statutory and regulatory criteria. Each alternative was analyzed with regard to the following seven criteria prescribed by USEPA guidance (1988):

- Overall protection of human health and the environment
- Compliance with applicable or relevant and appropriate requirements (ARARs)
- Long-term effectiveness
- Reduction of toxicity, mobility, volume, persistence, and propensity to bioaccumulate
- Short-term effectiveness
- Implementability, reliability, and constructibility
- Cost

Two additional criteria that will be considered after the public comment period is complete are state agency acceptance and community acceptance. The results of the detailed evaluation of the alternatives are discussed in Chapter 5 of the technical memorandum.

6 COMPARATIVE EVALUATION OF ALTERNATIVES

After the detailed evaluation, the alternatives for each medium were compared to each other to determine their relative benefits or drawbacks, using the seven evaluation criteria listed above. State and community acceptance will be considered after the public comment period. The results of the comparative evaluation are compiled in Tables ES-8 through ES-11.

7 REFERENCES

TerraGraphics Environmental Engineering. 2000. Draft Baseline Human Health Risk Assessment, Coeur D'Alene Basin—Public Review Draft. Prepared for Idaho Department of Health and Welfare Division of Environmental Quality, and USEPA Region 10 by TerraGraphics, URS Greiner, CH2M HILL, and WhiteShield. July 17.

USEPA (United States Environmental Protection Agency). 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final. Office of Emergency and Remedial Response, Washington DC. EPA 540/G-89/004. October.

Table ES-1
Preliminary Remedial Action Objectives

Environmental Media	Preliminary Remedial Action Objectives
Soils and Source Materials	<p>Prevent mechanical transportation of soil containing unacceptable levels of contaminants into residential areas and structures.</p> <p>Prevent the exposure of humans to lead in soil such that there is a 95% or greater probability that a child or children ages 0 to 84 months have blood lead levels less than 10 µg/dL, and a 1% or lower probability that a child or children ages 0 to 84 months have blood lead levels greater than 15 µg/dL.^a</p> <p>Prevent direct human exposure to soils (ingestion, inhalation, and dermal contact) that:</p> <ul style="list-style-type: none"> • would produce excess cancer risks greater than 1x10⁻⁶; OR • have concentrations of COPCs greater than selected PRGs for soil (see Table 2-1).
Groundwater and Surface Water as Drinking Water	Prevent ingestion by humans of groundwater or surface water withdrawn or diverted from a private, unregulated source and used as drinking water and which contains COPCs for drinking water exceeding selected PRGs for drinking water (see Table 2-2).
House Dust	Prevent the introduction of lead to residences from areas outside the home via tracking and air pathways so that there is a 95% or greater probability that a child or children ages 0 to 84 months have blood lead levels less than 10 µg/dL, and a 1% or lower probability that a child or children ages 0 to 84 months have blood lead levels greater than 15 µg/dL. ^a
Fish Consumption	Prevent ingestion by humans of aquatic organisms from surface waters containing contaminants of concern exceeding risk-based threshold concentrations.
Vegetable Consumption	<p>Prevent ingestion by humans of homegrown vegetables containing contaminants of concern exceeding risk-based threshold concentrations.</p> <p>Prevent use of residential garden soil that has concentrations of COPCs greater than rural northern Idaho background levels.</p>

Notes:

^a Development of these objectives are based on directives by EPA OSWER as presented in Appendix D.

NAAQS – National Ambient Air Quality Standards

OSWER – Office of Solid Waste and Emergency Response

TSP – total suspended particulates

µg/dL – micrograms per deciliter

Table ES-2
Summary of Remedial Technologies and Process Options - All Media

General Response Action	Remedial Technology	Process Option	Retained	Not Retained	Reason for Exclusion/Notes	
Soil						
No Action	No Action	None	●			
Access and Use Modifications	Public Information Updates	Deed Notices	●			
		Sod/Grass Requirements	●		Retained as interim barrier in undeveloped areas	
		Pamphlet Distribution	●			
		Press Releases	●			
		Public Meetings	●			
		Notice Posting	●			
	Access Modification	Advisory Signs	Advisory Signs	●		
			Fence Construction	●		
	Local Regulation	Institutional Controls Program	Institutional Controls Program	●		
	Health Intervention	Panhandle Health District Lead Health Services	Panhandle Health District Lead Health Services	●		
			Community Health Protection Program (Kids First)		●	Low effectiveness for intervention; health monitoring retained
	Relocation	Temporary Relocation	Temporary Relocation	●		
Permanent Relocation			●			
Containment	Capping	Soil Cap Construction	●			
		Clay		●	Soil caps are equally effective, cost less	
		Synthetic Membranes		●	Soil caps are equally effective, cost less	
		Sprayed Asphalt		●	Soil caps are equally effective, cost less	
		Asphaltic Concrete Cap Construction	●			
		Multilayered Cap	●			
		Concrete Cap Construction	●			
		Chemical Sealants/Stabilizers	●		Retained only as temporary remedial action	
	Horizontal Barriers	Visual Markers	Visual Markers	●		Retained for potential use with soil removal
			Capillary Barrier	●		
			Chemical Barrier		●	Not effective for human health exposure pathways
			Limestone Rock Barrier		●	Not effective for human health exposure pathways
	Surface Controls	Surface Sealing	Surface Sealing	●		Interim use only during remedial activities
			Soil Stabilization		●	Other surface controls equally effective, cost less
		Grading	Grading	●		
			Diversion and Control Structures	●		
			Revegetation	●		Potential use to limit erosion and dust
	Interim Construction-Related Dust Suppression	Water	Water	●		Interim use only during remedial activities
			Membrane/Tarps	●		Interim use only during remedial activities
			Organic Agents/Polymers/Foams	●		Interim use only during remedial activities
			Hygroscopic Agents		●	Other technologies equally effective, cost less
	Volume Reduction	Excavation & Backfill	Soil Removal & Replacement	●		
			Sod Removal and Replacement	●		
Decontamination		Exterior Washing	Exterior Washing	●		
			Mechanical Operations	●		

Table ES-2
Summary of Remedial Technologies and Process Options - All Media

General Response Action	Remedial Technology	Process Option	Retained	Not Retained	Reason for Exclusion/Notes
Treatment	Chemical Treatment	pH Adjustments		●	Limited effectiveness at reducing exposure
		Phosphate Stabilization		●	Cost too high for volume and extent needed
		Leaching		●	Unproven technology
	In situ Treatment	Deep Tilling	●		
		Pozzolanic Agents		●	Aesthetically unacceptable
		Soil Leaching		●	Unproven technology
	Disposal	Temporary Storage	Waste Storage	●	
Subterranean Disposal		Deep Mine Disposal	●		
Permanent Above-Ground Disposal		Existing Waste Repository	●		Potential use with soil removal
		New Waste Repository	●		Potential use with soil removal
Drinking Water					
No Action	No Action	None	●		
Access and Use Modifications	Public Information Updates	Pamphlet Distribution	●		
		Press Releases	●		
		Public Meetings	●		
		Notice Posting	●		
	Relocation	Temporary Relocation	●		
		Permanent Relocation	●		
Treatment	Community Source Treatment	Precipitation		●	Other options are equally effective, cost less
		Modified Activated Carbon	●		Potential option for lead removal
		Ion Exchange		●	Other options are equally effective, cost less
		Alumina Adsorption	●		Only supplemental to other treatments
		Oxidation	●		Potential use with alumina for arsenic removal
		Filtration	●		
	Wellhead Treatment	Filtration	●		
	Point-of-Use Treatment	Filtration	●		
		Home Reverse Osmosis	●		
Public Water Purveyor		●			
Provide New Supply	Purveyor Hookup	Public Water Purveyor	●		
	Well Drilling	Deepen Existing Well		●	Low effectiveness, high cost; risk to aquifers
		Rehabilitate Existing Well		●	Not effective if source aquifer contaminated
		Abandon Existing Well	●		
		Drill New Well	●		Must consider suitability of alternative aquifer
	Water Importation	Bottled Water	●		

Table ES-2
Summary of Remedial Technologies and Process Options - All Media

General Response Action	Remedial Technology	Process Option	Retained	Not Retained	Reason for Exclusion/Notes	
House Dust						
No Action	No Action	None	●			
Access and Use Modifications	Public Information Updates	Pamphlet Distribution	●			
		Press Releases	●			
		Public Meetings	●			
		Notice Posting	●			
		Health Intervention	Panhandle Health District Lead Health Services	●		
		Community Health Protection Program (Kids First)		●	Low effectiveness for intervention; health monitoring retained	
	Hazard Isolation	Limited Isolation			●	Education in Lead Health IP should be as effective
		Complete Isolation			●	Cleaning should be equally effective, cost less
		Renovation			●	Cleaning should be equally effective, cost less
	Relocation	Temporary Relocation		●		
Permanent Relocation			●			
Containment	Capping	Sand Cap - Crawl Space	●			
		Synthetic Cap - Crawl Space	●			
		Volume Reduction	Decontamination	Interior Washing		●
		One-Time Cleaning of Hard Surfaces	●			
		Periodic/Regular Cleaning of Hard Surfaces		●	One-time cleaning equally effective, costs less	
		One-Time Industrial Vacuuming		●	Not effective	
		Periodic/Regular Industrial Vacuuming		●	Other options more effective, cost less	
		One-Time Heavy-Duty Vacuuming		●	Not effective	
		Periodic/Regular Heavy-Duty Vacuuming		●	Other options more effective, cost less	
		On-Demand Self-Checkout Heavy Duty Vacuuming	●			
		Cleaning of Heating/Cooling Systems	●			
		Cleaning of Attic/Basement Dusts	●			
	Remove & Replace	Remove/Replace Contaminated Flooring	●			
		Remove/Replace Soft Furniture	●			
		Remove/Replace Heating and Cooling Systems			●	Cleaning these systems as effective, costs less
		Remove/Replace Attic and Basement Insulation			●	Costs more than cleaning, effectiveness not demonstrated
		Remove/Replace Foundation			●	Foundation containment more effective, costs less
		Remove/Replace Crawl Space Soil			●	Isolation and barriers more effective, cost less
	Air Filtration	Air Purifying Filters for Heating & Cooling Systems			●	Not likely to be effective
		Portable Air Purifying Filters			●	Not likely to be effective
Fish						
No Action	No Action	None	●			
Access and Use Modifications	Public Information Updates	Pamphlet Distribution	●			
		Press Releases	●			
		Public Meetings	●			
		Field Contacts	●			
		Notice Posting	●			
		Monitoring	Monitoring	Fish Sampling	●	
	Fish Counts	●				

Table ES-3
Summary of Retained Alternatives

Alternative	Description	Abbreviated Name
Soil Alternatives^a		
Alternative S1	No Action	No Action
Alternative S2	Information and Intervention	Information and Intervention
Alternative S3	Information and Intervention and Access Modifications	Access Modifications
Alternative S4	Information and Intervention and Limited Removal and Barriers	Partial Removal and Barriers
Alternative S5	Information and Intervention and Complete Removal	Complete Removal
Drinking Water Alternatives		
Alternative W1	No Action	No Action
Alternative W2	Public Information	Public Information
Alternative W3	Public Information and Residential Treatment	Residential Treatment
Alternative W4	Public Information and Alternative Source, Public Water Utility	Public Water
Alternative W5	Public Information and Alternative Source, Groundwater	Groundwater
Alternative W6	Public Information and Multiple Alternative Sources	Multiple Alternative Sources
House Dust Alternatives		
Alternative D1	No Action	No Action
Alternative D2	Information and Intervention and Vacuum Loan Program/Dust Mats	Vacuum Loan
Alternative D3	D2 and Extensive Cleaning	Extensive Cleaning
Fish Consumption Alternatives		
Alternative F1	No Action	No Action
Alternative F2	Information and Intervention	Information and Intervention
Alternative F3	Information and Intervention and Monitoring	Monitoring

^a For residential properties, Alternatives S2, S4, and S5 include relocation, if necessary. For recreational areas, Alternative S4 includes access modifications and site improvements, if necessary.

Table ES-4
Remedial Technologies and Process Options - Retained Soil Alternatives

Remedial Technology	Process Option	Alternative				
		S1	S2	S3	S4	S5
No Action	None	●				
Public Information Updates	Deed Notices		●	●	●	
	Sod/Grass Requirements				●	
	Pamphlet Distribution		●	●	●	●
	Press Releases		●	●	●	●
	Public Meetings		●	●	●	●
	Notice Posting		●	●	●	
Access Modification	Advisory Signs		●	●		
	Fence Construction			●		
Local Regulation	Institutional Controls Program		●	●	●	
Health Intervention	PHD Lead Health Intervention Program		●	●	●	●
Relocation (Not recreational areas)	Temporary		●		●	●
	Permanent		●		●	●
Capping	Soil				●	
	Asphaltic Concrete				●	
	Multilayered Cap				●	
	Concrete Cap				●	
	Chemical Sealants/Stabilizers (temporary only)				●	
Horizontal Barriers	Visual Barrier				●	
	Capillary Barrier				●	
Surface Controls	Surface Sealing				●	●
	Grading				●	●
	Diversion and Control Structures				●	●
	Revegetation				●	●
Interim Construction-Related Dust Suppression	Water				●	●
	Organic Agents/Polymers/Foams				●	●
	Membranes/Tarps				●	●
Excavation/Backfill	Soils Removal and Replacement				●	●
	Sod Removal and Replacement				●	●
Decontamination	Exterior Washing				●	●
	Mechanical Operations				●	●
Disposal	Deep Tilling				●	●
	Waste Storage				●	●
	Deep Mine Disposal				●	●
	Existing Waste Repository				●	●
	New Waste Repository				●	●

Alternative S1 = No Action

Alternative S2 = Information and Intervention

Alternative S3 = Access Modifications

Alternative S4 = Partial Removal

Alternative S5 = Complete Removal

For residential properties, Alternatives S2, S4, and S5 include relocation, if necessary.

For recreational areas, Alternative S4 includes access modifications and site improvements, if necessary.

PHD = Panhandle Health District

Table ES-5
Remedial Technologies and Process Options - Retained House Dust Alternatives

Remedial Technology	Process Option	Alternative		
		D1	D2	D3
No Action	None	●		
Public Information Updates	Pamphlet Distribution		●	●
	Press Releases		●	●
	Public Meetings		●	●
	Notice Posting		●	●
Health Intervention	PHD Lead Health Intervention Program		●	●
Relocation	Temporary		●	●
	Permanent (considered only for select isolated cases)		●	●
Capping	Sand Cap, Crawl Space Soil			●
	Synthetic Cap, Crawl Space Soil			●
Decontamination	One-Time Cleaning of Hard Surfaces			●
	On-Demand Self-Checkout Heavy-Duty Vacuuming		●	●
	Dust Mats		●	●
	Cleaning of Heating/Cooling Systems			●
	Cleaning of Attic/Basement Dusts			●
Remove/Replace	Remove/Replace Contaminated Flooring			●
	Remove/Replace Soft Furniture			●

Alternative D1 = No Action

Alternative D2 = Information and Intervention, Vacuum Loan/Dust Mats

Alternative D3 = D2 + Extensive Cleaning

PHD = Panhandle Health District

Table ES-6
Remedial Technologies and Process Options - Retained Drinking Water Alternatives

Remedial Technology	Process Option	Alternative					
		W1	W2	W3	W4	W5	W6
No Action	None	●					
Public Information Updates	Pamphlet Distribution		●	●	●	●	●
	Press Releases		●	●	●	●	●
	Public Meetings		●	●	●	●	●
	Notice Posting		●	●	●	●	●
Wellhead Treatment	Filtration			●			
Point-of-Use Treatment	Filtration			●			●
	Reverse Osmosis			●			●
Public Water Hookup	Public Water System				●		●
Well Drilling	Abandon Existing Well					●	●
	Drill New Well					●	●
Point-of-Use Monitoring	Tap Sampling			●		●	●
	Other Point Sampling			●		●	●

Alternative W1 = No Action
 Alternative W2 = Public Information
 Alternative W3 = W2 + Residential Treatment
 Alternative W4 = W2 + Alternative Source, Public Water Utility
 Alternative W5 = W2 + Alternative Source, Groundwater
 Alternative W6 = W2 + Multiple Alternative Sources

Table ES-7
Remedial Technologies and Process Options - Retained Fish Consumption Alternatives

Remedial Technology	Process Option	Alternative		
		F1	F2	F3
No Action	None	●		
Information & Intervention	Pamphlet Distribution		●	●
	Press Releases		●	●
	Public Meetings		●	●
	Notice Posting		●	●
Monitoring	Fish Sampling			●
	Creel Sampling			●
	River Ranger Program			●

Alternative F1 = No Action
 Alternative F2 = Information and Intervention
 Alternative F3 = F2 + Monitoring

**Table ES-8
Comparative Evaluation of Soil Alternatives**

Alternative	Criteria							Cost for 500 ppm Cleanup Level	Cost for 1000 ppm Cleanup Level
	Overall Protectiveness	Compliance with ARARs	Long-Term Effectiveness	Reduction of Toxicity, Mobility, Volume	Short-Term Effectiveness	Implementability			
Recreational Areas									
Alternative S1	⊙	⊙	⊙	⊙	⊙	●	--	\$0	
Alternative S2	◐	⊙	◐	⊙	◐	●	--	\$243,000	
Alternative S3	◐	⊙	◐	⊙	●	○	--	\$692,000	
Alternative S4	◐	◐	◐	◐	●	◐	--	\$2,018,000	
Residential Yards									
Alternative S1	⊙	⊙	⊙	⊙	⊙	●	\$0	\$0	
Alternative S2	○	⊙	○	⊙	○	●	\$9,340,000	\$5,511,000	
Alternative S4	◐	◐	◐	◐	●	◐	\$91,757,000	\$49,928,000	
Alternative S5	●	●	●	●	●	◐	\$140,250,000	\$76,208,000	
Other Areas									
Alternative S1	⊙	⊙	⊙	⊙	⊙	●	--	\$0	
Alternative S2	○	⊙	○	⊙	○	●	--	\$312,000	
Alternative S3	◐	⊙	◐	⊙	●	○	--	\$2,212,000	
Alternative S4	◐	◐	◐	◐	●	◐	--	\$35,252,000	
Alternative S5	○	●	●	●	●	◐	--	\$52,437,000	

Rating system:

- High
- ◐ Medium
- Low
- ⊙ Lowest

- Alternative S1 = No Action
- Alternative S2 = Information and Intervention
- Alternative S3 = Access Modifications
- Alternative S4 = Partial Removal
- Alternative S5 = Complete Removal

Note: For residential areas, comparative evaluation is for 500 ppm cleanup level; the cleanup level for recreational and other areas is assumed to be 1000 ppm.

Table ES-9
Comparative Evaluation of Drinking Water Alternatives

Alternative	Criteria						
	Overall Protectiveness	Compliance with ARARs	Long-Term Effectiveness	Reduction of Toxicity, Mobility, Volume	Short-Term Effectiveness	Implementability	Cost
Alternative W1 (No Action, all areas)	⊙	⊙	⊙	⊙	⊙	●	\$0
Alternative W2 (Public Information, all areas)	○	⊙	○	⊙	○	●	\$428,000
Alternative W3 (Residential Treatment, all areas)	▶	▶	▶	○	●	●	\$1,418,000
Alternative W4 (Public Water) ^a							
Upper Basin (inside water district)	●	●	●	⊙	▶	●	\$129,000
Upper Basin (outside water district)	●	●	●	⊙	▶	○	\$7,208,000
Lower Basin & Kingston (inside water district)	●	●	●	⊙	▶	▶	\$688,000
Lower Basin & Kingston (outside water district)	●	●	●	⊙	▶	○	\$2,821,000
Alternative W5 (Groundwater) ^a							
Upper Basin (inside water district)	●	●	▶	⊙	▶	○	\$152,000
Upper Basin (outside water district)	●	●	▶	⊙	▶	○	\$268,000
Lower Basin & Kingston (inside water district)	●	●	▶	⊙	▶	●	\$1,245,000
Lower Basin & Kingston (outside water district)	●	●	▶	⊙	▶	●	\$1,245,000
Alternative W6 (Multiple Alternative Sources)	●	●	●	○	●	●	\$2,210,000

^a Does not include Alternative W2 or 1% discount for relocation

Upper Basin (inside water district) - includes Mullan, Wallace, Silverton, Woodland Park, Corwall, Mace, Burke, Big Creek, Montgomery Gulch and Pine Creek

Upper Basin (outside water district) - includes McCarty, Day Rock, Black Cloud, Zanettiville, Gem, Frisco, Black Bear, Yellow Dog, Sunny Slopes, Osburn, Moon Gulch, Nuckols Gulch, Terror Gulch, and Two Mile Creek

Lower Basin & Kingston (inside water district) - generally includes Kingston, Cataldo and Harrison. Specific status of areas relative to Lower Basin water district boundaries is not known.

Lower Basin & Kingston (outside water district) - status of areas outside Lower Basin water district boundaries is not known.

Rating system:

- High
- ▶ Medium
- Low
- ⊙ Lowest

Alternative W1 = No Action

Alternative W2 = Public Information

Alternative W3 = W2 + Residential Treatment

Alternative W4 = W2 + Alternative Source, Public Water Utility

Alternative W5 = W2 + Alternative Source, Groundwater

Alternative W6 = W2 + Multiple Alternative Sources

HUMAN HEALTH ALTERNATIVES TECH MEMO, COEUR D'ALENE BASIN, IDAHO
EXECUTIVE SUMMARY—PUBLIC COMMENT DRAFT

Table ES-10
Comparative Evaluation of House Dust Alternatives

Alternative	Criteria						
	Overall Protectiveness	Compliance with ARARs	Long-Term Effectiveness	Reduction of Toxicity, Mobility, Volume	Short-Term Effectiveness	Implementability	Cost
Alternative D1	⊙	⊙	⊙	⊙	⊙	●	\$0
Alternative D2	◐	●	◐	○	○	●	\$1,390,000
Alternative D3	●	●	◐	●	◐	◐	\$7,610,000

Rating system:

- High
- ◐ Medium
- Low
- ⊙ Lowest

Alternative D1 = No Action

Alternative D2 = Information and Intervention, Vacuum Loan/Dust Mats

Alternative D3 = D2 + Extensive Cleaning

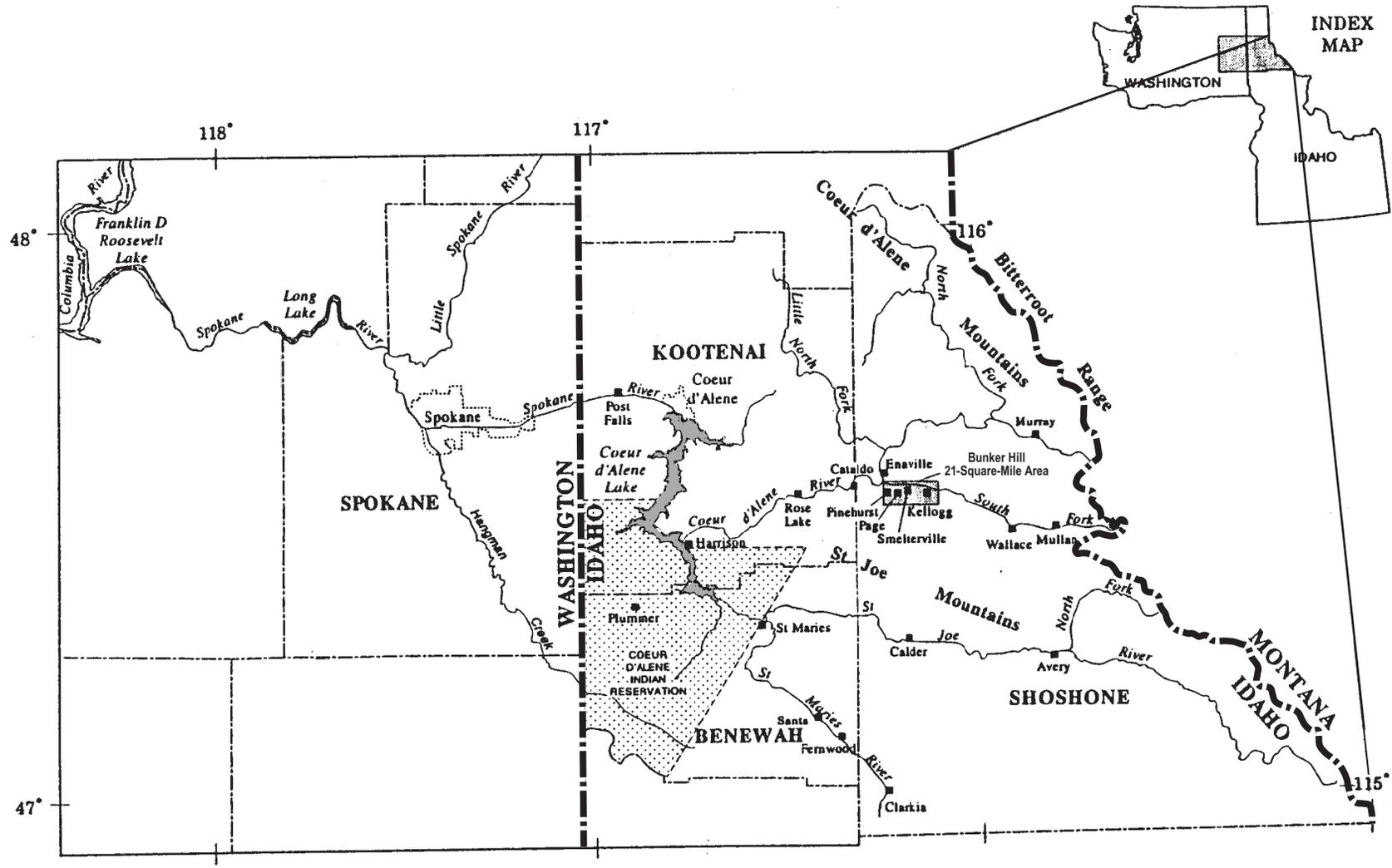
Table ES-11
Comparative Evaluation of Fish Consumption Alternatives

Alternative	Criteria						
	Overall Protectiveness	Compliance with ARARs	Long-Term Effectiveness	Reduction of Toxicity, Mobility, Volume	Short-Term Effectiveness	Implementability	Cost
Alternative F1	⊙	⊙	⊙	⊙	⊙	●	\$0
Alternative F2	◐	⊙	◐	⊙	◐	◐	\$230,000
Alternative F3	●	⊙	●	⊙	◐	◐	\$929,000

Rating system:

- High
- ◐ Medium
- Low
- ⊙ Lowest

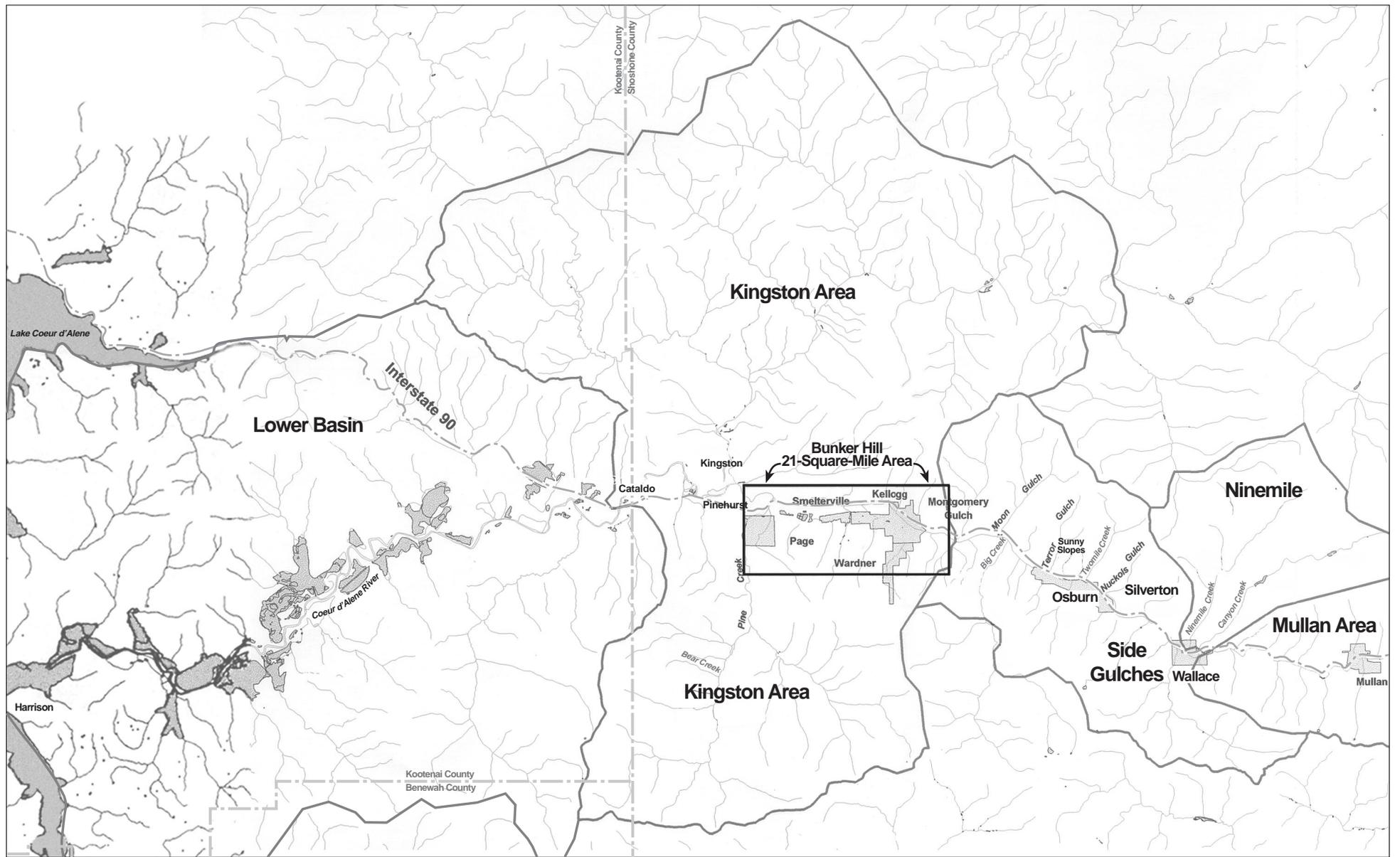
Alternative F1 = No Action
 Alternative F2 = Information and Intervention
 Alternative F2 = Monitoring

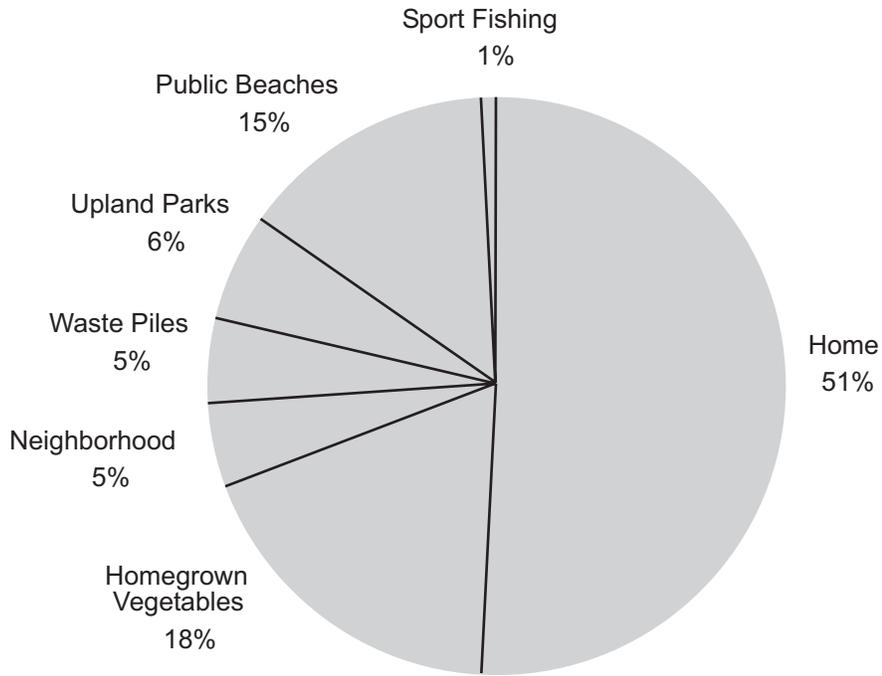


Base compiled from U.S. Geological Survey
 State base maps 1:1,000,000

CH2MHILL

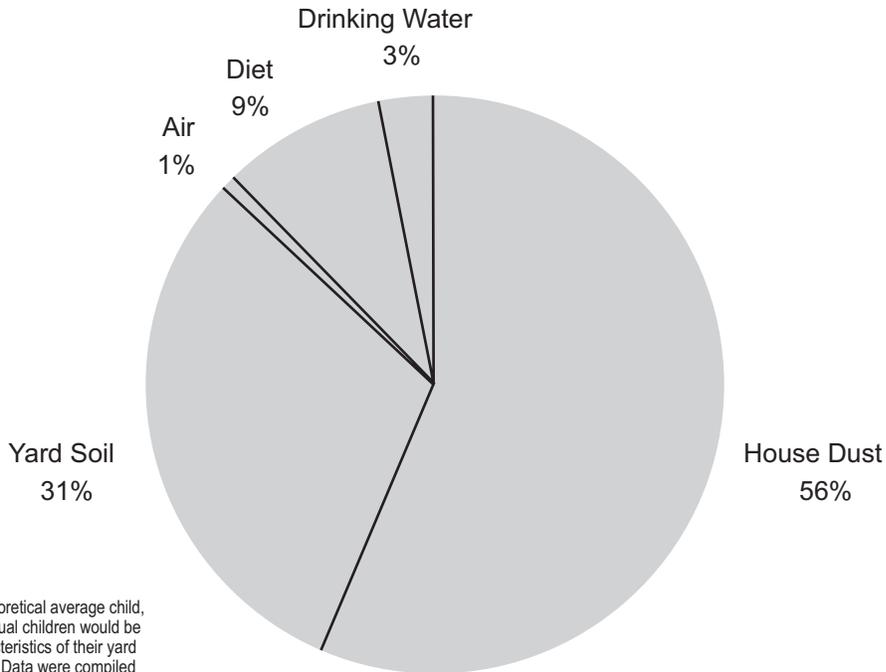
FIGURE ES-1
Location of Coeur d'Alene River Basin
 Human Health Alternatives Tech Memo
 Coeur d'Alene Basin, Idaho





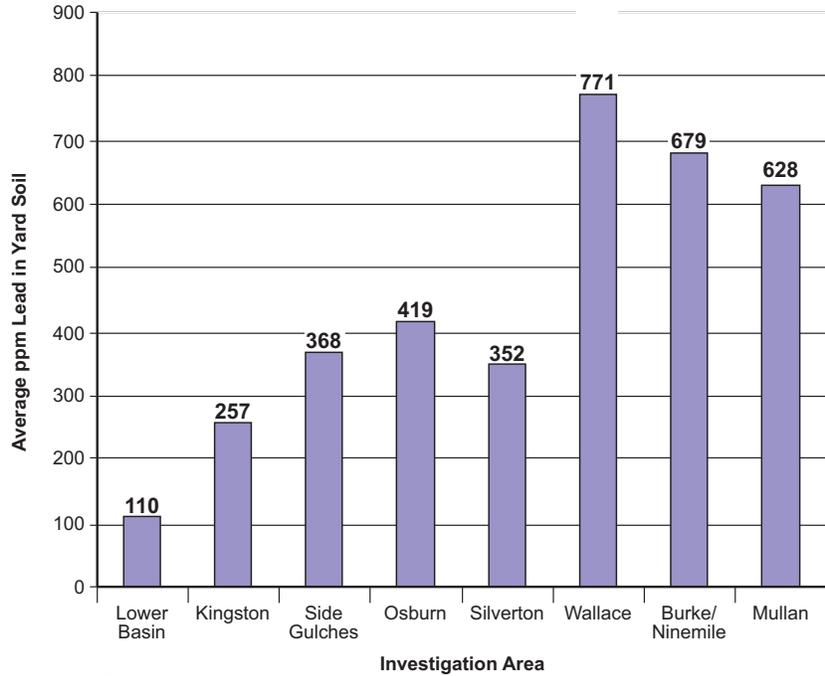
NOTE: Percentages are for a theoretical average child, and exposures for individual children would be determined by the characteristics of their yard and that child's activities. Data were compiled from the Human Health Risk Assessment, TerraGraphics, 2000.

FIGURE ES-3
Average Child's Basin-Wide Lead Exposure
Human Health Alternatives Tech Memo,
Coeur d'Alene Basin, Idaho



NOTE: Percentages are for a theoretical average child, and exposures for individual children would be determined by the characteristics of their yard and that child's activities. Data were compiled from the Human Health Risk Assessment, TerraGraphics, 2000.

FIGURE ES-4
Average Child's Home Lead Exposure
Human Health Alternatives Tech Memo,
Coeur d'Alene Basin, Idaho



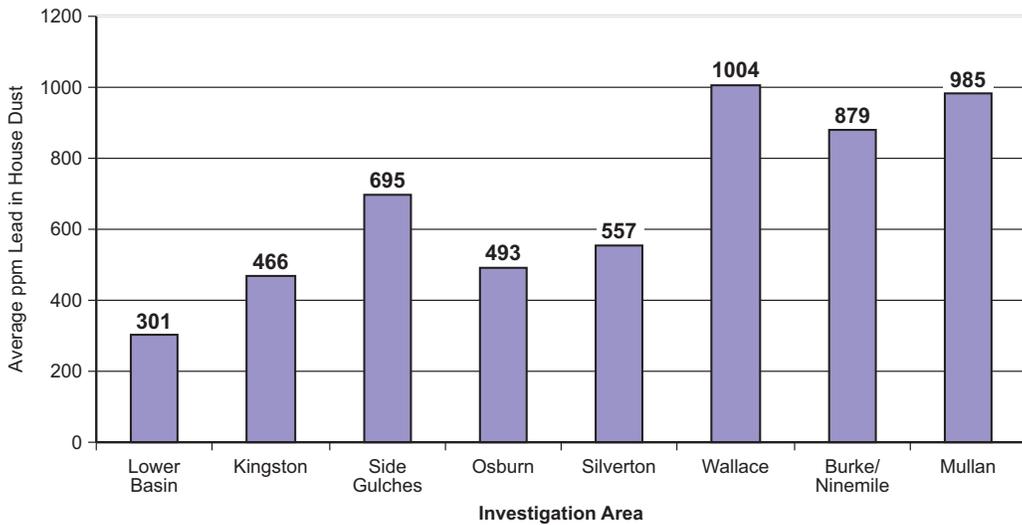
MAXIMUM VALUES			
Lower Basin	7350	Silverton	6098
Kingston	0229	Wallace	16026
Side Gulches	3356	Burke/Ninemile	5410
Osburn	12884	Mullan	20218

NOTE: Data from Human Health Risk Assessment, TerraGraphics Environmental Engineering, 2000.

FIGURE ES-5

Lead Levels in Yard Soil

Human Health Alternatives Tech Memo, Coeur d'Alene Basin, Idaho



MAXIMUM VALUES			
Lower Basin	3140	Silverton	3390
Kingston	1750	Wallace	29725
Side Gulches	3929	Burke/Ninemile	5800
Osburn	2192	Mullan	4060

NOTE: Data from Human Health Risk Assessment, TerraGraphics Environmental Engineering, 2000.

FIGURE ES-6

Lead Levels in House Dust

Human Health Alternatives Tech Memo, Coeur d'Alene Basin, Idaho