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Superfund Record of Decision:

Commencement Bay – Nearshore/Tideflats, WA

50272-101

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16. Abstract (Limit: 200 words)

The 67-acre Commencement Bay-Nearshore/Tideflats site, a former lead and copper smelting facility, is part of the larger 950-acre property located in Ruston and Tacoma, Washington. Land use in the area is residential, including schools, playgrounds, and parks. The site also contains the Asarco smelter, inactive since 1985, approximately 4,000 residents, and part of a coastal zone. In 1890 lead smelting operations began, but in 1912, Asarco converted the plant to a copper smelter. The smelting process specialized in processing ores with high arsenic concentrations and also recovered arsenic-trioxide and metallic arsenic as by-products. As part of the processing of copper from ores and concentrates, slag, a hard, glassy material containing elevated concentrations of arsenic, lead, and other metals, was produced. Smelter slag was used around the community for driveways, walkways, curbs, parking areas, and as backfill in utility trenches. In 1985, copper smelting operations ceased, and the arsenic production plant closed in 1986. As a direct result of 95 years of airborne emissions from smelting operations, historical studies throughout the 1970s and 1980s identified elevated contaminant concentrations in multiple environmental media, including soil, house dusts, indoor and outdoor air, and garden vegetables. Once copper smelting and arsenic processing ceased, ambient air

(See Attached Page)

17. Document Analysis a. Descriptors

Record of Decision - Commencement Bay - Nearshore/Tideflats, WA
Fourth Remedial Action
Contaminated Media: soil, debris (slag)
Key Contaminants: metals (arsenic, lead)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 82
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(See ANSI-Z39.18) *See Instructions on Reverse* OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

Abstract (Continued)

concentrations of these metals were reduced by more than 90 percent. In 1985 and 1988, State investigations indicated that ingestion of contaminated soil was the primary route of exposure to arsenic. In 1989, EPA required Asarco to remove contaminated soil to a depth of three inches at the 11 nonresidential high-use properties, and to replace the excavated soil with 9-12 inches of imported soil. EPA has divided the Commencement Bay - Nearshore/Tideflats site into seven OUs for remediation; four of which are associated with the Asarco Smelter. Three previous 1998, 1989, and 1990 RODs addressed source and ground water contamination at the site as OUs 3, 1 and 5, and 7, respectively. This ROD addresses the arsenic- and lead-contaminated soil and slag in the area surrounding the smelter, known as the Ruston/North Tacoma Study Area, as OU4. Future RODs will address the contaminated soil, sediment, ground water, and surface water at the site, as OUs 2, 6, and 7. The primary contaminants of concern affecting the soil, and slag/debris are metals, including arsenic and lead.

The selected remedial action for this site includes sampling individual properties to determine if soil exceeds the established EPA action levels of 230 mg/kg for arsenic and 500 mg/kg for lead, followed by excavation of any contaminated soil and slag to a depth of 18 inches; replacing the excavated soil and slag with clean soil and gravel and re-landscaping; capping contaminated dirt alleys and parking areas with asphalt to provide an impermeable barrier to contaminants, or removing the soil and replacing it with gravel; disposing of the contaminated soil offsite; implementing a maintenance and monitoring program for the capped areas; placing a marker to clearly identify the base of the cap; fencing and planting low-lying shrubs in steeps contaminated areas where excavation is not possible; establishing a temporary staging area or transfer facility for excavated soil, if necessary; implementing safety measures, including air monitoring; developing a soil testing, collection, and disposal program to remove soil from residences; and developing and implementing institutional controls. The estimated present worth cost for this remedial action ranges from $60,000,000 to $80,000,000, which includes an O&M cost of $2,000,000 for 7 years.

PERFORMANCE STANDARDS OR GOALS:

Soil cleanup goals are based on reduction of the additional potential skin cancer risk of arsenic to no more than 5 in 10,000; a national goal of reducing lead levels in children's blood to no greater than 10 ug/dl; and EPA guidance for soil lead cleanup levels, including arsenic 230 mg/kg and lead 500 mg/kg.

RECORD OF DECISION

COMMENCEMENT BAY NEARSHORE/ TIDEFLATS SUPERFUND SITE OPERABLE UNIT 04 RUSTON/NORTH TACOMA STUDY AREA RUSTON AND TACOMA, WASHINGTON

June 1993

EPA Region 10

DECLARATION FOR THE RECORD OF DECISION

Site Name and Location

Commencement Bay Nearshore/Tideflats Superfund Site
Operable Unit 04 -- Ruston/North Tacoma Study Area
Ruston and Tacoma, Washington

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Ruston/North Tacoma Study Area, in Ruston and Tacoma, Washington, which was chosen in accordance with CERCLA, as amended by SARA, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for this site. The State of Washington concurs with the selected remedy.

Assessment of the Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent or substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

The EPA has divided the Commencement Bay/Nearshore Tideflats Superfund site into seven operable units (OU's) in order to facilitate the investigation, analysis, and cleanup of this very large site. Four of these OU's are associated with the Asarco smelter:

- OU 02 Asarco Tacoma Smelter
- OU 04 Asarco Off-Property (Ruston/North Tacoma Study Area)
- OU 06 Asarco Sediments
- OU 07 Asarco Demolition

The remedy described in this ROD addresses OU 04 and involves the cleanup of arsenic and lead contaminated soils and slag in the Study Area, the residential community surrounding the smelter. This remedy will address the principal threat posed by conditions at the site, which is the ingestion of contaminated soil and dust, and includes:

- Designation of "action levels" or concentrations of arsenic or lead in soil. Engineering measures will address properties or areas that exceed action levels.

- Sampling of individual properties to determine if soil exceeds the action levels.

- o Excavation and off-site disposal of contaminated soil and slag from properties that exceed action levels. Contaminated soil below 18 inches will not be excavated but will be capped.
- o Excavation of slag from all other properties.
- o Replacement of excavated soil and slag with clean soil and gravel.
- o Asphalt capping or soil removal and replacement with gravel of contaminated dirt alleys and parking areas.
- o Fencing and planting low lying shrubs in steep areas.
- o Soil collection program for soil above action levels that is not excavated during the cleanup (e.g., soil below 18 inches that is uncovered in the future).
- o The development and implementation of community protection measures (CPMs). CPMs are administrative requirements that will address soil that is not excavated but that contains concentrations of arsenic or lead that exceed either action levels or levels commonly found in urban areas.

Statutory Determinations

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies, to the maximum extent practicable for this site. However, because treatment of the principal threats of the site was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element.

Because the remedy may result in hazardous substances remaining on-site above health-based levels, a review will be conducted no less often than every five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

[signature]

Gerald A. Emison
Acting Regional Administrator
U.S. EPA Region 10

6-16-93
Date

RECORD OF DECISION

COMMENCEMENT BAY NEARSHORE/
TIDEFLATS SUPERFUND SITE
OPERABLE UNIT 04
RUSTON/NORTH TACOMA STUDY AREA
RUSTON AND TACOMA, WASHINGTON

June 1993

EPA Region 10

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RUSTON/NORTH TACOMA STUDY AREA
RUSTON AND TACOMA, WASHINGTON

1.0 SITE DESCRIPTION

The Ruston/North Tacoma Study Area (Study Area) is an operable unit of the Commencement Bay Nearshore/Tideflats (CB N/T) Superfund site. The CB N/T Superfund site was listed on the interim priority list by the U.S. Environmental Protection Agency (EPA) in 1981, and included in the first published National Priorities List in September 1983. The Study Area, approximately 950 acres, comprises an arc of approximately one mile radius surrounding the Asarco Tacoma smelter (Asarco smelter) and consists of the Town of Ruston and a northern portion of the City of Tacoma, Washington (Figure 1). The EPA and the Washington State Department of Ecology (Ecology) identified the Study Area as the primary focus for conducting a Remedial Investigation/Feasibility Study (RI/FS) (see Section 2.0 for a discussion of how the Study Area was defined). This Record of Decision (ROD) addresses contaminated soils and slag within the residential Study Area surrounding the Asarco smelter.

The smelter began operations in 1890 as a lead smelter. Asarco purchased the smelter in 1905 and converted it to a copper smelter in 1912. The smelter specialized in processing ores with high arsenic concentrations and recovered arsenic trioxide and metallic arsenic as by-products. In recovering copper from ores and concentrates, the smelting process also produced slag, a hard, glassy material containing elevated concentrations of arsenic, lead, and other metals. Copper smelting operations ceased in 1985, and the arsenic production plant was closed in 1986. The Asarco smelter facility, including demolition of structures on the smelter property, and sediments adjacent to the smelter property are being addressed as separate operable units of the CB N/T Superfund site (see Section 4.0).

The Study Area land use is primarily residential and includes schools, playgrounds, and parks. The Study Area includes a population of approximately 4,290, and about 1,820 housing units. Commercial development consisting of retail shops and small businesses is limited in extent and mainly confined to an area along Pearl Street. The Asarco smelter, which ceased operations in 1985, is located to the northeast of the Study Area and was the principal industrial facility in the area. The southern portion of Point Defiance Park and Zoo, which extends along a wooded peninsula to the northwest of the smelter, is located within the Study Area and includes access to the Vashon Island Ferry. Properties to the southeast of the Study Area, which were previously industrial in nature, are actively being redeveloped with restaurants, a fishing pier, park areas, and other public uses.

The Study Area is characterized by a rolling topography. Elevations, according to United States Geological Survey documents, range from 10 feet (3 meters) above Mean Sea Level (MSL) to 250 feet (75 meters) MSL, with elevations decreasing at a fairly uniform rate towards the northeast (Commencement Bay). High bluffs form the shoreline boundary of the Study Area separating it from Commencement Bay and the Asarco smelter facility. Steep ravines occur in the vicinity of rail tracks that cross the site in an east-west direction. There are areas of dense vegetation, such as steep slopes of ravines (particularly southwest and west of the Asarco property) and along the slope toward Commencement Bay above Ruston Way. In general, however, construction of residences has resulted in clearing most of the area with the exception of scattered trees and landscaping.

Few surface water features exist within the Study Area. Some springs emerge from shallow ground water zones along the face of the shoreline bluffs. A field investigation of ground water conditions was not included as part of the RI. Based on the impermeable characteristics of the till and silts, the presumed depth to ground water, and the characteristics of the contaminants, it is not considered likely that contamination from Asarco smelter airborne emissions has migrated to the ground water or substantially affected ground water quality. Ground water in the Study Area is not currently used as a source for drinking water.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Operation of the Asarco smelter for over 95 years resulted in contamination of various environmental media in the surrounding area. That contamination was the result of airborne emissions from smelting operations. Early soil sampling studies as well as deposition modeling were useful in suggesting the overall pattern of soil contamination with distance and direction from the smelter. The Exposure Pathway Study (discussed further below) conducted by the University of Washington included additional sampling locations, and provided information on soil contamination at the time of the smelter closure in 1985-1986.

In 1988 a Field Investigation Report (FIR) was developed for the Washington State Department of Ecology. Based on a review of all available soil sampling results, sampling for the FIR was designed to characterize soil contamination patterns in an area out to about 100 parts per million (ppm) arsenic, which was interpreted to be at a distance of about 3/4 to 1 mile from the smelter.

The EPA RI/FS work plans were developed in 1989. The sampling focused on the same Study Area as the FIR, and was designed to address data gaps, areas of uncertainty, and develop additional spatial data.

Subsequent to all of these soil sampling studies, the Cleanup Standards under the Model Toxics Control Act (MTCA) were adopted by Ecology (February 1991). The cleanup standard for soil arsenic in residential areas as defined in the regulation would result in a larger area for characterizing the extent of soil contamination by arsenic (to an area defined by 20 ppm rather than by 100 ppm). This ROD, however, addresses contaminated soils and slag within the more limited Study Area surrounding the former smelter site as defined for the RI study (see also Section 4.1).

Asarco is liable under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or the Superfund law) for the cost of cleanup of hazardous substances that were released from the smelter. EPA first notified Asarco of its potential liability for the contamination of the area surrounding the smelter in July 1984. EPA had previously notified Asarco of its potential liability for the contamination of Commencement Bay in March 1982.

2.1 Cleanup Activities in Areas Surrounding the Smelter Site

The residential area adjacent to the smelter has been the subject of many investigations over the past 20 years (see summary of reports on pages 1-8 through 1-13 of the Remedial Investigation (RI) Report for Ruston/North Tacoma, Washington, Bechtel, January 1992). Several recent studies, mentioned above, are described in the following text. These studies are significant in that they formed the basis for a 1989 EPA decision to conduct an Expedited Response Action (ERA) at several publicly accessible properties in the Study Area.

Exposure Pathways Study

Initiated in 1985 and released in 1987, the Exposure Pathways Study (Ruston/Vashon Arsenic Exposure Pathways Study, University of Washington, 1987) investigated the pathways contributing arsenic to the bodies of residents in Tacoma and Vashon/Maury Islands. One of the objectives of this study was to determine what environmental media required remediation to effectively reduce the body burden of arsenic in the affected population. The study involved the repeated sampling of urine and a number of environmental media for arsenic analyses. It was performed just at the time when smelter operations ceased.

In the Exposure Pathways Study, an individual's age was shown to be significant for determining urinary arsenic levels, with young children most affected. Among other findings, the arsenic concentrations on children's hands were significantly associated with urinary arsenic concentrations, and with time spent in contact with soil and house dust. Ingestion of contaminated soil was identified as the primary route of exposure to arsenic.

Field Investigation Report

In 1988, a detailed investigation (Field Investigation Report [FIR], Ruston/Vashon Island Area, Black & Veatch, 1988) of post-shutdown soil contamination in the Study Area was performed by Ecology. Approximately 288 soil samples were collected from residential and non-residential high-use areas (parks, playgrounds, and vacant lots) within approximately 1 mile of the smelter. The FIR included an evaluation to determine if soil contamination was related to smelter emissions.

Endangerment Assessment and Engineering Evaluation/Cost Analysis

In conjunction with the FIR, an Endangerment Assessment (EA) (Endangerment Assessment Ruston/Vashon Island Area, Black & Veatch, 1988) and Engineering Evaluation/Cost Analysis (EE/CA) (Engineering Evaluation/Cost Analysis of Removal Action Alternatives: Ruston/Vashon Island Area, Black & Veatch, 1988) were also performed by Ecology. The EA evaluated the potential health effects from exposure to smelter-related contamination in soil, house dust, and air. The EE/CA was developed to evaluate removal action alternatives.

Urinary Arsenic Survey

As a follow-up to the Exposure Pathways Study, an additional urinary arsenic survey (Urinary Arsenic Survey, North Tacoma, Washington, Tacoma-Pierce County Health Department, 1988) was performed by the Tacoma-Pierce County Health Department (TPCHD) of children ages 2 - 8 years living within approximately 1/2 mile of the smelter. The results indicated that urinary arsenic levels had generally declined since smelter closure. Some individuals, however, still had elevated levels.

Expedited Response Action

Of the 20 nonresidential high-use areas identified and sampled as part of the FIR, 11 were determined to have arsenic concentrations resulting in estimated risks outside of EPA's range of acceptable risks for carcinogens. In March 1989, EPA and Asarco signed an Administrative Order on Consent for the performance of an ERA. Under the ERA, Asarco agreed to remove three inches of arsenic-contaminated soil at the 11 nonresidential high-use properties, and replace the excavated soil with 9 to 12 inches of imported soil. The 11 sites (see Figure 2) totalled about 15 acres and included playgrounds, parks, and vacant lots - locations where children were likely to spend time playing. While additional information was required to fully characterize the nature and extent of contamination in the residential community, these nonresidential sites were selected for early remedial action because of elevated concentrations of arsenic in soil, and accessibility by the public, especially children. A portion of one of the sites has not been cleaned-up due to difficulties in securing access from the property owner.

Remedial Investigation/Feasibility Study

In 1989, EPA contacted Asarco about conducting the further investigation and analysis of cleanup alternatives. Asarco was not willing to conduct the investigation and analysis as required by EPA, so EPA funded and performed this work. EPA released its Baseline Risk Assessment, RI, and Feasibility Study in January 1992.

2.2 Cleanup Activities at the Smelter Site

In addition to the investigation and cleanup of the residential community, EPA and Asarco are also investigating and analyzing cleanup options for the smelter property, and for contaminated marine sediments adjacent to the smelter site. See Section 4.0 for a brief description of these activities.

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

Throughout EPA's RI/FS activities leading up to this ROD, extensive efforts have been made to inform and involve the public, particularly residents in the community. EPA conducted the activities summarized in this section because the agency believes that community involvement is a key element in developing and implementing a successful cleanup plan.

In addition to the many activities discussed below, EPA has complied with the specific requirements for public participation under CERCLA by publishing a Proposed Plan for public comment on August 14, 1992. The Proposed Plan public comment period ran from August 17, 1992 through October 17, 1992. During the comment period EPA held two public meetings. The Proposed Plan was mailed to approximately 800 individuals on EPA's mailing list. A summary fact sheet of the Proposed Plan was also sent to all residents of the Study Area by a postal carrier route bulk mailing. EPA also published newspaper advertisements in Tacoma's Morning News Tribune to announce the availability of the Proposed Plan, the comment period, and the public meetings.

To prepare for the release of the Proposed Plan, EPA developed a communications strategy in 1990 for its activities related to the Ruston/North Tacoma Study Area. The communications strategy included three main components: Community Relations; Periodic Briefings; and the formation of a Coordinating Forum. This strategy supplemented the existing Community Relations Plan (September 1989), which addresses all of the CB N/T Operable Units. The following summarizes the numerous community relations activities that EPA has conducted to date. Many activities are on-going activities. The activities are listed below as either outreach or education.

3.1 Outreach

General Public

Community Liaison: In 1989, EPA hired a part time community liaison. The EPA liaison staffs an office in Ruston three days a week to answer questions and research information for citizens. He also participates in many of EPA's public involvement activities, including speaking at local community organization's meetings. EPA staff in Seattle also respond to numerous public telephone inquiries.

Community Workgroup: Also in 1989, EPA began a Community Workgroup. Community members were invited to attend by way or a fact sheet that was mailed to residents throughout the Study Area. EPA has since been meeting regularly with the workgroup. EPA often presents ideas to the group for outreach efforts as well as draft language for public information documents (fact sheets, brochures) for feedback and comments. The workgroup provides valuable input to EPA.

Open houses: In January 1991 EPA held three open houses to provide citizens in Ruston and North Tacoma an opportunity to meet representatives of EPA, and to hear the citizens interests and concerns about EPA's efforts to conduct an RI/FS. The open houses were advertised through a notice which was mailed to the Study Area and through newspaper advertisements.

Community interviews: During February, March, and April 1991 EPA interviewed 46 concerned people in the Ruston and North Tacoma communities to learn about community concerns, desired involvement in the project, and suggestions about how to best involve the entire community.

Public Comment Periods: From February 17 through April 17, 1992 EPA held a 60 day public comment period on its RI, Risk Assessment, Feasibility Study and other documents in the Administrative Record. This was the first of two public comment periods to provide residents and officials an opportunity to comment on the cleanup alternatives considered by EPA.

The second comment period, which ran from August 17 through October 17, 1992 focused on EPA's Proposed Plan including the preferred clean-up alternative. Comments received during these two public comment periods are summarized along with EPA's responses in the attached Responsiveness Summary (Appendix A).

Community Workshops/Public Meetings: During the first public comment period, community workshops were held on March 11 and March 31, 1992. Both workshops were well attended (approximately 100 people attended the first workshop and 200 attended the second). The purpose of the workshops was to provide an opportunity for residents to ask questions, provide comments, and learn more about the cleanup alternatives for the site. A transcript was taken of the March 31 meeting, and EPA has prepared a summary of the March 11 workshop. The transcript and summary are available in EPA's Administrative Record for the Study Area (see Table 1).

During the second public comment period EPA held two public meetings. At the meetings, participants learned more about EPA's Proposed Plan and preferred cleanup alternative and had the opportunity to provide public comments. Transcripts were taken of these two meetings (held September 2 and October 1, 1992). The transcripts are available in EPA's Administrative Record for the Study Area (see Table 1).

Small group meetings: Upon request, EPA staff have attended group meetings such as bankers and appraisers associations, Kiwanis, rotary and garden clubs, senior citizens centers, schools, and citizens groups. EPA interacts with these groups in order to educate interested groups about EPA's activities, and to learn about different groups concerns and needs for information about the site. EPA staff continue to meet with small groups as requested.

Elected Officials/Local Government

Periodic Briefings: Briefings have been held for the Town of Ruston, City of Tacoma, Tacoma Environmental Commission, Congressman Norm Dicks and other interested government officials.

Coordinating Forum: In March 1991, EPA established a Coordinating Forum to facilitate discussion and coordination among the various entities involved and/or affected by this project, and to assist in the development and selection of a remedy that would be implementable in the communities. The Forum met monthly from March 1991 through April 1992. The participants included elected officials, key agency decision makers, management, and staff of various organizations including:

- Agency for Toxic Substances and Disease Registry
- Asarco
- City of Tacoma
- Metropolitan Parks District
- Puget Sound Air Pollution Control Authority
- Tacoma-Pierce County Health Department
- Town of Ruston
- Environmental Protection Agency
- Washington Department of Ecology
- Washington Department of Health
- Washington Department of Labor and Industries

In March 1992, the Coordinating Forum published preliminary findings regarding Community Protection Measures (CPMs) associated with each cleanup alternative, and posed issues for consideration in developing a preferred cleanup alternative. EPA continued to work with key representatives of the Forum to develop the CPMs outlined in Section 9.10 of this ROD.

Real Estate Professionals

On June 18, 1992 EPA joined with Ecology, the City of Tacoma, and Town of Ruston to co-sponsor a seminar on property transactions for realtors, appraisers, banking professionals and legal counsel who conduct business in the Study Area. To publicize the event, EPA issued an open invitation to a mailing list of those who had contacted the agency with questions and concerns.

Nearly 100 people attended the seminar. EPA presented information on its preliminary plans for the cleanup, and on the issue of liability, and then opened the floor for discussions among the professionals. EPA prepared a summary of the seminar for public information.

3.2 Education

Information Repositories: EPA has established ten repositories where citizens can review detailed information about Superfund activities in the Tacoma area. Documents subject to public comment can also be found in these locations. The repositories, frequently advertised in fact sheets and in newspaper notices prepared by EPA, are listed in Table 1.

Fact Sheets and Brochures: Fact sheets and brochures have been prepared by EPA for distribution to members of the community to provide current information on the status of site activities. Table 2 includes a list of fact sheets and brochures published about the Study Area. Fact sheets which exclusively discuss the ERA activities have been excluded.

4.0 SCOPE AND ROLE OF OPERABLE UNITS

The EPA has divided the CB N/T site into seven operable units (OU's) in order to facilitate the investigation, analysis, and cleanup of this very large site. Four of these OU's are associated with the Asarco smelter:

- OU 02 Asarco Tacoma Smelter
- OU 04 Asarco Off-Property (Ruston/North Tacoma Study Area)
- OU 06 Asarco Sediments
- OU 07 Asarco Demolition

The remedy described in this ROD addresses OU 04 and primarily involves the cleanup of arsenic and lead contaminated soils in the residential community surrounding the smelter.

4.1 Scope of Current Work

OU 04. Asarco Off-Property (Ruston/North Tacoma Study Area)

EPA believes that current conditions in the Study Area pose unacceptable risks over the long-term to its current and future residents, and that cleanup actions are therefore necessary. EPA's goal is to reduce potential exposures to arsenic and lead by physically removing contaminated soil to the extent practicable. Removal of contaminated soil will also reduce the contaminants that are transported into homes or other buildings.

EPA estimates that 273 acres of land including 525 residential lots will require cleanup due to the presence of lead and/or arsenic contaminated soil, and slag. The remedy selected in this ROD includes sampling of individual properties to determine if soil exceeds the action levels, excavation of contaminated soil and slag, replacement of excavated soil and slag with clean soil and gravel, asphalt capping or soil removal and replacement with gravel of contaminated dirt alleys and parking areas, fencing and planting low lying shrubs in steep areas, and the development and implementation of community protection measures. These actions will address the principal threat posed by conditions at the site which is the ingestion of contaminated soil and dust.

The remedy selected in this ROD applies to those properties or areas located within the Study Area, as well as the three areas located directly to the south of the Study Area where sample results show that soils exceed the action levels. Available data suggests that contamination above background concentrations exists beyond the Study Area. It is possible that some additional properties beyond the Study Area, particularly to the south-southwest, also have soils exceeding the action levels and may require cleanup. EPA will evaluate the need for further sampling and appropriate cleanup activities outside of the Study Area separately from the current action, and at a later date.

4.2 Other Related Activities

OU 02. Asarco Tacoma Smelter, and OU 07. Asarco Demolition

In September 1986, EPA and Asarco signed an Administrative Order on Consent under which Asarco agreed to conduct investigation, analytical, and site stabilization activities at the smelter site under EPA oversight. Site stabilization activities, including removal of some of the most contaminated structures, were conducted by Asarco in 1986 and 1987. The investigation and analysis for the cleanup of soil, surface water, and ground water at the smelter site is anticipated to be completed in the Fall of 1993. Following completion of these activities, EPA will issue for public review and comment a Proposed Plan for the cleanup of the smelter site.

In the meantime, Asarco is completing the demolition of remaining structures under a federal Consent Decree with EPA signed in 1991. Demolition of remaining structures is expected to continue through 1994-95. Also under this Consent Decree, Asarco installed controls on surface water that runs onto the site to minimize the contact of surface water with contaminated soil.

OU 06. Asarco Sediments

EPA is analyzing cleanup options for contaminated marine sediments adjacent to the smelter property. EPA anticipates releasing a Feasibility Study and a Proposed Plan, for public review and comment, in the summer of 1993.

5.0 SITE CHARACTERISTICS

5.1 Sources of Contamination

Asarco smelter operations resulted in the deposition of arsenic, lead, and other contaminants from smelter emissions to the surrounding areas. Soils in the community are currently contaminated as the result of the accumulation of deposited materials over the operating history of the smelter. Areas closest to the smelter have been most affected by various low-level fugitive[1] emissions sources from smelting operations. Areas at greater distances from the smelter have been most affected by tall stack emissions.

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[1] Fugitive emissions are emissions from smelter processes that were not captured by a filter or similar control system.

In addition to the deposition of airborne contaminants released from the smelter, smelter slag has been used at a number of locations in the surrounding community. Slag was produced as a by-product of smelting operations. Typical uses of slag in the community include driveway, walkway, or curbside aggregate, parking area surfacing, and backfill in utility trenches. No inventory of slag use in the community is available.

5.2 Nature and Extent of Contamination

Based upon the results of previous investigations regarding the impacts of smelter operations on the surrounding area, the RI was designed to focus on the area most likely to require cleanup, on soils as the primary environmental medium of concern, and on arsenic as the primary contaminant of concern. The RI was also designed to expand upon the existing information known about arsenic and other contaminants in soils as presented in the FIR (see Section 2.0 for a brief discussion of the FIR) and earlier soils studies.

During the RI, 222 soil samples were collected to provide additional information on the distribution of arsenic and other metals in surface and subsurface soils in the Study Area. Samples were collected at three depths (surface, 6 to 10 inches, and 12 to 16 inches) at selected locations. Samples were collected to fill data gaps, i.e., where little or no previous information existed, to increase confidence in the arsenic distribution defined by previous FIR data, to provide information on the vertical extent of arsenic contamination in soil, and to determine if arsenic was concentrated or dispersed in areas such as gullies, parking lots, and alleys. Samples were collected from residential properties as well as nonresidential areas including unpaved streets, alleys and parking lots, and storm drains and ditches.

All soil samples collected during the RI were analyzed for arsenic. In addition, selected samples were analyzed for antimony, cadmium, copper, lead, mercury, and silver. This subset of metals was selected for evaluation due to their previously identified high correlations, and their presence in smelter feedstocks.[2] Samples were also analyzed for physical parameters related to the possible movement of arsenic in the environment including leachability, soil particle size, and pH.

Table 3 provides a summary of metals concentration data for residential surface and subsurface soil samples. The table includes results for the combined RI and FIR data sets. The soil sampling results demonstrate the presence of metals above background concentrations in area soils. (See sections 4.1 and 4.5 of the RI for additional information on comparisons of sample results to background concentrations.) As a result of an evaluation conducted in the EA, local urban background concentrations for arsenic and lead have been characterized as 20 ppm and 250 ppm respectively (see Section 2.0 for a description of the EA).

Arsenic and lead are the two contaminants of primary concern for human health (see Section 6.1 of this ROD). Therefore, the selection of action levels and the cleanup activities called for in this ROD, are focused on arsenic and lead. Because the other metals identified above are generally found at elevated concentrations at the same locations as arsenic and lead, cleanup measures to reduce exposures to arsenic and lead will be effective in reducing exposures to the other metals.

The RI study data indicates that there is an overall pattern of decreasing contaminant concentrations with increasing distance from the smelter, with a directional component reflecting wind patterns. Soil concentrations, however, vary from one property to another within the Study Area, probably reflecting in large part human activities that have disturbed surface soils. While soil concentrations generally decrease with depth, other patterns of arsenic distribution with depth were also identified. In general, these patterns were observed at locations where information suggested that the soil had been disturbed. While the collection of soil samples for the RI did not extend much

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[2] Smelter feedstocks are the raw copper-bearing material that was fed into the smelter.

below a depth of one-foot, it is possible that contamination may exist deeper than one foot in some areas.

Figures 3 and 4 identify the combined RI and FIR soil sampling locations and concentrations for arsenic and lead respectively. The data for arsenic are plotted on Figure 3 in the form of color-coded symbols corresponding to the following concentration ranges: 0 to 46 ppm; 47 to 230 ppm; 231 to 400 ppm; 401 to 800 ppm; and greater than 800 ppm. These ranges were selected to illustrate the wide range of arsenic concentrations found within the Study Area. Approximately 81 percent of all surface soil samples collected in the Study Area exceed 46 ppm. Approximately 34 percent of all soil samples exceed 230 ppm - the arsenic action level selected in this ROD. Nineteen percent of all soil samples exceed 400 ppm, and 5 percent exceed 800 ppm.

The highest levels of soil arsenic, i.e., above 800 ppm, occur within a small area near the smelter property. Areas that are further away from the smelter generally show lower levels of both soil arsenic and lead contamination. At these lower levels, much larger areas including greater distances from the smelter are included. The area where impacts from the Asarco smelter can no longer be detected in soil (i.e., where arsenic concentrations in soil would be within urban background levels of 20 ppm) is estimated to be well beyond the Study Area (see Section 4.3.1. of the RI for further information on the possible extent of contamination beyond the Study Area). It should be noted, however, that some samples taken from within the Study Area were also below estimated urban background levels for arsenic and lead.

Based upon consideration of all RI and FIR soil data, and the selected action levels for arsenic and lead, EPA estimates that 273 acres of land, including approximately 525 residential lots, may require cleanup action. This includes driveway slag or slag of smaller size used for other purposes, but would not include large pieces of ornamental slag. Estimated portions of the Study Area most likely to require cleanup are shown in Figure 5.

5.3 Contaminant Migration

The results of the RI indicate that samples from unpaved streets and alleys were generally lower in arsenic content than residential surface soil samples taken in the same vicinity. Erosion, new road base material, and vehicular tracking may account for redistribution of arsenic-bearing soil particles and thus the lower arsenic concentrations in the unpaved street samples.

Historical studies through the 1970's and 1980's showed elevated contaminant concentrations in multiple environmental media, including soils, house dusts, indoor and outdoor air, and garden vegetables. Since copper smelting and arsenic processing ceased, ambient air concentrations have been reduced by more than 90 percent. The remaining soil contamination, however, is likely to continue to affect other media by contaminant transport and mobility, e.g., tracking of soil into houses and releases of fugitive particulates to ambient air. The most important transport mechanisms of soil, dust, and slag particles containing arsenic and lead appear to be through resuspension, redeposition, and tracking. Therefore, the selected remedial actions (excavation of contaminated soil and replacement with clean soil) will likely reduce contamination and potential exposures from other site environmental media, e.g., house dust, over the long-term.

Based upon the results of the RI, EPA has concluded that soil arsenic and lead are unlikely to experience substantial leaching or downward movement in Study Area soils due to infiltration of water. In addition, naturally occurring fate and transport processes appear unlikely to significantly reduce soil arsenic or lead concentrations in the near term. Without remediation, or the altering (disturbing) of soil, contaminant concentrations in soil are expected to remain at or near current levels for decades.

5.4 Affected Population

The current and future residents of Ruston and North Tacoma, especially young children, are the populations with potential exposures and health risks. The areas surrounding the Asarco smelter have for some time been largely developed in single family residential land use. A sizable population currently lives in the areas with soil concentrations exceeding background levels. An estimated 4,000 people live within a distance of approximately one mile from the smelter (roughly equivalent to the area with soil arsenic concentrations at or above 100 ppm, but including some lower concentrations).

6.0 SITE RISKS

Operation of the Asarco smelter for a period of more than 90 years resulted in residual contamination of the environment, particularly soils, in the surrounding areas of Ruston and North Tacoma. Potential exposures and health risks for current and future residents resulting from that residual contamination were evaluated in a risk assessment. Children are of special concern because their typical behaviors, like playing outdoors and various hand-to-mouth activities, may result in exposure to soil contamination. Children are also particularly at risk for some effects of exposure to metals, especially lead.

Risk assessment for a Superfund site is a four-step process. The first step, data collection and evaluation, identifies the contaminants at the site. The second step, toxicity assessment, uses the results of years of research and testing of the effects of chemicals on the health of people and animals to decide which of the contaminants found at a site might pose a health threat. The third step, exposure assessment, defines how people might contact the contaminants and how much of the contaminant may enter their body. The final step, risk characterization, brings the information from the first three steps together to determine the potential severity of health threats from the site.

The following sections provide a summary of the human health and ecological risk assessments, as well as EPA's risk management decisions regarding the selection of remedial action objectives and goals.

6.1 Identification of Contaminants of Concern

EPA evaluated metals which were known to be associated with the smelter (antimony, cadmium, arsenic, copper, mercury, lead, selenium, silver, and zinc). Two were determined to be of particular concern for human health: arsenic and lead. EPA determined that the other metals did not individually pose significant risks to the community even at the highest levels detected in Study Area soils.

6.2 Exposure Assessment

Six exposure scenarios were evaluated in the risk assessment: (1) ingestion of soils and house dusts; (2) ingestion of garden vegetables grown in contaminated soils; (3) dermal contact with contaminated soils; (4) inhalation of particles in the air, either outdoors or indoors; (5) ingestion of slag and house dusts derived from slag; and (6) ingestion of soils and house dusts by a child with pica (ingestion of abnormally high amounts of non-food substances, such as soil). The scenario of most concern to EPA is the ingestion of soils and house dusts because it was estimated to result in the highest potential exposures of all of the scenarios evaluated. Several of these scenarios, for example, pica soil ingestion, slag ingestion, and garden vegetable ingestion, would only apply to certain residents.

For arsenic, site-specific data were combined with EPA's standard exposure assumptions (e.g., living at a residence for 30-years) to estimate the amount of arsenic taken into the body on a daily basis (the exposure). Exposures were estimated at five soil arsenic concentrations ranging from

140 ppm to 1,600 ppm. These values represent a range of soil concentrations occurring in the Study Area. Tables 4 and 5 summarize the exposure factors and the arsenic concentrations in each exposure scenario for which exposures and risks were calculated. Tables 6 and 7 summarize the amount of arsenic estimated to be taken into the body for the different exposure scenarios (media-specific intake rates). The site-specific data used in the exposure assessment included:

- air monitoring data for arsenic at sites near the Asarco property boundary;
- soil data from the 1988 FIR;
- soil data from the RI;
- slag data, including sampling of driveway slag and house dusts at three sites remote from the smelter; and
- garden vegetable tissue concentrations from local studies to evaluate contaminant uptake in relation to garden soil concentrations.

Typical background exposures to arsenic from normal diet, drinking water, and air sources were compared to estimated exposures from contaminated community soils. Estimated exposures from the more highly contaminated soils were several times greater than typical background exposures.

For lead, possible childhood lead exposures were calculated using the "LEAD4" model developed by EPA. This model considers multiple potential pathways for childhood lead exposures and predicts a distribution of blood lead levels for discrete age intervals. The exposure assumptions used in the model are summarized in Table 8. Table 9 summarizes the amount of lead estimated to be taken into the body (intake rate) at different soil lead concentrations ranging from 20 ppm to 2,700 ppm. These values represent a range of soil concentrations occurring in the Study Area.

6.3 Toxicity Assessment

In the risk assessment, EPA evaluated the potential human health effects from exposure to arsenic and lead. These effects are discussed below.

Arsenic

Both cancer and noncancer outcomes are associated with exposure to arsenic. Studies have demonstrated that ingestion of arsenic is associated with an increased risk of skin cancer, and inhalation of arsenic is associated with an increased risk of lung cancer. Estimated risks for these types of cancer have been calculated by EPA. There is also evidence that ingestion of arsenic can result in cancers of other organs (e.g., liver, lung, bladder, and kidney). These additional cancer risks, however, were not calculated in the risk assessment because EPA has not adopted the necessary information to estimate risks for these cancers.

Noncancer risks from the ingestion of arsenic include skin hyperpigmentation and skin keratoses. At higher exposure levels, other possible noncancer effects include vascular, neurological, and gastrointestinal disorders. Death from exposure to high environmental levels of arsenic (well above those occurring at this site) has been documented.

Lead

Exposure to lead at elevated concentrations can affect many systems of the body. At lower environmental concentrations, the primary concern is for learning and behavioral effects in young children. The best indicator of lead exposure is lead levels in the blood. Recent studies show that IQ and attention span effects can be correlated with slight increases in blood lead levels. Based on these recent studies, acceptable childhood blood lead levels have been reduced to 10 micrograms of lead per deciliter of blood (ug/dl). That blood lead level is used in the risk assessment as a value against which to assess risks from lead exposures.

6.4 Epidemiological Studies

Several health (epidemiological) studies on community residents living near the smelter have been performed. These include studies to determine if lung cancer deaths or adverse effects on the fetus (e.g., lower birth weight or birth defects) occurred at higher than normal levels in the community due to smelter contaminants. These studies have not found statistically significant increases in adverse health effects associated with arsenic exposures. This lack of observed health effects, however, does not contradict EPA's risk assessment since the relatively low levels of risk of concern to EPA would be difficult to observe or measure in community health studies. Further, no epidemiological studies have been performed in the Study Area for the effects identified in the risk assessment as being of greatest concern for ingested arsenic exposure - skin cancer and other skin effects.

While not statistically significant, one lung cancer study of community residents did suggest a possible arsenic relationship for lung cancers. The level of arsenic in the air in the community at the time of exposure, however, was much higher than current levels, and therefore does not directly contribute to understanding current risk estimates.

Urinary arsenic monitoring in the Ruston and North Tacoma area has been done periodically since the early 1970's. The most recent scientifically designed survey conducted by the TPCHD in 1988 showed some significantly elevated values, although the average levels appear to have dropped since closure of the smelter.

There are also no recent blood lead measurements in children from Ruston and North Tacoma. The only available blood lead data, from the 1970's, reflects much higher automobile emissions of lead from gasoline and generally higher urban air lead levels, and are not relevant to current conditions.

6.5 Risk Characterization

<u>Arsenic/Cancer Risk</u>

Information on the toxicity of arsenic and the calculated exposures in the Study Area was combined to estimate the skin and lung cancer risks for individuals living in the Study Area (see Table 10). Estimated risks will vary depending on the arsenic concentrations in individual yards. On Tab 10, risks at 800 ppm soil arsenic concentration are used as an example to show the reasonable maximum exposure - the highest exposure reasonably expected to occur. Only 5 percent of the Study Area is expected to have soil concentrations exceeding 800 ppm. Risks will be less for those areas with lower soil arsenic concentrations.

Cancer risks for the air inhalation pathway represent risks of lung cancer. The cancer risks for all other pathways represent skin cancer. The estimated air inhalation lung cancer risks are based on monitoring data collected near the smelter property boundary. Lung cancer risks are expected to decrease with increasing distance from the smelter. The highest risks for skin cancer result from the ingestion of soil/house dust and slag/house dust. The skin cancer risks from the dermal absorption and garden vegetable pathways are small in comparison. Pica behavior, as modeled in the risk assessment, would result in approximately a doubling of skin cancer risk compared to the non-pica individual.

<u>Arsenic/Noncancer Risk</u>

For noncancer effects, EPA develops a "Hazard Quotient" to estimate the potential risks from ingestion and dermal absorption of arsenic in Study Area soils (see Table 11). As the Hazard Quotient rises above a value of "1", the potential for noncancer effects increases.

The dermal absorption and garden vegetable exposure pathways have hazard quotients below 1.0, indicating no significant risks of noncancer outcomes (adverse skin effects). Potential soil and house dust exposures, as well as the case-specific exposures to slag and for a pica child, have hazard quotients above 1.0 (ranging from 2.2 to 16.0) indicating the potential for adverse skin effects in the exposed population.

Lead

The "LEAD4" model was used to estimate the potential for a child to exceed a 10 ug/dl blood lead level at various soil lead concentrations within the Study Area. Soil lead data is available from 41 locations within the Study Area (see Figure 4). The potential for a child to exceed a 10 ug/dl blood lead level, based on the soil lead data, varied from 1 percent to 98 percent.

6.6 Uncertainty in the Risk Assessment

The risk assessment document includes a discussion of the uncertainties in the estimation of exposures and risks. Since these risks are generally derived in a conservative manner, they have a low likelihood of being underestimates. The actual risks could be lower than the estimates shown for those effects considered in the risk assessment. However, as noted above in Section 6.3, other types of cancer (liver, lung, bladder and kidney), for which no risk estimates have been derived, have been associated with ingestion of arsenic. Possible risks for these additional adverse effects may therefore be in addition to those estimated in the risk assessment.

6.7 Potential Health Risks Exceed Acceptable Levels

As a general policy, EPA uses the results of the baseline risk assessment to determine if remedial action is warranted at a Superfund site. According to the National Contingency Plan (NCP) and EPA guidance, action under Superfund is generally warranted for cancer effects when the baseline risk assessment indicates that an individual's excess lifetime cancer risk, using reasonable maximum exposure assumptions exceeds 10^{-4}.[3] For noncancer effects, potential health risks increase as the Hazard Quotient rises above "1". For lead, EPA has determined that unacceptable risks occur when an individual has greater than a 5 percent chance of exceeding a blood lead level of 10 ug/dl.

For both arsenic and lead, the estimated exposures and risks in the Study Area exceed those levels that generally require remedial action at a Superfund site as defined by EPA in the NCP and program guidance. Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

6.8 Remedial Action Objectives and Goals

The remedial action objectives and goals identified by EPA and included in Table 12 are based upon the results of the risk assessment, and a number of other risk management considerations including the scope, costs, and impact on the community of remedial actions, as well as community acceptance of the remedy. Further information on how EPA considered these factors in the selection of the action levels for the site can be found in EPA's January 1992 *Ruston/North Tacoma Site Preliminary Remedial Action Objectives Decision Memorandum.*

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[3] EPA's acceptable risk range is defined in section 300.430(e)(2)(i) of the NCP as 10^{-4} to 10^{-6}. EPA guidance provides that "10^{-4}" can include estimated risks slightly above 1×10^{-4} if justified based on site-specific information (Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions, OSWER Directive 9355.0-30, April 22, 1991).

The remediation goals or action levels identified by EPA are 230 ppm for arsenic and 500 ppm for lead. Properties or areas that exceed these action levels will require cleanup. The arsenic action level of 230 ppm is based on reducing the additional potential skin cancer risk to no more than 5 in 10,000, within EPA's acceptable risk range for cancer causing chemicals.[4] The 500 ppm action level for lead is based upon a national goal of reducing levels in children's blood to no greater than 10 ug/dl, as well as EPA guidance that recommends establishing soil lead cleanup levels of 500 to 1,000 ppm.

In addition to being protective of human health and the environment, any final site remedy must also comply with applicable or relevant and appropriate requirements (ARARs). The Washington State MTCA cleanup standards are applicable requirements for the Ruston/North Tacoma site.

EPA has coordinated with Ecology in evaluating the MTCA requirements. Under MTCA Method A, the soil cleanup levels for residential areas are 20 ppm for arsenic and 250 ppm for lead. MTCA requires that some form of action be taken to address contamination above these levels. In evaluating the available remedial actions to address contamination at this site, Ecology has considered the nature and extent of site contamination, the nature of human health risks, the exposure pathways, and the potential impacts and costs associated with physical remediation activities in the community. Ecology concluded that the EPA action level of 230 ppm for soil arsenic represents a best balancing of factors for a level at which engineering actions (e.g., soil removal) for remediation should begin at this site. For lead, Ecology can elect to use the conservative Method A cleanup level of 250 ppm, or it can use site-specific information and the latest version of EPA's biokinetic model to establish a cleanup level (see WAC 173-340-702(6)). Ecology has determined that the results of applying the "LEAD4" model support setting the soil lead cleanup level under MTCA at 500 ppm for this site.

CPMs (discussed further in Sections 7.0 and 9.10) will be used to address the residual risk presented by soils which have arsenic concentrations between the MTCA cleanup level of 20 ppm and the EPA action level of 230 ppm.

6.9 Environmental Risks

The approach used in the ecological risk evaluation (Technical Memorandum: Ecological Risk Evaluation, EPA, July 1992) was to compare site-specific soil concentrations with data from scientific literature. The few available site-specific ecological studies were considered, but differences in site conditions during and after smelter operations limited the application of those results.

The primary contaminants of concern for potential ecological effects in the Study Area were identified as arsenic, copper, and lead. Soil, plants, invertebrates (earthworms and insects), small mammals, birds, and pets (e.g., dogs and cats) were considered in the evaluation.

Current soil contaminant concentrations in the Study Area appear likely to cause adverse effects on some plants and soil invertebrates. Small mammals and birds feeding on soil invertebrates could also have elevated tissue levels of the contaminants of concern. Based on a simplified exposure and risk assessment, small mammals in the most contaminated parts of the site could experience adverse health effects. Larger mammals, including pets such as dogs, are not anticipated to be at substantial risk from potential exposures to soil contaminants. Uncertainties in the extent, severity, duration, and significance of possible adverse ecological effects at this site are relatively high because of the lack of site-specific studies.

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[4] EPA's "Ruston/North Tacoma Site Preliminary Remedial Action Objectives Decision Memorandum" documented why an action level corresponding to a 5×10^{-4} level was warranted based on site-specific considerations.

Copper is typically a contaminant of concern in ecological risk studies. The human health risk assessment, however, identified only arsenic and lead as the contaminants of primary concern. Action levels for arsenic and lead have been identified by EPA (see Section 6.8). Although there is no risk-based action level for copper, copper has been shown to be highly correlated with arsenic and other smelter-related metals in Study Area soils, reflecting the significance of smelter emissions as a source of these metals. As a result, remediation for arsenic and lead would also address most areas of elevated copper concentrations.

It is possible that there could be some ecological effects associated with remaining soil contamination after the cleanup. Such effects, if any, are likely to be relatively subtle and limited in magnitude. Other factors related to typical urban activities and land use changes could also effect plants and animals in the Study Area. Any ecological effects from residual contamination below the action levels may be difficult to distinguish from the effects of these other factors.

EPA has considered the information in the ecological risk evaluation in selecting action levels for site soils. It appears likely that the selected action levels for human health would also reduce potential ecological effects to levels that are, at worst, relatively hard to detect and of little consequence given the existing effects of urban land uses throughout the Study Area. Therefore, the selected action levels were determined to be adequately protective of ecological risks at the site.

7.0 DESCRIPTION OF ALTERNATIVES

In the FS, EPA developed and considered six alternatives for cleanup of soils contaminated as a result of emissions from the Asarco smelter. The FS alternatives included varying degrees of cleanup activities that would apply to residential lawns, garden areas, commercial properties, open park lands, empty lots, unpaved streets and alleys, and other exposed soil surfaces or areas where arsenic and/or lead concentrations exceed EPA's cleanup goals.

EPA's Preferred Alternative, described and issued with the Proposed Plan, combined elements from several of the six FS alternatives. EPA considered several general principles and guidelines (see section 7.8) when deciding upon the Preferred Alternative. The Preferred Alternative was presented as the best balance of benefits and tradeoffs for the Ruston/North Tacoma community for consideration during public comment. The Preferred Alternative has since been further modified by public comment.

Except for the "No Action" alternative, the cleanup alternatives were designed to reduce exposure to contaminated soil and dust, as well as to reduce the potential transport of soil contaminants inside homes and other buildings. While EPA believes that the cleanup action must reduce the likelihood of exposure to contaminated soil, it is also important that residents enjoy the fullest use of their properties.

While not discussed in the soil cleanup alternatives listed below, cleanup activities would also include the remediation of slag from driveways, and from other areas within the Study Area where slag use could lead to potential human exposures. In areas where slag is removed, it would be replaced with gravel.

During the technology screening process conducted as part of the FS, EPA considered a range of treatment options and conducted a soil washing treatability study. The results of the screening process and the treatability study indicated that treatment is neither practical nor effective in reducing contamination levels. Treatment alternatives, therefore, were dropped from further consideration.

In addition, each alternative with the exception of "No Action" includes provisions for implementing community protection measures within the Study Area. Community protection measures (described below) were deemed necessary for any alternative under which contaminated soil would be left in place. This includes areas where arsenic remains in soil in concentrations above the action level, (e.g., below a soil cap or paved road), as well as areas where arsenic and lead exceed concentrations normally found in urban areas, but are below the action levels.

The following section describes the six FS alternatives, the common components of the alternatives, the general principles and guidelines that guided EPA in composing the Preferred Alternative, as well as a description of the Preferred Alternative. Tables 13 and 14 provide a comparative summary of the alternatives.

7.1 Alternative 1 - No Action

The No Action alternative is required by law to be evaluated and provides a baseline for comparison against other alternatives. Under this alternative, there are no physical remediation activities or community protection measures. Because no remedial activities would be implemented, there would be no reduction in the current potential risks from exposure to residential soils and dust, i.e., risks would be essentially the same as those identified in the baseline risk assessment.

Total Estimated Present Worth Cost	None
Estimated Time to Complete	Not Applicable

7.2 Common Components of the Alternatives

Except for the No Action alternative, all of the remaining alternatives have some components in common. These components are described below and are not repeated in the discussions of each alternative.

a. Common Components of Alternatives 3 through 6 and the Preferred Alternative

Extent of Remediation

Soil removal or containment activities at properties or areas that exceed EPA's action levels generally would address sod areas (residential and commercial), landscaped areas, garden areas, unpaved driveways, and roadway shoulders. A "marker," e.g., a porous geotextile or geocomposite material, would be placed at the base of the excavation to demarcate for future intrusions the maximum depth of the excavation. Excavated soil would be replaced with "clean" soil, i.e., soil with concentrations of arsenic less than 20 ppm and lead less than 250 ppm. Even lower values for the replacement soils, especially for lead, are likely achievable, e.g., lead less than 100 ppm. Soil would not be removed from beneath sidewalks, driveways, streets, or other paved areas.

Dirt alleys and parking areas where soils exceed the action levels would be paved with asphalt to provide an impermeable barrier to contamination. The total area to be covered with asphalt was estimated, with the use of aerial photographs and site visits, to be about 5 percent of the total site Study Area (approximately 14 acres). This area is based upon the assumption that all dirt alleys and unpaved areas contain soil lead and arsenic at concentrations above action levels and therefore require remediation.

Steeply sloped areas (see Figure 6) which could not be capped with asphalt, graveled, or sodded would be fenced and planted with low-lying shrubs. A geotextile fabric would be used to aid in the growth and development of natural vegetation, as well as in the reduction of erosion.

Vegetation Removal and Replacement

The lawn areas of remediated yards would be revegetated with sod and maintained to ensure that the grass cover is well established. To the extent possible, yard landscaping would be returned to its original condition. Sod and any fertilizer would be applied by a landscape contractor using -

conventional construction equipment. Shrubs and other types of groundcover would be planted by hand (see Section 9.10 (c) below for information on cap maintenance procedures).

Reasonable attempts, which do not hinder the progress of the remediation and are not excessively costly, would be made to accommodate owners who wish to retain original landscaping. The actual vegetation removal and replacement plan would be determined on a property-by-property basis in conjunction with the property owners.

Safety Measures During Remediation

During implementation of the cleanup, safety measures would include, at a minimum, the use of health and safety monitoring equipment and personal protection gear, the use of dust suppression techniques during excavation activities, lining and covering truck beds when transporting contaminated materials, removing soils from truck wheels before trucks travel on public roads, the establishment of local truck routes to minimize disruption to the community, provisions for road maintenance and repair if improper measures (e.g., excess loads) result in damage to roads, and covering of any stockpiled materials.

Disposal

Under current state law (Dangerous Waste Regulations), removed soil with arsenic concentrations greater than 100 ppm is considered a dangerous waste and requires disposal at a hazardous waste facility. There are no such facilities available in the state of Washington at this time. The Department of Ecology is currently evaluating a petition by Asarco to exempt residential soils from the disposal criteria in the Dangerous Waste Regulations. If approved, additional disposal options could become available in the future. EPA, therefore, considered several possible disposal options in the FS including an out-of-state non-hazardous waste facility operated by Finley Buttes Landfill Company in Arlington, Oregon, an out-of-state Class I hazardous waste facility in Arlington, Oregon owned by Chemical Waste Management, Inc., and disposal on the Asarco smelter property.[5]

The facilities described above were examined as part of the cost estimating process to provide a range of potential disposal fees. For those alternatives where a range of costs is shown, the lower costs reflect disposal of contaminated soil at a nonhazardous waste facility, and the higher costs indicate disposal at a hazardous waste facility. All of the alternatives, except for 4a, assume final disposal of contaminated soil at a facility outside of the residential Study Area. Alternative 4a includes disposal on the Asarco smelter property.

Shrubs and other yard waste removed during the remedial action are not expected to be of significant concern due to low arsenic and lead levels. The inclusion of contaminated soils with vegetation during the digging and clearing for remedial actions may be of greater concern than actual plant tissue uptake of arsenic and lead. This waste could be disposed in a municipal solid waste facility within the State of Washington, or routed to the Tacoma urban composting facility, if determined to have minimal concentrations of contaminants.

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[5] A determination to dispose of Study Area soils on the smelter property cannot be made in this ROD. An evaluation of the viability of disposing of Study Area soils on the smelter property is being conducted as part of the smelter cleanup process. EPA will seek further public review and comment on this issue when the Proposed Plan for cleanup of the smelter property is issued.

b. Common Component of Alternatives 2 through 6 and the Preferred Alternative

Community Protection Measures

Community protection measures, commonly referred to as institutional controls, are non-engineering measures used to prevent or limit public exposure to soil contamination. These measures could be used as the sole component of remediation (to prevent or minimize exposure to contaminated soil), or in conjunction with an engineering action (to ensure that the technology is implemented and remains effective). Alternative 2 relies upon community protection measures as the sole remediation component. Varying degrees of community protection measures would be necessary for alternatives 3 through 6 and the Preferred Alternative to the extent that contaminated soil is not removed from individual properties. The objectives for community protection measures for the Ruston/North Tacoma site were defined as follows:

- To control activities that intentionally disturb contaminated soils by providing guidelines or permit requirements for conducting those activities with the minimum amount of contact with or movement of contaminated soil.

- To ensure the long-term integrity of caps (soil, sod, and asphalt) used in the alternatives by providing for maintenance, repair, and inspection of any capped areas.

- To establish a post-cleanup storage/disposal program for contaminated soil.

- To provide a means for notifying potential future property owners if contaminated soil remains at a property, and inform them of the above guidelines and responsibilities.

- To educate the community over the long-term on the above guidelines and responsibilities.

The possible community protection measures, which could be used to meet the objectives identified above, were described and evaluated in the FS and are listed below:

- Development of Policy and Planning Documents
- Land Use and Development Regulations
- Special Legislation
- Real Property Restrictions
- Contractual Agreements with Individuals
- Contractual Agreements with Potentially Responsible Parties (PRPs)
- Public Education and Public Involvement

The effective implementation of community protection measures relies upon the cooperation and involvement of the community and the local officials. Accordingly, the specific community protection measures included in the selected remedy (see Section 9.10) were identified following significant input from the Ruston/North Tacoma Coordinating Forum, the Ruston/North Tacoma Community Workgroup, and public comments given or submitted during two public comment periods associated with the RI/FS and the Proposed Plan.

7.3 Alternative 2 - Limited Action

The [illegible]ed action alternative would rely solely upon the community protection measures described in [illegible]ction 7.2b to reduce exposure to contaminants and to achieve the remedial action objectives. [illegible]ch measures would include controlling soil disturbances, establishing a soil disposal program, notifying future property owners if contamination exists, and implementing public education programs to inform residents on how they can reduce their exposure to contaminated soil.

Total Estimated Present Worth Cost	$3 million
Estimated Time to Complete	Ongoing and Indefinite

7.4 Alternative 3 - Containment of Contaminated Soil

The containment alternative focuses on containing contaminated soil by covering lawns, parks, and other areas of exposed soil with sod, by covering dirt alleys and parking areas with asphalt, and by implementing the community protection measures program identified in Alternative 2.

The implementation of this alternative would involve tilling of existing soil and grass with a rototiller to a depth of about 6 inches. This tilled material would form the subsoil or base for the new sod. Most trees and shrubs would remain undisturbed; only very small vegetation would be removed during the remedial action. In some cases, where existing soil was deemed inadequate to support new sod, additional sandy loam would be applied to form a 2 inch lift. The application of this additional soil would therefore require the removal of an equivalent volume of original soil to maintain original grade. This excavated material would constitute a remedial action by-product which would require disposal.

The subsoil would be prepared (raked and rolled) and covered with a new, clean, 1 inch sod layer. The placement of 1 inch of clean sod may enhance the risk reduction aspect of this alternative over merely applying seed to existing soil. The application of sod would result in a negligible positive change in the grade of each lot. Each home lot (approximate size <1/4 acre) would require at least one day for sod replacement. Based upon a site remediation rate of four average homes-per-day, and a schedule of 20 work days per month, this alternative would require less than 1 year to complete.

Capping and sodding would produce over 26,000 cubic yards of soils which would require disposal. Soil removed during the remedial action would be disposed in a permitted land disposal facility as discussed in section 7.2a. Removed soil would be loaded into dump trucks and transferred into larger dump trailers for transport to Arlington, Oregon. The transfer of materials would be required because many streets throughout the Study Area cannot be easily accessed by the larger vehicles.

Total Estimated Present Worth Cost	$24 to 27 million
Estimated Time to Complete	1 Year

7.5 Alternative 4a and 4b - Excavate 1 Foot of Soil/Backfill/Temporary Storage at Asarco Smelter Facility/Permanent Disposal

This alternative relies primarily on excavation and removal of 1 foot of contaminated soil as a means to comply with the remedial action objectives. The excavated soil would be temporarily stored at the Asarco smelter facility until a decision is made on the location for final disposal. Soil would either be disposed a) on the smelter property, or b) transferred off-site to a permitted disposal facility. Excavated soil would be replaced with clean/uncontaminated soil, regraded to near original grade, revegetated with shrubs, and covered with a layer of sod. If contaminated soil remains at depth following excavation, the clean soil would act as a cap or barrier to the contamination. Community protection measures would include measures to ensure the continued integrity of that cap.

Contaminated soil would be removed from large open areas of the site using graders and front-end loaders. More confined areas would require the use of backhoes and small loaders. For very restricted spaces (as the case may be at many residential lots) hand tools may be required. Excavation would not proceed below the foundation of existing buildings. Implementation of this alternative would begin with mobilization and establishment of truck loading areas, clearing and grubbing, establishment of work areas for contractor offices, and decontamination facilities.

Implementation of this alternative would result in over 187,000 cubic yards of contaminated soil which would require disposal. Approximately 7 years would be required to complete the soil excavation, removal, and replacement at the site. This estimate was based upon a 10-month work year with 20 work days per month. The average remediation rate would be about eight homes per month at 140 cubic yards/day, using seven 35 cubic yard dump trailers per day (actual load capacity 20 cubic yards).

Contaminated soil would be transported to the Asarco facility for storage in a secure area of the site where access could be controlled. Soil would be stored at the Asarco facility until a determination is made regarding the viability of containing the soil on-site. Asarco is evaluating on-site disposal as part of the smelter facility RI/FS for waste associated with smelter demolition and smelter site cleanup. A final determination regarding on-site disposal will not be made until the ROD for the smelter property cleanup is signed. This decision is expected within the next year. Therefore, it is possible that under this alternative soil may be stored on-site for a lengthy period of time.

There are several possibilities for the temporary storage of contaminated soil from the residential area on the smelter site. The total Asarco site covers approximately 67 acres. About 40 acres are covered by structures which will be demolished in accordance with the December 1990 Demolition Record of Decision. In addition, some storage capacity exists in the fine ore bins building, which currently contains soil removed during the ERAs.

As part of the smelter facility RI/FS, and in order to fully evaluate the possibility of disposal at the Asarco facility, Asarco has prepared a containment facility siting report. This report identified potential locations within the Asarco smelter property that could be modified for use as a permanent disposal facility for excavated soil and debris. On-site containment has been evaluated primarily for the disposal of debris from stack demolition and other demolition and cleanup activities on the smelter site.

EPA and Asarco have discussed possible disposal options for excavated residential soils including disposal on the smelter site. Modifications to the preliminary designs for on-site disposal could result in additional capacity to accommodate residential soil. EPA and Asarco agree that determining the viability of this option depends to a large extent on a more specific estimate of soil and demolition debris to be removed, and upon the hazardous waste classification of the materials (residential soil and smelter site soil and debris) to be disposed. Because this classification and final volume estimates have not yet been established, it is difficult to obtain accurate detailed cost estimates for on-site disposal at this time. In addition, because the option of disposing of residential soil on-site is presently in a conceptual stage, and specific design criteria have not been established, it is difficult to make accurate predictions regarding the configuration of a disposal facility and its capacity.

4a Temporary Storage and Permanent Disposal at Asarco Smelter Facility

Total Estimated Present Worth Cost	$43 to $56 million
Estimated Time to Complete	7 Years

4b Temporary Storage at Asarco Smelter Facility Followed by Permanent Disposal at Appropriate Off-site Facility

Total Estimated Present Worth Cost	$67 to $87 million
Estimated Time to Complete	7 Years

7.6 Alternative 5 - Excavate 1 Foot of Soil/Backfill/Disposal

This alternative is identical to Alternative 4 except that excavated soil would be shipped directly off-site for disposal at a permitted landfill. The disposal options evaluated for this alternative are identical to those discussed in Alternative 3.

Significant differences between this alternative and Alternative 4 include a potential substantial increase in soil transportation distances and the elimination of an indefinite period of temporary soil storage. This alternative would incorporate the same elements of soil removal, transportation, backfilling and revegetation as described for Alternative 4.

Total Estimated Present Worth Cost	$61 to 82 million
Estimated Time to Complete	7 Years

7.7 Alternative 6 - Excavate to Depth at Which Background Contaminant Levels Are Achieved/Backfill/Disposal

This alternative is identical to Alternatives 4 and 5 except for the following - at properties or areas that exceed the action levels, excavation would proceed to a depth until background concentrations of arsenic and lead (20 ppm arsenic and 250 ppm lead) are achieved. Current data indicate that soil lead and arsenic concentrations are highly variable with depth throughout the Study Area. In addition, RI soil samples were not collected from depths greater than 16 inches, and therefore, it is not possible to accurately predict the distribution of contaminants below this depth. Additional field sampling during the remedial design phase would be necessary on a site-by-site basis to accurately define the depth of contamination prior to excavation.

Despite these limitations, estimates of the required depth of excavation were made to provide a basis for the development of this alternative. Depth profile data were not available for lead; however, the statistically significant linear correlation between lead and arsenic in surface soils provides a measure of assurance that similar trends for arsenic and lead over depth may be evident and, therefore, the arsenic profile data alone are adequate for conceptual estimates.

The conceptual excavation, design, and thus the cost estimate for this alternative, were based upon certain assumptions made in the FS regarding likely contamination levels at depth (see the FS Section 3.1.6 for further information). These assumptions represent the interpretation and application of a relatively limited set of subsurface soil data. Therefore, the assumptions and the estimates derived from the data would change and undergo refinement during the remedial design stage if Alternative 6 was selected.

The total volume of material which may require excavation and removal under this alternative is 341,000 cubic yards. Significant differences between this Alternative and Alternatives 4 and 5 include a substantial increase in the volume of soil, and the possibility of damage to some structures due to deep excavation, and the possibility that some residents may need to be relocated temporarily during excavation operations.

Relocation periods are expected to be very short, possibly no more than a few days for each resident affected and not all residents would be affected. Relocation may be necessary to ensure the safety of residents should construction activities become so extensive that the foundations of buildings are damaged or utilities services are interrupted. Other factors which may affect decisions for relocation include noise levels during remediation and limitations on access to residences. This alternative would incorporate the same elements of soil removal, transportation, and backfilling and revegetation as described for Alternatives 4 and 5.

CPMs for individual properties would generally not be required once remediation was complete since no contamination above background concentrations would remain. However, community protection measures would be required for any areas where excavation has not occurred (e.g., under roads and sidewalks and within steeply sloped areas), and where practices such as utility repair and maintenance would be conducted in unremediated areas.

Because the total volume of material to be excavated and the rate of excavation will not be determined until the design phase, it is not possible to precisely calculate the time to complete this alternative. However, based upon a 10 month work year with twenty work days per month the average remediation rate would be about four homes per month at 140 cubic yards/day using seven 35 cubic yard dump trailers per day (actual load capacity 20 cubic yards). Thus, approximately 12 years would be required to complete the soil excavation, removal and replacement at the site.

Total Estimated Present Worth Cost	$85 to 119 million
Estimated Time to Complete	12 Years

7.8 General Principles and Guidelines

The nine criteria described in Section 8.0 of this ROD are the framework that EPA used to evaluate benefits and tradeoffs among the range of FS alternatives in order to define the Preferred Alternative (described below) and to select the final remedy described in Section 9.0. Some of the balancing and modifying criteria are emphasized more than others depending on the specific conditions or problems at an individual site. Based on comments received from Study Area residents during the first public comment period, the following principles and guidelines represent features that are important to the community if a significant cleanup action is to be implemented:

(1) **Remove contaminated soil** from properties or areas which exceed EPA's action levels of 230 ppm arsenic and 500 ppm lead.

(2) **Minimize the need for long-term legal or administrative measures on individual properties** (e.g., cap maintenance requirements).

(3) **Reduce uncertainties for homeowners** by (a) sampling individual properties and (b) planning for homeowner involvement in the cleanup process.

(4) **Reduce the cleanup time frame** to the shortest duration possible.

(5) **Minimize disruption to the community during cleanup.** Schedule cleanup activities to fit within daily community routines to the extent possible. Use safety measures during cleanup to protect residents and workers.

7.9 The Preferred Alternative

The Preferred Alternative combined several elements of the alternatives described and evaluated in the FS. Below is a description of the Preferred Alternative, followed by a discussion of how it compares to the alternatives presented in the FS as discussed above.

Description of the Preferred Alternative

The Preferred Alternative calls for excavation of soils from properties or areas that exceed EPA's action levels for arsenic and lead. Excavated areas would be filled with clean soil and re-landscaped. In order to determine the specific areas requiring cleanup, each property within the area most likely to exceed action levels (see Figure 5) would be sampled. Other locations within the Study Area would be sampled as needed or as requested by the property owner. The majority of properties requiring cleanup can be cleaned completely (i.e., soil above the action levels will not remain), therefore eliminating the need for long-term controls on many private properties.

Soil which exceeds action levels below 18 inches would not be excavated. In cases where sampling shows that soil above action levels exists below 18 inches, 18 inches of contaminated soil would be removed and replaced with clean soil, and a maintenance and monitoring program for the capped area would be established. The purpose of this program would be to ensure that clean soil remains in place to cover any remaining areas where soil concentrations exceed action levels. It would also ensure that if contaminated soil is excavated in the future for development or other reasons, proper safety procedures are followed. In addition, a post-cleanup soil collection and disposal program would be established to provide a place for disposal of any remaining soil contaminated above action levels that may be excavated from beneath a clean soil cap for development or other purposes.

Excavated soil would be disposed at an appropriate facility outside of the residential Study Area. An interim staging area or transfer station, however, may be needed in the community or on the smelter site during cleanup activities.

Other elements of the Preferred Alternative include: asphalt capping of contaminated alleys and right-of-ways; development of educational materials for Study Area residents; and removal of slag driveways.

Total Estimated Present Worth Cost	$60 to 80 million
Estimated Time to Complete	7 Years

Comparison of Preferred Alternative to FS Alternatives

The element of Alternative 6 that was retained in the Preferred Alternative was the emphasis on removal of contaminated soil so that the need for long-term legal or administrative measures on individual properties after the cleanup -- including requirements for maintaining a soil cap -- can be significantly reduced throughout the Study Area. Alternative 6 provided that if all soil at depth above levels commonly found in urban areas (20 ppm arsenic) was removed, long-term measures on individual properties would not be required.

If an exemption to the State Dangerous Waste Regulations is granted (see section 7.2 a. above), long-term measures on individual properties will not be necessary if soil at a property or area above EPA's action levels (e.g., 230 ppm arsenic) is removed. Therefore, since the Preferred Alternative involves removal of soil above action levels, it provides the same benefit of Alternative 6 in terms of significantly reducing the need for long-term measures on individual properties after the cleanup, but the Preferred Alternative will not require nearly as much soil removal as Alternative 6.

Further, because the Preferred Alternative includes sampling of individual properties before a cleanup is conducted, it allows for flexibility in determining the depth to which contaminated soil would be removed. Contaminated soil would be removed only to the depth necessary as indicated by sampling. For example, if sampling shows that soil contamination above action levels exists to 6 inches below the surface, it would only be necessary to remove soil to a depth of 6 inches. Based on existing soil samples, EPA believes that the majority of properties would require excavation only within 6 inches of the surface.

The Preferred Alternative is similar to Alternatives 4 and 5 in that it includes a practicable limit on the depth of excavation at individual properties. Alternatives 4 and 5 required excavation to a depth of 1 foot at each property (Alternative 6 had no limits on the depth of excavation). The Preferred Alternative would limit excavation to a maximum depth of approximately 18 inches.

8.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

The alternatives outlined in Section 7.0 were evaluated using each of the nine evaluation criteria as required by the National Contingency Plan, and described in Table 15. The purpose of this evaluation was to identify the advantages, disadvantages, and relative tradeoffs among the alternatives. While all nine criteria are important, they are weighted differently in the decision-making process. Threshold criteria are used to determine whether an alternative meets a required level of performance. Primary balancing criteria are used to evaluate technical, economic, and practical realities, and modifying criteria require consideration of state and community concerns.

The following is a discussion of the evaluation of the nine criteria for each of the remedial alternatives. The No Action alternative does not meet the two threshold criteria and therefore is not addressed further in this section.

<u>Threshold Criteria</u>

8.1 Overall Protection of Human Health and the Environment

The key factor in evaluating the overall protection provided by each of the alternatives, including the Preferred Alternative, is the extent to which an individual's exposure to contaminated soil is reduced or eliminated. A general summary of EPA's range of cleanup alternatives demonstrates the varying approaches to achieving protectiveness including:

- using administrative/legal measures to prevent or minimize individual contact with contaminated soil, and to reduce risk where contact does occur (Alternative 2);
- specifying placement of a sod cover over contaminated soil to act as a barrier between an individual and the soil (Alternative 3);
- requiring removal of one foot of contaminated soil with a soil cap to isolate contaminated soil (Alternatives 4 and 5);
- requiring removal of soil from properties or areas above action levels to a maximum depth of 18 inches (the Preferred Alternative); and,
- requiring removal of soil from properties or areas above action levels to a depth at which background levels are achieved, except under structures or roadways (Alternative 6).

Each of these alternatives provides protection by either reducing exposure to contaminants or removing the contaminants, but differ in several significant respects, for example, the extent to which protectiveness can be maintained over the long-term (see Section 8.3 below). Differences among alternatives are examined under each of the remaining criteria.

8.2 Compliance with Federal and State Environmental Standards

All of the alternatives (except Alternative 2 - Limited Action) would comply with ARARs under federal or state environmental laws for the site. Table 16 lists the ARARs for the alternatives that were considered.

Alternative 2 appears to be inconsistent with both EPA's expectation and Ecology's requirement that limited action, or an action that relies solely on institutional controls such as community protection measures, should not substitute for more active measures (or a higher preference cleanup technology under MTCA) unless such active measures are found to be impractical. EPA and Ecology have determined that both (1) the physical removal of contaminated soil to a certain depth, and/or (2) the capping of contaminated soil is practicable and technically possible in the Study Area.

Requirements for an appropriate off-site facility for the disposal of contaminated soil will be described in Ecology's final decision on Asarco's petition to exempt residential soils from the Ruston and Tacoma area from disposal in a hazardous waste facility.

The requirements for hazardous waste under the Resource Conservation and Recovery Act (RCRA) are not applicable or relevant and appropriate for the Study Area cleanup because the soil and slag to be disposed are not hazardous waste.[6] Based on soil samples taken during the RI, the soil does not exhibit the toxicity characteristic under 40 C.F.R. § 261.24 or any other characteristic under 40 C.F.R. Subpart C. Slag is not regulated as a hazardous waste under 40 C.F.R. § 261.4(b)(7).

Balancing Criteria

8.3 Long-Term Effectiveness and Permanence

The long-term effectiveness of an alternative corresponds directly to the extent to which contaminated soil is removed under that alternative due to the potential for disturbance and re-exposure. The alternatives that rely on containment of contaminated soil and community protection measures (without soil removal) are not likely to be as effective over the long-term as removal of contaminated soil because the continued enforcement, awareness, and acceptance of such measures by government agencies and Study Area residents cannot be guaranteed.

Alternative 6 is the most effective over the long-term in terms of reducing risk to human health. The excavation of soil at depth contaminated above background levels (20 ppm arsenic and 250 ppm lead) would essentially ensure that all risks due to contact with contaminated soil above EPA's action levels would be minimized. Even under Alternative 6, however, some contaminated soil above EPA's action levels may remain under hard surfaces, such as roadways, houses, and buildings, or in steeply sloped areas.

The Preferred Alternative offers the next most comprehensive level of long-term protection because it would cleanup, to a maximum depth of 18 inches, most of the properties or areas that exceed action levels. A clean cover of soil would be installed, and cap maintenance measures would be established, where soils over the action levels are left below the cover. Based on current depth profile sampling data (to a depth of 16-inches), EPA estimates that only a small percentage of properties would have contamination remaining below 18 inches.

Alternatives 4 and 5 are the next most effective over the long-term because they would require excavation of soil to a depth of 12 inches at properties or areas that exceed EPA's action levels. A clean cover of 12-inches of soil would be installed and cap maintenance measures would be established where soils over the action levels are left below the cover.

The Preferred Alternative and Alternatives 3, 4 and 5 also call for a soil testing, removal and collection program for the Ruston/North Tacoma residents if soil areas above EPA's action levels need

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[6] Under Washington state's Dangerous Waste Regulations (Chapter 173-303 WAC), removed soil or slag with arsenic concentrations greater than 100 ppm is considered dangerous waste (see Section 7.2.a for information on the petition for exemption from the Dangerous Waste Regulations).

to be excavated after the cap is in place, for example during remodeling activities that require excavation of soil below the cap.

Alternative 3 is less effective than 4, 5, 6 and the Preferred Alternative because it involves very little removal of contaminated soil. Typical use of a yard could penetrate or degrade the sod barrier, exposing contaminated soil. Alternative 3 is more protective over the long-term than Alternative 2, however, because placing a new sod barrier would reduce potential exposure to contaminated soil at least to some extent.

Alternative 2 would provide the least protection over the long-term because it would not provide for either a comprehensive removal of contaminated soil or a physical barrier against contaminated soil. Its success would depend upon the sustained acceptance, understanding, and participation of the community in the community protection measures programs. Alternative 2 also provides for a soil disposal program for individual disturbances of contaminated soil.

8.4 *Reduction of Toxicity, Mobility, or Volume through Treatment*

None of the alternatives provide for treatment of contaminated soil. Although soil washing was considered the most viable treatment alternative for the Ruston/North Tacoma soils, it was determined that further consideration of soil washing was not justified based on the results of a "Treatability Study" (Fractionation and Soil Washing of Ruston/North Tacoma Soils, EPA, November 1991). The study showed that soil washing was not consistently effective at reducing the concentrations of contaminants to protective levels.

8.5 Short-Term Effectiveness

The potential for short-term risks and exposures, e.g., inhalation of contaminants by workers or residents because of dust and particles generated by movement of soil, and increased traffic in the community, are directly related to the extent of soil excavation required by each of the alternatives, including the Preferred Alternative. Alternative 6 would potentially present the most significant short-term exposures because more extensive soil removal would be required than under any other alternative. Short-term risks are potentially less of a problem under Alternatives 2 and 3 because extensive soil removal is not required.

Short term risks and exposures can be minimized because dust control and safety measures, including air monitoring, would be required during excavation. Also truck beds would be lined and covered when transporting contaminated materials, truck wheels would be cleaned before travelling on public roads, and local truck routes would be established to minimize disruption to the community. The Preferred Alternative would require that local roads used for transporting contaminated soils be regularly inspected and repaired if damage occurs due to improper use when implementing the remedy. In addition, trucks would be expected to use common safety precautions (e.g., brake inspections). Also, rail transportation of contaminated soil may be an acceptable alternative to trucks.

An analysis of short-term effectiveness includes an evaluation of the time necessary to complete cleanup activities under an alternative. Although short term risks to the community under Alternative 2 would be low, the community protection measures program under this alternative would be ongoing indefinitely throughout the entire community.[7] Alternative 3 would involve both minimal short-term risks because extensive soil excavation is not required, and because of the relatively short time frame to complete its activities - perhaps 1 year to complete sodding replacement activities.

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[7] Some form of community protection measures program would be necessary for all of the alternatives. Since the primary purpose of the program is to address contaminated soils that remain in the community after the cleanup, the scope and duration of the program will be more substantial when less soil is removed from the Study Area.

Alternatives 4, 5, and the Preferred Alternative are generally similar in terms of their short-term effectiveness, although the Preferred Alternative may be advantageous because it allows for varying depths of excavation based on soil depth profiles (Alternatives 4 and 5 require that all contaminated soils be removed to a 12 inch depth). Short-term risks and exposures are potentially greater for Alternative 6 because removal of more soil increases the possibility for damaging utilities and other structures. Also, Alternative 6 may require almost twice as much time to complete as Alternatives 4, 5, or the Preferred Alternative.

8.6 Implementability

All alternatives are technically feasible. Alternative 3 is the easiest physical cleanup to implement, requiring only replacement of sod. Alternatives 4, 5, 6 and the Preferred Alternative require the extensive removal and replacement of soil as well as sod.

The excavation, soil replacement, and sodding activities performed under Alternatives 3 through 6 and the Preferred Alternative are common practices and do not limit the implementability of these alternatives. Access to private properties would be required for Alternatives 3 through 6 and the Preferred Alternative. Off-site disposal facilities are available for Alternatives 3, 5, 6 and the Preferred Alternative. The availability of disposal services on the Asarco smelter facility under Alternative 4, however, will not be determined until the cleanup action for the smelter is selected (see Section 7.5).

Each alternative involves the use of community protection measures to varying degrees. The development, implementation, and enforcement of these measures would require extensive coordination with other agencies and private parties. Under Alternatives 2 and 3, community-wide acceptance of and compliance with community protection measures may be difficult to maintain over a long period of time. Fewer community protection measures would be required as part of either the Preferred Alternative or Alternatives 4, 5, and 6 due to the removal of the majority of contaminated soil.

8.7 Cost

The total cost of the alternatives is summarized in Table 17. These costs are estimated for the purpose of comparison and are considered to be accurate within -30 to +50 percent. The estimates are based on the estimated areas exceeding action levels (273 acres shown in Figure 5). The alternatives, except for 4a, assume final disposal of contaminated soil at a facility outside of the residential area. Alternative 4a assumes disposal of soil on the smelter site.

The incremental cost associated with the alternatives involving soil removal compared to the alternatives that do not remove soil is reasonable and proportionate to the increased effectiveness over the long-term of the soil removal alternatives (also see the discussion of cost-effectiveness in Section 10.3 below). Moreover, the estimated cost of the Preferred Alternative is well within the range of estimated costs for Alternatives 4 through 6.

Modifying Criteria

8.8 State Acceptance

Ecology agrees that "the long-term effectiveness of an alternative corresponds directly to the extent to which contaminated soil is removed." Ecology believes that the engineering action levels selected represent a best balance of the factors related to this site. Ecology further believes that the residual risks can be adequately addressed through CPMs. Ecology emphasizes that this decision on engineering action levels is specific for the factors related to this site only. Accordingly, Ecology concurs with the EPA preferred alternative and the remedy selected in this ROD.

8.9 Community Acceptance

Community acceptance is an important consideration in the selection of a cleanup remedy for the Ruston/North Tacoma Study Area. Generally, community concerns about the site have centered around the significance of the potential health threat from the contaminated soils, the stigma associated with living at a Superfund site, and the resulting economic impacts. Some citizens have questioned whether the risk warrants a cleanup, while others have stated that they would prefer EPA to err on the side of protectiveness. Because the estimated risks do warrant cleanup, and acceptance of cleanup measures by the community is important to successful implementation of the remedy, EPA implemented a significant community involvement plan throughout the RI/FS activities.

The goal of the community involvement plan was to provide opportunities for the community to actively participate in developing the remedy. The community became involved in a variety of ways including: the Ruston/North Tacoma Coordinating Forum and Community Workgroup; regular community meetings (open houses, workshops, public meetings); and by commenting during two 60-day public comment periods held during the RI/FS and Proposed Plan processes. (A more detailed description of community involvement activities can be found in Section 3).

During the first of two public comment periods (February - April 1992) EPA requested public comments on the six alternatives evaluated in the FS. EPA used the comments received to develop the Preferred Alternative which was outlined in the Proposed Plan. Public comments were submitted on a variety of subjects including: health concerns; property values; soil sampling and disposal; community protection measures; cleanup levels; and the length of time to complete a cleanup. A summary of the comments received during the first comment period and EPA's responses is included in section (F) of the Proposed Plan.

The Preferred Alternative (described in the Proposed Plan) consisted of elements from five of the six alternatives described and evaluated in the FS. For the Preferred Alternative, EPA selected elements that were protective of human health and the environment, and those that commenters recommended. The Proposed Plan including the Preferred Alternative was the subject of the second public comment period (August - October 1992).

Specific comments on the Proposed Plan included comments pertaining to: homeowner involvement in the cleanup; expanding the cleanup area; the depth of soil excavation; paving of dirt roads; the overall protectiveness of the plan; and support of the plan. See the Responsiveness Summary included as Appendix A of this ROD for a detailed summary of public comments from both comment periods, and EPA's responses.

In general some community members still do not believe that cleanup of arsenic and lead contaminated soils in the Study Area is necessary. Other commenters, however, felt that if EPA must require a cleanup, the Preferred Alternative addressed many of their concerns. In addition, some community members commented that a cleanup was necessary and should be implemented. Some felt that soil should be cleaned-up to reduce the potential health risks, while others thought a cleanup would eliminate the "stigma" that they feel EPA's Superfund activities have created in the community.

One common theme contained in most of the comments was the need for input from the homeowners. Commenters felt that a homeowner should have a say in what happens on their property and not be subject to, or pay for, actions they didn't want.

Although there is not a consensus within the community on whether cleanup actions should be taken, by involving the public in developing the cleanup plan, and by addressing many community concerns in the Preferred Alternative and the Selected Remedy, a remedy has been selected that will be acceptable to many members of the community.

EPA will continue to implement community involvement activities throughout the cleanup to ensure that homeowners and other interested citizens continue to be involved. These efforts will include working individually with homeowners before, during and after cleanup to make sure the work is done properly and to their satisfaction.

9.0 THE SELECTED REMEDY

EPA has selected the Preferred Alternative, as modified by public comments, as the remedy for contaminated soil in the Ruston/North Tacoma Study Area. This remedy addresses soil in residential, commercial, and public areas, vacant lots, parking strips, landscaped areas, garden areas, unpaved driveways, and roadway shoulders. In addition, this remedy addresses slag used in driveways and other areas where slag use could lead to potential human exposure.

The remedy employs both engineering and community protection measures to reduce exposure of current and future residents to contaminated soil and dust, and to reduce the potential transport of soil contaminants inside homes or buildings where exposures may occur. Following are the individual components of EPA's Selected Remedy.

9.1 Sampling

The following approach will be used to determine the individual properties or areas at which a cleanup will take place (i.e., those properties or areas, including significant areas within individual properties, that exceed action levels):

(a) Surface and depth samples will be taken at all properties within the shaded area in Figure 5 (i.e., the area where properties are most likely to exceed action levels). Depth samples will be taken in order to determine the extent of contamination and the level of excavation required. In addition, all schools, parks, and playgrounds within the Study Area will be inventoried and sampled.

(b) Additional samples will be taken in areas outside the shaded area, including the three properties immediately outside the Study Area, where concentrations in excess of action levels were detected.

(c) Samples will also be taken at properties outside of the shaded area but within the Study Area as needed to supplement the RI sampling results or at the request of property owners. If a sampled property or area is identified as exceeding action levels, sampling will also be conducted at contiguous properties.

(d) EPA will provide sample results to homeowners in the Study Area and indicate whether a cleanup is or is not necessary.

(e) EPA will evaluate the need for further sampling (and appropriate cleanup activities) outside the Study Area separate from the final cleanup action for the Study Area (see Section 4.1 of this ROD for additional information).

(f) The current data base of sampling results will be expanded to store the results for all of the properties that are sampled (see Section 9.10 below).

9.2 Small Quantity Soil Disposal Program

A soil collection and disposal program will be conducted for owners of properties requiring cleanup (i.e., properties where sample results exceed action levels) that generate small quantities of soil **prior to** the final cleanup of their property (see Section 9.10 (b) below on post-cleanup soil collection service).

9.3 Excavation of Contaminated Soil, Sod, and Slag

At properties or areas where soil exceeds action levels (230 ppm arsenic and 500 ppm lead)[8], soil and sod will be excavated. Slag driveways within the Study Area (as well as other uses of slag where small particles could be ingested) will be excavated and replaced with gravel. Large pieces of ornamental slag, e.g., slag used in retaining walls or as a landscaping feature, will not be removed.

(a) Removal activities generally will address sod areas (residential, public, and commercial), landscaped areas, garden areas, unpaved driveways, and roadway shoulders. Removal activities, in general, will not address soil within residential areas that is covered by an existing structure or hard surface, e.g., concrete pads, patios, sidewalks, driveways, crawl spaces, wooden decks, and dirt basements and garages. When these conditions are encountered within a residential yard, flexibility will be employed in making cleanup determinations by considering the following factors: (1) the potential for exposure; (2) the feasibility of conducting the cleanup; and (3) contaminant concentrations in other parts of the yard (i.e., as an indication of possible concentrations in covered areas).

(b) The depth of excavation at individual properties will depend on the depth of contamination shown by sampling results, but will not in general exceed a maximum depth of 18 inches. Flexibility will be used in making cleanup determinations in those areas where contamination may extend just slightly below 18 inches.

(c) Samples will be taken after excavation to confirm that contaminated soil from properties or areas that exceed action levels has been removed.

(d) Excavated soil and sod will be replaced with "clean" soil and sod, i.e., soil with concentrations of arsenic and lead that do not exceed concentrations commonly found in local urban areas - 20 ppm arsenic and 250 ppm lead. Even lower values for the replacement soils, especially for lead, are likely achievable, e.g., lead less than 100 ppm. Vegetation will be replaced. Slag will be replaced with gravel.

(e) It may be necessary to establish a temporary staging area or transfer facility for excavated soil within or near the Study Area, potentially including on the Asarco smelter site. The transfer of materials may be required because many streets throughout the Study Area cannot be easily accessed by the larger vehicles that will be used to transport removed soils to the disposal location. The staging area or transfer station is not meant, however, to serve as a long term storage facility.

9.4 Properties or Areas Where Soil Above Action Levels Remains

If areas above action levels remain below 18 inches, the replacement soil will serve as a cap or barrier to the remaining contaminated soil. Vegetation will be replaced.

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[8] Based on comments received during the Proposed Plan public comment period, there is some misunderstanding regarding the cleanup of properties contaminated solely by lead. It is possible that some exceedances of 500 ppm soil lead may occur in the Study Area unrelated to releases from the Asarco smelter. Under this remedial action, EPA will take or compel remedial actions at the site that address current contamination from smelter operations and releases, but not similar contamination resulting from other sources, such as lead-based paints or automotive emissions, that are widespread. The Superfund law limits the extent to which EPA can address releases from these other sources (see CERCLA § 101(22) and § 104(a)(3), 42 U.S.C. §§ 9601(22) and 9604(a)(3)). Some property-specific determinations may be required to decide on the inclusion or exclusion of such areas as part of site remediation.

(a) A "marker," e.g., a geotextile fabric or geocomposite material, will be used to clearly identify the base of the cap for future intrusions.

(b) Community protection measures, described below in Section 9.10, will apply to the capped areas.

9.5 Dirt Alleys and Parking Areas

Dirt alleys and parking areas with soil that exceeds action levels will either be capped with asphalt to provide an impermeable barrier to contaminants, or the contaminated soil will be removed and replaced with clean gravel. A determination regarding the appropriate option will be made based on consideration of the sampling results and the extent of contamination, the relative cost effectiveness of the options given the area to be remediated, and consultations with the local municipalities.

9.6 Fencing

Soil in areas which are too steeply sloped to be excavated will be fenced and planted with low lying shrubs (see Figure 6). A geotextile material will be applied to the soil to provide erosion protection, as well as a means for supporting vegetative development.

9.7 Cleanup Timeframe, Schedule and Prioritization

The cleanup of properties will generally proceed within an area at a time, beginning with the most highly contaminated areas. The Study Area will be divided into manageable zones. To the extent possible, within an area or zone, priority may be given to schools, parks, playgrounds, daycares, homes with children, or other areas where children tend to gather. EPA believes that this is not only the most efficient method for cleaning up properties, but that this strategy will be the least disruptive to the community overall.

Attempts will be made to shorten the estimated 7 year cleanup timeframe as much as possible by using the maximum amount of trucks, crews, etc., that are available and that the community is willing to tolerate. Community input will continue to be sought as the cleanup progresses and zones are established and individual lots scheduled for cleanup actions (see Section 9.16 below).

9.8 Information for Deed Notice

If requested by an owner of property, a factual description of the sampling results and/or the cleanup that has been completed at that property will be provided. Owners may want to use this information for the purpose of a deed notice to show that the property did not require cleanup actions, or that cleanup actions were completed on the property.

9.9 Safety Measures

During implementation of the cleanup, safety measures will include, at a minimum, air monitoring, the use of dust suppression techniques during excavation activities, covering of any stockpiled materials, lining and covering truck beds when transporting contaminated materials, removing soils from truck wheels before trucks travel on public roads, and the establishment of a transportation plan to establish local truck routes to minimize disruption to the community.

9.10 Community Protection Measures

The CPMs program for the Study Area included in this ROD addresses: (1) areas where complete removal of soils above the action levels is not practicable, e.g., areas where contamination above the action levels is to be left at depths greater than 18 inches or may be detected in the future under roadways, sidewalks or buildings; as well as (2) areas where soil arsenic levels exceed concentrations normally found in urban areas, but are below the action levels and therefore would not require cleanup. The appropriate CPMs for soils in the second category include educational measures on how to minimize contact with contaminated soil, measures to take if contact does occur, how to dispose of soils in an environmentally safe manner, and the components listed under (d), (e), and (f) in this section below. The appropriate CPMs for soils in the first category are discussed further below.

EPA believes that the measures outlined in this Section, at a minimum, are the most effective way to implement the CPMs program. Specific details for the program will be finalized during the design phase of the cleanup.

A full time person from the TPCHD will be funded to serve as the CPMs program coordinator. The coordinator will be responsible for developing and carrying out the program elements described below, and for coordinating the development, implementation, and evaluation of the CPMs program with a workgroup[9] and the Community Relations Program coordinator (described below in Section 9.16). The CPMs program will include, at a minimum, the following elements:

(a) <u>Measures to control soil disturbances</u>.

Guidelines and safety procedures will be developed for conducting excavations so that contact with remaining contaminated soil is minimized, and that such soil is appropriately disposed. The guidelines will address the following areas: (1) significant development projects; (2) soil disturbance activities conducted by homeowners or citizens; and (3) utilities maintenance projects.

The guidelines for conducting significant development projects will be dispensed with permits issued in Ruston and Tacoma.

The information for homeowners will address any special considerations identified, e.g., children, parents, and eating garden vegetables. Day cares will be identified as a specific audience for receiving educational material. In addition, educational material will be developed for distribution in the schools.

The CPMs program coordinator will work directly with Ruston and Tacoma to identify specific departments conducting utility maintenance activities. Educational materials, including appropriate distribution methods, will be developed to address the needs of the identified departments.

(b) <u>Soil testing, collection, and disposal program</u>.

A soil testing, collection, and disposal program will be developed to apply when soil above the action levels is excavated from beneath a cap or other area where contamination remains, including from existing ERA sites (see Section 9.12 below). The program will be available for contaminated soil that is excavated as a result of small scale homeowner activities, development projects, and City or

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[9] As part of the proposed conditional exemption for arsenic contaminated soils in the Ruston/ North Tacoma Study Area, Ecology will require an ongoing education program to inform residents about appropriate measures to minimize residual risk from contaminated soils, and the proper management of these soils. To meet the requirements for coordinating the education program with local and state government, staff conducting the program will work with a workgroup to set goals for the education program and provide input from the community on education measures. The workgroup will include representatives from the Town of Ruston, the City of Tacoma, TPCHD, EPA and Ecology, as well as residents of the Study Area, members of the business community, parents, students, school personnel, and other interested citizens. The workgroup will provide guidance in the development and implementation of the education program.

Town maintenance projects. Transportation of excavated material to the disposal facility will be provided. A component of this program will address the development and distribution of information on the availability and use of this program.

(c) Measures to maintain the integrity of caps.

A maintenance and monitoring program will be established to ensure the continued integrity of soil, sod and asphalt caps, including visual inspections of capped areas. Maintenance activities will include repair of damages to, or failures of, caps that are caused by improper placement, e.g., insufficient drainage measures.

Homeowners will generally be responsible for maintaining and repairing established caps in individual yards as part of the normal upkeep of private property. The City and Town will be responsible for general cap maintenance and repair activities on public access areas and roadways, but not for damage as a result of remediation activities or as a result of a failure of the remedy.

(d) Development of a property specific data base.

Information regarding sample results and cleanup activities at individual properties will be consolidated into a data base. The data base will be easily accessed, frequently updated, and centrally located and maintained. The data base will be available to interested individuals (e.g., property owners) in Ruston and Tacoma. Efforts will be made to determine the best ways to inform people about the existence of the data base, as well as additional parties that need to be made aware of its existence, e.g., real estate personnel.

(e) Notification to future property owners.

The data base will provide information to current and future property owners regarding (1) sample results, (2) completed cleanup efforts, and (3) cap maintenance responsibilities for properties or areas where contamination remains above the action levels. The real estate and lending communities will be informed about the data base to ensure that information necessary for property transfers is readily available.

(f) Evaluations of the effectiveness of the CPMs program.

A yearly progress report will be prepared regarding activities and educational measures conducted under the CPMs program. The workgroup, identified above, together with an independent entity identified by the workgroup, will be responsible for reviewing the report, evaluating the adequacy of the CPMs program, and suggesting any necessary changes.

9.11 Funding

As part of the remedy, a funding mechanism will be established under EPA, state or local direction or oversight to provide resources to implement the selected remedy including ongoing educational measures and the community protection measures program.

9.12 Expedited Response Action Properties

In 1990, 1991, and 1992 under an Administrative Order on Consent with EPA, Asarco conducted cleanup actions at 10 publicly accessible areas (and portions of an 11th area) where soil exceeded 250 ppm arsenic. The top 3 inches of soil was removed and replaced with a 9 to 12 inch soil cap. Access agreements between Asarco and the property owners were established that included provisions for the care, maintenance and monitoring of the soil and vegetation caps. These agreements were designed to be effective until the completion of the Ruston/North Tacoma RI/FS and the issuance of this ROD. As part of the RI/FS, EPA evaluated the ERA sites to determine whether the ERA was an effective permanent remedy.

The Selected Remedy is similar to the ERA activities in that they both involve the removal and replacement of contaminated soil, and provisions for the care, maintenance and monitoring of soil caps. Under the Selected Remedy, the ERA properties will be sampled to a depth of approximately 18 inches from the surface of the cap. If contaminated soil is found, the ERA property will be included in the community protection measures program (see Section 9.10) outlined in this ROD. Given that this effort provides for the continued care, maintenance and monitoring of ERA site soil caps, further remediation of ERA sites is not necessary.

The portions of Site 8 of the ERA properties that have not yet been remediated will be cleaned up in accordance with the Selected Remedy under this ROD.

9.13 Disposal

Current state regulations require disposal of removed soil with arsenic concentrations above 100 ppm at a hazardous waste facility (Dangerous Waste Regulations, 173-303-141 WAC). The nearest such facility is located in Arlington, Oregon. Asarco has submitted a petition to Ecology requesting an exemption from the requirements of these regulations. Ecology has evaluated the petition and has proposed to conditionally exempt both soil with arsenic concentrations less than 230 ppm, and soils with arsenic concentration greater than 230 ppm from the disposal criteria required in the regulation.

Where soils with arsenic levels at or below the 230 ppm action level are excavated, educational measures will be provided on how to minimize contact with and dispose of these soils in an environmentally safe manner. For soils with arsenic concentrations over the 230 ppm action level, specific disposal facility criteria have been proposed. The proposed conditions of the exemption are described in Table 16. These conditions, when finalized, will be requirements for the Selected Remedy.

Based on the current information regarding disposal as described in the paragraph above, EPA has selected disposal at an appropriate off-site facility for the Selected Remedy. If the dangerous waste exemption is approved, however, other possible disposal locations for Study Area soil may become available in the future. For example, there are other non-hazardous waste landfills in the state which might meet the exemption requirements. In addition, before EPA selects a cleanup remedy for contaminated soil and ground water at the Asarco smelter site, EPA expects to consider a range of cleanup alternatives that may include consolidation of contaminated soil on the smelter site, treatment of contaminated soil and ground water, capping of contaminated soil, and excavation and off-site disposal of contaminated soil. It is possible that if EPA decides to select on-site disposal, capacity may be available for Study Area soil. EPA notes, however, that its decision on the cleanup of the Study Area is separate and apart from its decision on the cleanup of the smelter site. The selection of a cleanup remedy for the Asarco smelter site will be subject to further public review and comment.

9.14 Homeowner Access and Approval

Cleanup activities will be coordinated with homeowners to define the extent of work to be performed on individual properties. The following activities will take place prior to any soil removal activities on an individual property:

(a) Work with property owners to obtain access for sampling and conducting the remedy.

(b) Conduct site survey, photograph or videotape properties, and prepare detailed plan for each property. Verify stability of structures on the property, including foundations, with respect to anticipated depth of excavation (also see Section 9.17 below).

(c) Schedule the work with the homeowner.

9.15 Landscaping

The actual vegetation removal and replacement plan will be determined on a property-by-property basis to accommodate both the project needs and property owners to the extent that is reasonably possible. Reasonable attempts, which do not hinder the progress of the remediation and are not excessively costly, will be made to accommodate owners who desire to retain original landscaping.

9.16 Community Relations During Cleanup

A community relations program, including a full time coordinator, will be established to provide coordination and communication between cleanup personnel, residents, and property owners. The community relations program coordinator will work together with the coordinator and workgroup identified under the community protection measures program above (Section 9.10) to address the needs of the community including residents, businesses and schools. This program will include the following elements at a minimum:

(a) Establishment of a local information center within the community where information regarding cleanup activities and schedules could be obtained.

(b) Coordination and communication of cleanup schedules with property owners, including discussions with property owners and day care operators regarding the appearance of the community during cleanup activities, and any recommended safeguards or precautions.

(c) Notification to residences, businesses, and schools prior to the start of remediation efforts.

(d) Preparation and distribution of regular project updates to businesses, residents, and schools, and the identification of additional ways of keeping people informed about cleanup activities and progress.

(e) Regularly scheduled community meetings to discuss cleanup schedules and processes, and to address questions and concerns regarding cleanup activities.

9.17 Incidental Damage During Remediation

All possible precautions will be taken during remediation to avoid damage to property. It is possible, however, that the excavation of soil from properties, and the use of heavy equipment for remediation and transportation activities, may result in damage to some underground utilities, sprinkler systems, fences, foundations, yard lighting, roads, sidewalks, etc. Efforts will be made to anticipate and minimize these possible problems by working with the homeowners, municipalities, and utilities to prepare sketches of each property to identify all known underground items.

In addition, all properties including roads and sidewalks will be surveyed and inspected prior to remediation activities to establish existing conditions. Items damaged as a result of remediation activities will be repaired or replaced where feasible. As part of the replacement of clean soil on individual properties, efforts will be made to ensure adequacy of drainage and erosion control.

9.18 Cost of the Selected Remedy

EPA estimates a range of $60 to $80 million total present worth costs to conduct the Selected Remedy. The lower cost reflects the disposal of contaminated soil at a non-hazardous waste disposal facility (see Section 9.13 above) and the higher cost indicates disposal at an out-of-state hazardous waste facility. See Section 8.7 for more information on cost estimates and comparisons.

10.0 STATUTORY DETERMINATIONS

10.1 Protection of Human Health and the Environment

The selected remedy will eliminate, reduce, or control exposure to contaminants at properties or areas that exceed action levels for arsenic and lead as a result of emissions from the smelter. Risks from exposure to soil that exceeds the action levels will be eliminated by removing contaminated soil and disposing it elsewhere. Where soil removal is impracticable, e.g., where areas above action levels extend below 18 inches in depth, the risk will be controlled by placing a cap of clean soil and sod above the contaminated area to act as a barrier to direct contact exposure.

The goal of CPMs is to ensure that the remedy remains protective over the long-term. The objectives of CPMs include: monitoring the condition of the caps; informing homeowners - current and future - that residual contaminated areas exist on certain properties (or may exist in certain areas, e.g., below structures or roadways); and educating residents on minimizing exposure to contaminated areas, managing and disposing of soil if contaminated areas are excavated, and reducing exposure to concentrations that are below action levels but above levels that are commonly found in urban areas.

Short-term risks to the community during implementation of the cleanup action will be minimized through dust control and other protective measures.

10.2 Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy will attain ARARs under federal and state law (see Table 16).

10.3 Cost-Effectiveness

The cost of the Selected Remedy is proportional to its overall effectiveness and it represents a reasonable value for the money to be spent under NCP section 300.430(f)(1)(D). In determining this "proportionality," EPA compared the differences in cost and effectiveness between the two primary cleanup approaches under consideration for the Study Area: (1) removing from the Study Area as much soil that exceeds the action levels as feasible, replacing the removed soil with clean soil, and disposing the contaminated soil elsewhere (the Selected Remedy); versus (2) leaving the contaminated soil or dirt in place and covering it with sod or asphalt (Alternative 3 in the Feasibility Study). The difference in cost is justified based on the difference in effectiveness over the long-term between the two approaches.

The significant advantage to the more costly soil removal and replacement approach is that it permanently removes the majority of soil exceeding action levels, and therefore significantly reduces the need for community protection measures on many individual properties. The owner and residents of a property where soil contamination above action levels has been removed and replaced with clean soil will be able to enjoy the use of the property without undue restriction. Where it is not practicable to remove all contaminated soil, e.g., where soil above the action levels remains below 18 inches from the surface, the cleanup approach will rely on a cover of sod and 18 inches of clean soil to prevent exposure to the contamination. Soil caps will be necessary only at a limited number of properties.

The primary disadvantage to placing only a thin sod cover over existing contaminated soil is that supplemental measures will always be required to ensure that the sod cover continues to provide protection against the contamination. Sod covers can fail as a result of several types of disturbing activities, thus exposing residents to contaminated soil. Such disturbing activities, which reasonably could occur at many properties, include changes in structures on a property (e.g., adding a deck,-

tearing down a toolshed), loss of vegetative cover from imposition of lawn watering restrictions, or establishing or relocating a garden or children's play area.

The soil cap that would be used under the Selected Remedy where contaminated soil remains would not be as easily penetrated or degraded by human activities or dry conditions because of its thickness. Failures of sod covers are much more likely than failures of a sod-covered 18 inch soil cap, i.e., the protectiveness and long-term effectiveness of a cap increases as the thickness of the cap increases.[10]

In comparing the cost-effectiveness of the two cleanup approaches, EPA reevaluated the community protection measures components under both Alternative 3, as described in the FS, and the Preferred Alternative, as described in the Proposed Plan. More comprehensive long-term monitoring, maintenance, and repair measures for the sod covers as well as an enhanced soil collection service, especially for Alternative 3, would be necessary for an effective long-term cleanup. Such measures would make Alternative 3 nearly as effective as the Selected Remedy in preventing or reducing exposure to contaminated soil. Alternative 3 would not be as effective over the long-term as the Selected Remedy because of the impossibility of ensuring complete compliance with the maintenance, monitoring, and repair requirements at over 500 properties estimated by EPA to have soil exeeding the action levels.

In order to prevent failure of sod covers, they would have to be monitored on a regular basis and repaired when necessary. Also, an extensive program would have to be developed to ensure that "all" current and future homeowners and residents are fully aware of the need to maintain the cover in order to avoid exposure to contaminated soil. Further, the soil collection, testing, and disposal program would have to be substantially more intrusive and encompassing than under the Selected Remedy. This measure would be required in order to accommodate the contaminated soil that would not be removed during EPA's cleanup, but which may be excavated in the future as the result of some of the activities described above.

Because additional measures would need to be added to Alternative 3 to increase its protectiveness over the long-term, EPA has re-estimated the cost of Alternative 3 with such measures. The estimated cost of Alternative 3 in the FS was $24 million, which has been increased for a revised Alternative 3 to $36 million (non hazardous disposal). See Bechtel Memorandum dated May 1993 entitled "Revised Cost Estimates for the Selected Remedy and Alternative 3 at Ruston/North Tacoma Washington. Based on this reanalysis of the cost of long-term measures, which are necessary to a much less extent for the Selected Remedy, EPA's estimate of $60 million for the Preferred Alternative (nonhazardous disposal) has been revised to $62 million for the Selected Remedy.[11]

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[10] It should be noted that it does not appear practicable to use soil and sod covers without removing soil -- i.e., adding up to 18 inches of soil without removing an equivalent amount of soil first would seriously impact grading and drainage patterns.

[11] EPA has not reevaluated the cost of every other alternative in the FS because determining whether the Selected Remedy was cost-effective required only a comparison of the two distinct strategies to the cleanup -- removing contaminated soil versus leaving contaminated soil in place with a sod cover.

Alternatives 4 and 5 as described in the FS varied the disposal locations for the contaminated soil. The estimated cost of the Selected Remedy is based on disposal of removed soil in either the hazardous or nonhazardous facilities in Arlington, Oregon. Although this ROD selects appropriate off-site disposal, it does not preclude other disposal options that may become available in the future, including disposal on the smelter site (e.g., removed soil could be used as a subbase for capping or disposed in an on-site disposal facility).

Despite the significantly increased estimate of cost for Alternative 3, the continued effectiveness of such programs for hundreds of properties over many years would be problematic because the continued enforcement, awareness, and acceptance of such controls cannot be guaranteed. Moreover, the continual intrusiveness of such programs into an owner's use of his/her property may be substantial.

There is an advantage in the effectiveness over the long-term of a cleanup that removes most of the contaminated soil, as opposed to a cleanup that uses sod covers to contain contaminated soil. This advantage is well worth the incremental difference in cost - $62 versus $36 million - between the two approaches. Accordingly, the cost of the Selected Remedy is proportional to its effectiveness and is, therefore, cost-effective under CERCLA and the NCP.

10.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy is permanent to the maximum extent practicable because it requires removal from the Study Area of most of the soil contaminated above action levels. Removal of soil from properties or areas that exceed action levels significantly reduces the risk to residents of the Study Area. Soil removal "to the maximum extent practicable" is defined for purposes of the Study Area as properties or areas that exceed action levels down to 18 inches below the surface. This maximum extent practicable determination is based on the infeasibility of excavating and disposing of soil from below 18 inches in depth together with the effectiveness of soil caps to control exposure to contaminated soil below 18 inches.

The selected remedy represents the best balance of tradeoffs among the alternatives considered in the FS and Proposed Plan. The primary criterion relied upon in making this determination is "long-term effectiveness and permanence," which is analyzed above as part of the "protectiveness" and "cost-effectiveness" determinations. Also of significance in making this maximum extent practicable determination are comments received from the community. Among the residents in favor of a cleanup, most favor the cleanup approach that physically removes contaminated soil from the Ruston/North Tacoma Study Area.

As explained on pages 2-60 through 2-69 of the FS, and in the introduction to Section 7.0 of this ROD, active treatment measures are not practicable to address the large volumes of contaminated soil within the Study Area.

10.5 Preference for Treatment as a Principal Element

As explained in Section 10.4 above, the selected remedy will not satisfy the preference for treatment.

11.0 DOCUMENTATION OF SIGNIFICANT CHANGES

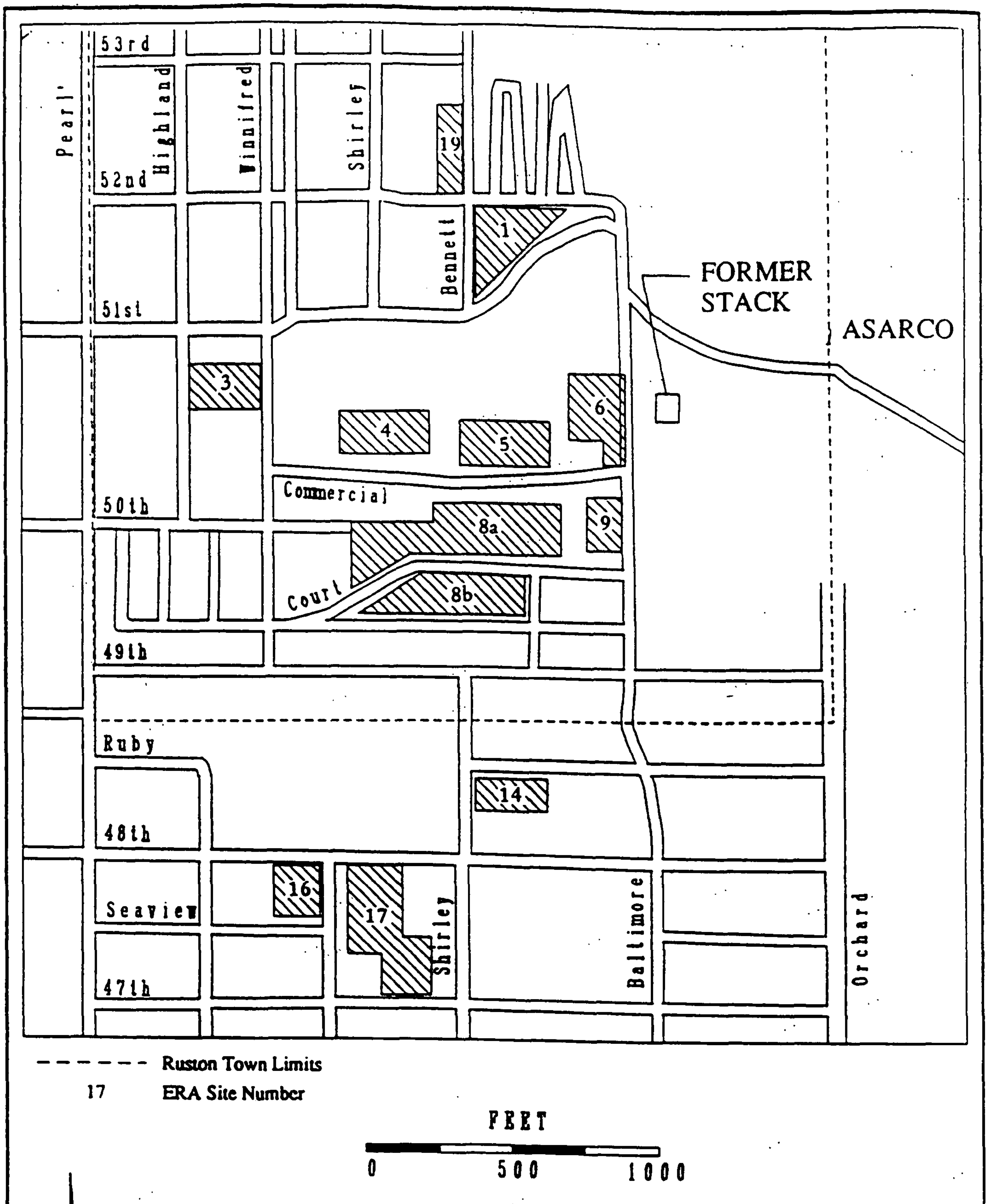
During the public comment period on the Proposed Plan, EPA received comments from Asarco regarding the asphalt paving of dirt alleys and parking areas where soil exceeds the action levels. Asarco commented that compared with asphalt capping, removal of contaminated soils from alleys and parking areas followed by replacement with clean gravel would be a superior alternative.

Since any options associated with disposal of Study Area soils on the smelter property can only be implemented if determined to be appropriate under the smelter cleanup, which is not expected to begin for several years, this cost-effectiveness analysis for the Study Area cleanup does not consider the cost of the smelter options. If such options are approved and implemented, however, EPA expects that the cost of the Selected Remedy may be reduced as disposal costs would be lower.

Asarco also suggested that the removal and gravel replacement option would be more cost effective than asphalt capping, and would also provide a more permanent solution.

EPA has reevaluated the Proposed Plan requirement for asphalt paving of dirt alleys and parking areas exceeding the action levels. The two approaches are similar in terms of their overall protectiveness. The primary difference between the two approaches is the need for long term maintenance of asphalt caps that are underlain by contaminated soils. The frequency of intrusions to the asphalt caps, however, would be less than those in residential lawn areas.

Accordingly, Section 9.5 of this ROD allows for dirt alleys and dirt parking areas that exceed action levels to be either capped with asphalt to provide an impermeable barrier to contaminants, or for the contaminated soil to be removed and replaced with clean gravel. A determination regarding the appropriate option will be made based on consideration of the following factors: (1) the sampling results and the extent (depth) of contamination; (2) the relative cost effectiveness of the options given the area (size) to be remediated; and (3) consultations with the local municipalities.

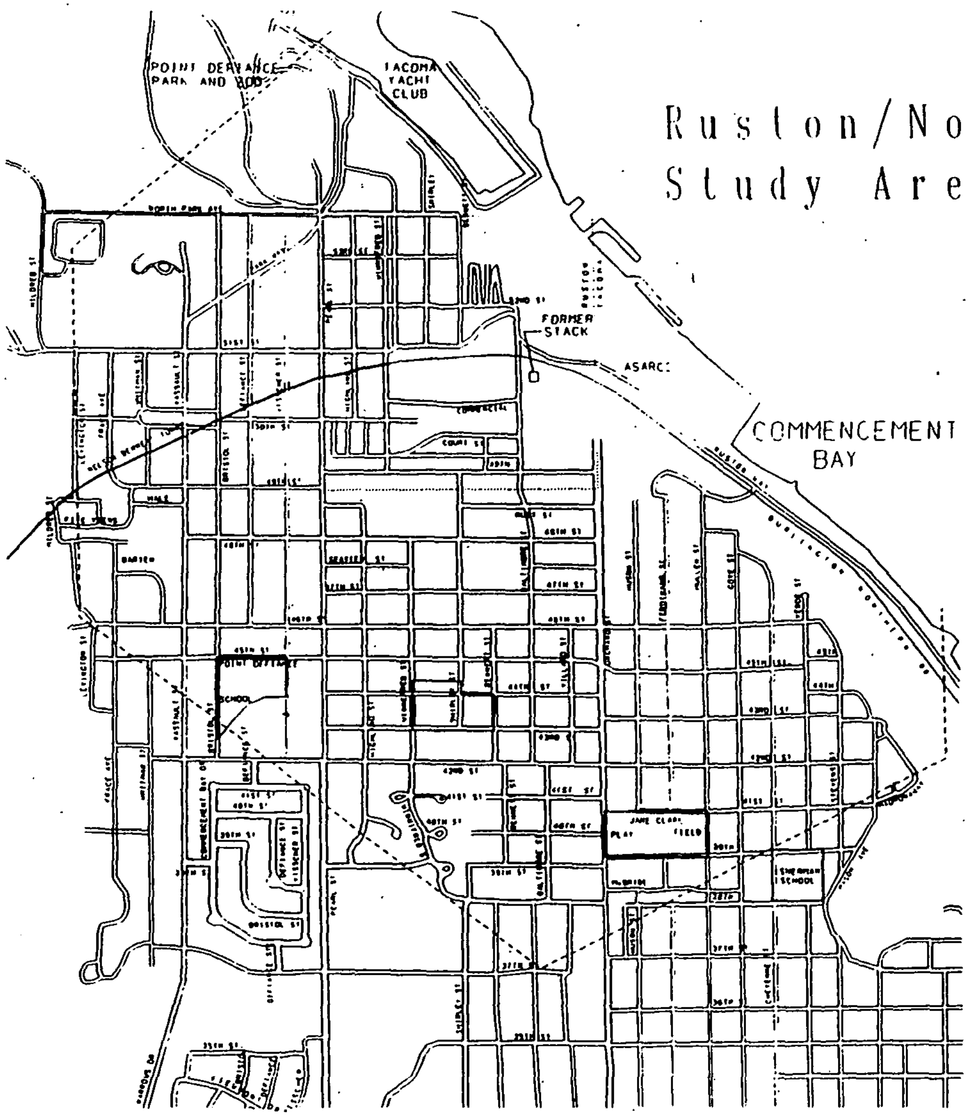


Expedited Response Action Sites

FIGURE 2

FIGURES

Ruston/North Tacoma Study Area



Study Area

FEET
0 800 1600

FIGURE 1

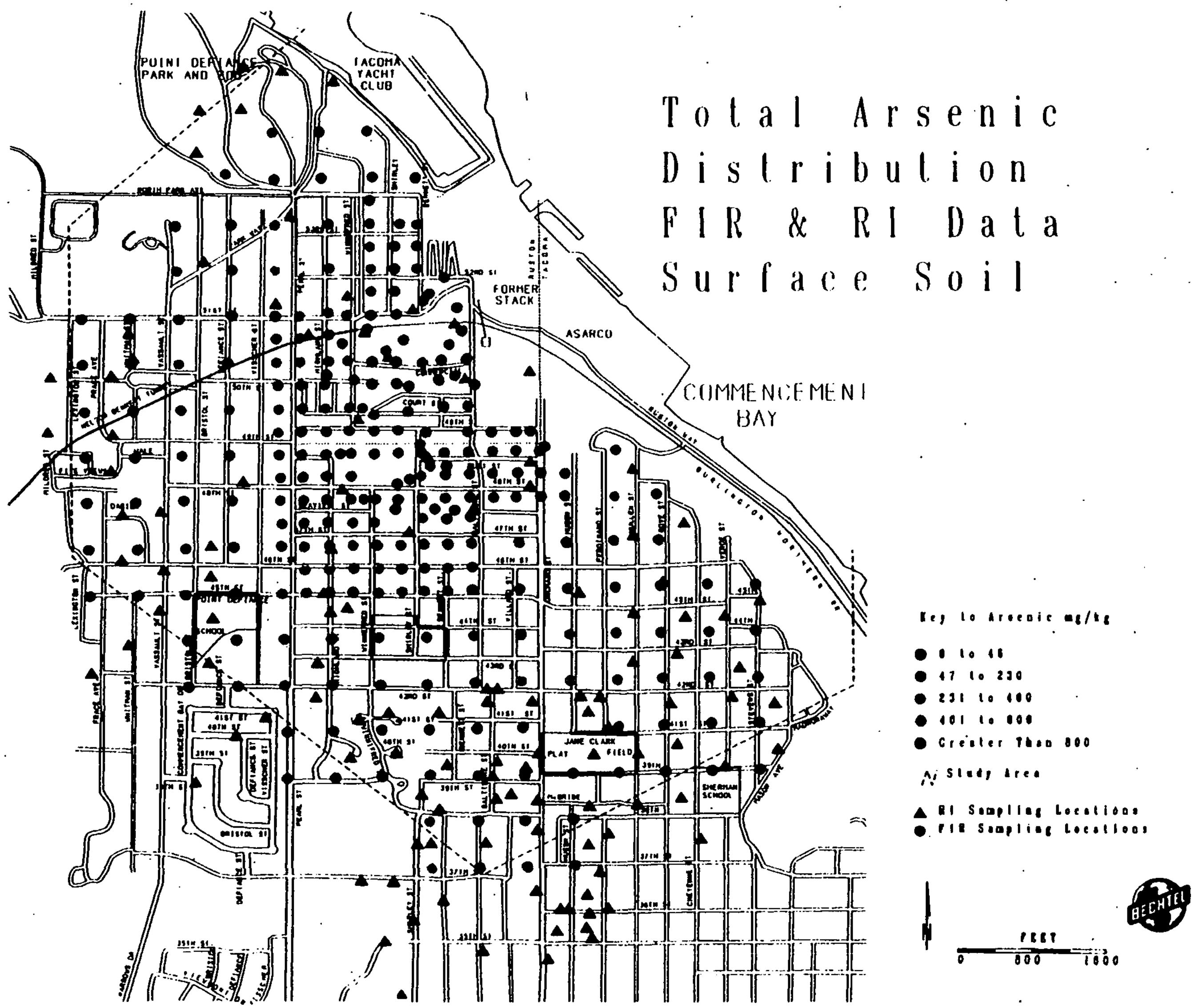
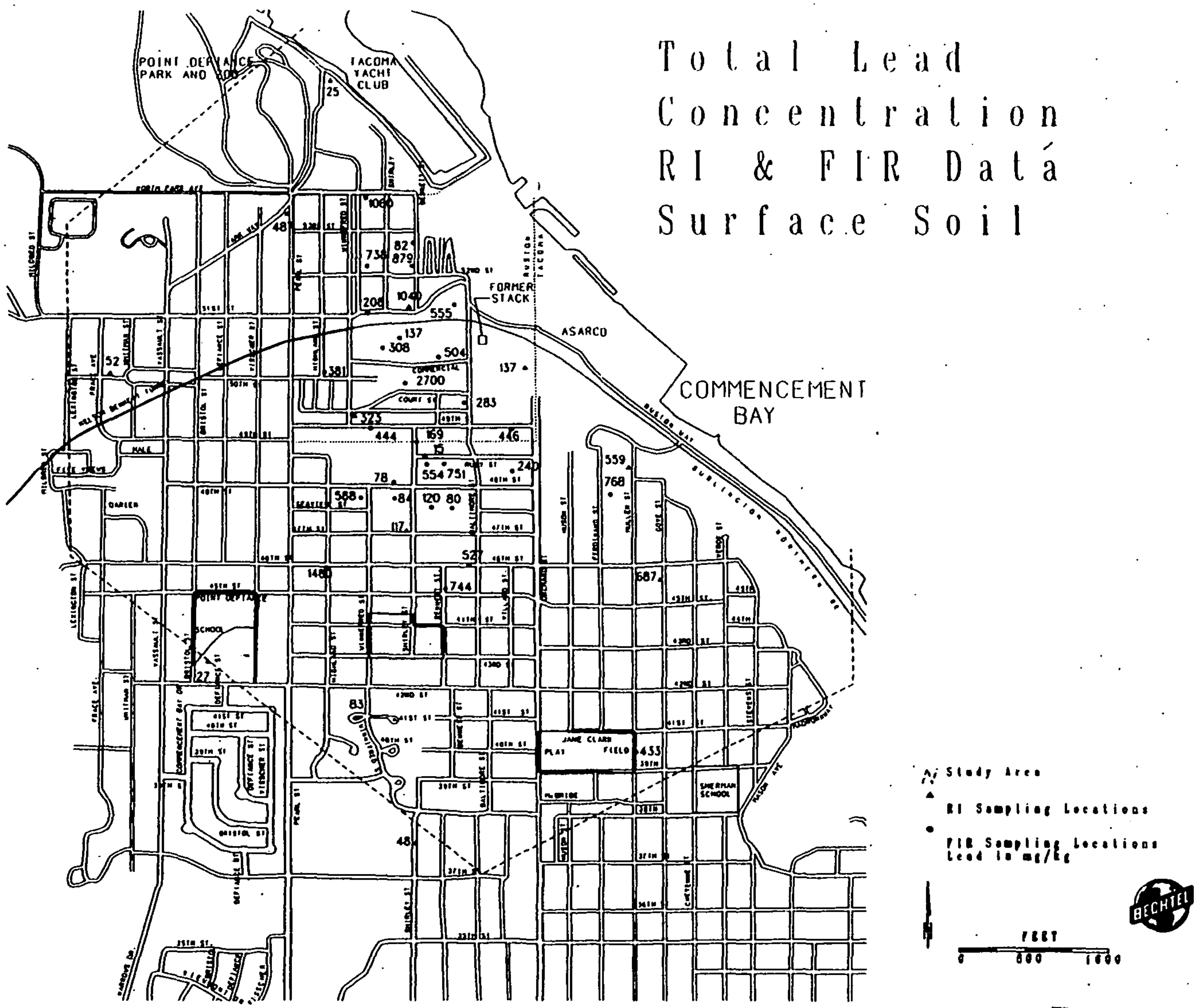

Total Arsenic Distribution FIR & RI Data Surface Soil
POINT DEFIANCE PARK AND ZOO
TACOMA YACHT CLUB
FORMER STACK
ASARCO
COMMENCEMENT BAY
JANE CLARK PLAY FIELD
SHERMAN SCHOOL
POINT DEFIANCE SCHOOL
Key to Arsenic mg/kg
0 to 46
47 to 230
231 to 400
401 to 800
Greater Than 800
Study Area
RI Sampling Locations
FIR Sampling Locations
FEET
0 800 1600

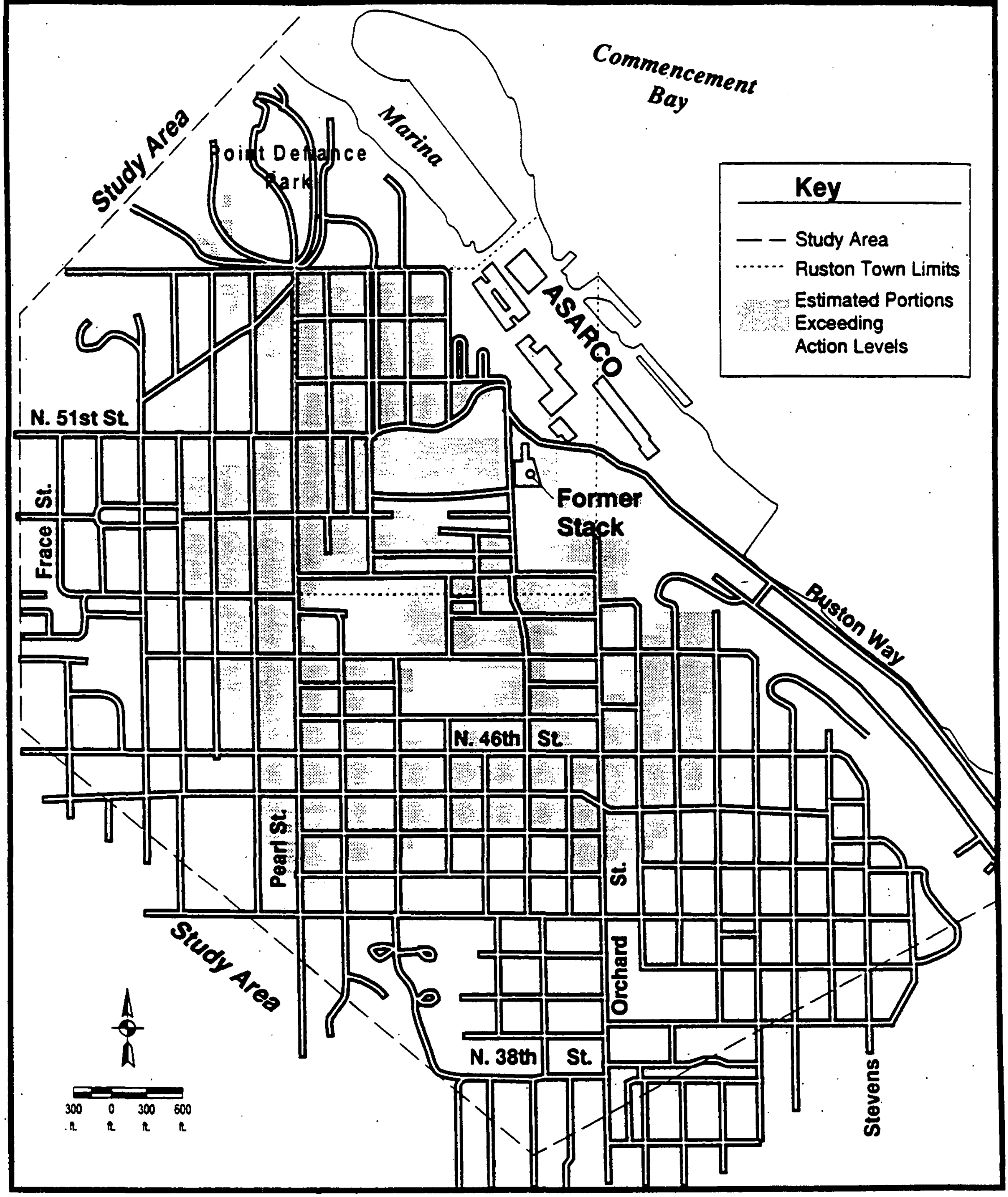
FIGURE 3



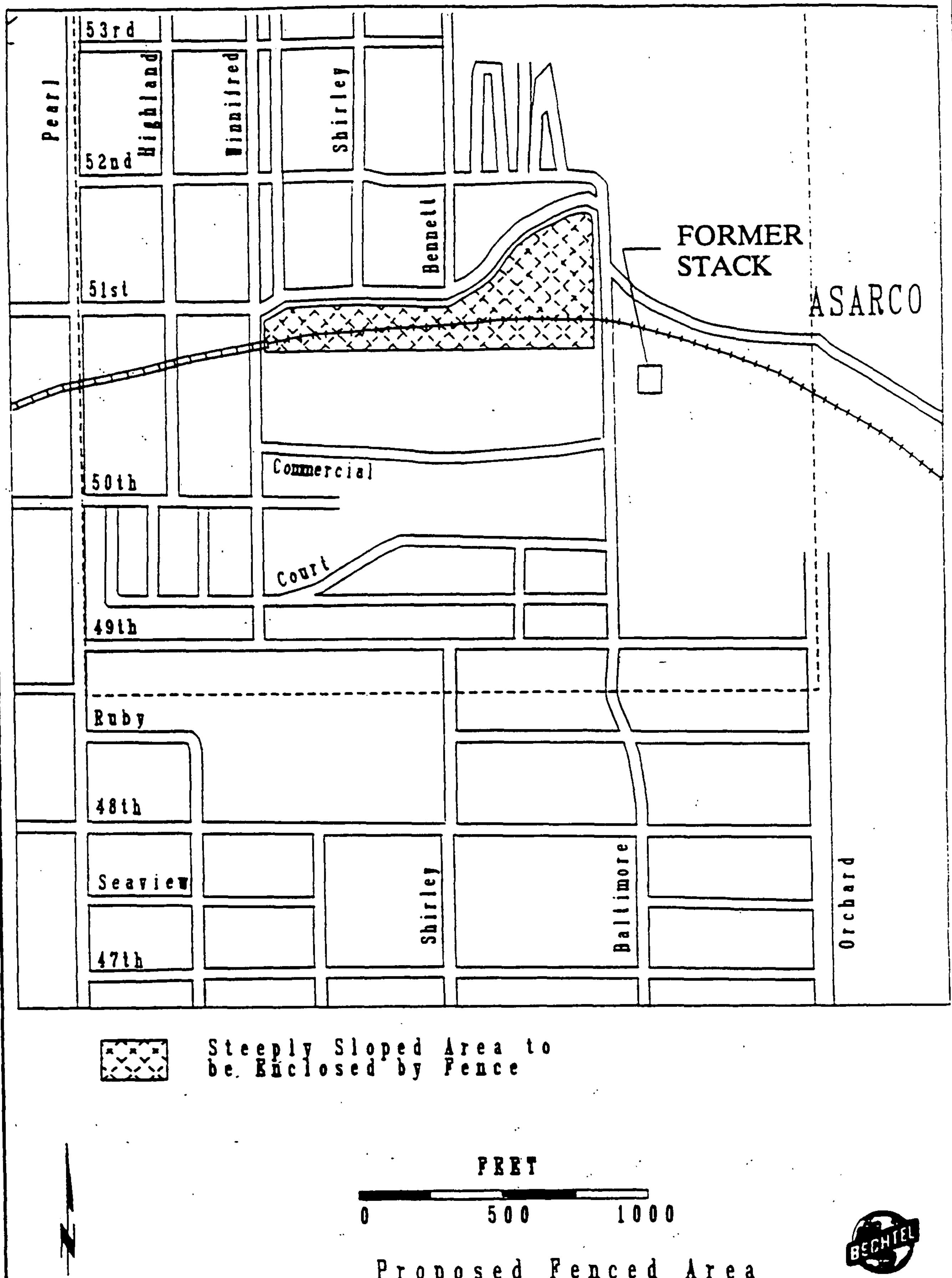
Total Lead
Concentration
RI & FIR Data
Surface Soil
POINT DEFIANCE PARK AND ZOO
TACOMA YACHT CLUB
FORMER STACK
ASARCO
COMMENCEMENT BAY
POINT DEFIANCE SCHOOL
JANE CLARK PLAY FIELD
SHERMAN SCHOOL
25
1060
481
738
82
879
208
1040
555
137
308
504
381
2700
137
283
323
444
169
446
10
554
751
240
559
768
78
84
588
120
80
117
527
1480
744
687
27
83
433
48
Study Area
RI Sampling Locations
FIR Sampling Locations
Lead in mg/kg
FEET
0
800
1600
BECHTEL

FIGURE 4

Figure 5:
Study Area and Estimated Portions Exceeding Action Levels



Based on the existing sampling results, EPA has estimated that the areas which are shaded on the map may require cleanup because they most likely exceed EPA's action levels. There could, however be properties within the shaded area that have soils with contamination below the action levels, and/or properties outside the estimated area that have contamination in excess of the action levels.



Proposed Fenced Area

FIGURE 6

TABLES

Table 1
RUSTON/NORTH TACOMA STUDY AREA
INFORMATION REPOSITORIES

Study Area	Address
In Tacoma:	McCormick Regional Branch Library 3722 North 26th (206) 591-5640 Tacoma Public Library, Main Branch * 1102 Tacoma Avenue, NW Room (206) 591-5622 City of Tacoma Environmental Commission 747 Market Street, Suite 900 (206) 591-5310 Tacoma Pierce County Health Dept. 3633 Pacific Avenue (206) 591-6553 Pacific Lutheran Library 121st & South Park Avenue (206) 535-7500 Citizens for a Healthy Bay 771 Broadway (206) 383-2429
In Ruston:	Ruston Town Hall 5117 North Winnifred (206) 759-3544
In Seattle:	U.S. Environmental Protection Agency * 1200 Sixth Avenue 7th Floor, Records Center (206) 553-4494
In Olympia:	Washington Department of Ecology 4415 Woodview Drive, S.E. (206) 438-3017

* The Administrative Record for the Ruston/North Tacoma Study Area is available at these two locations.

Table 2
LIST AND DESCRIPTION OF FACT SHEETS AND BROCHURES REGARDING THE RUSTON/NORTH TACOMA STUDY AREA

Date	Topic(s)
4/27/89	Described cleanup work underway at ERA sites and announced EPA's intent to conduct an overall investigation of the Study Area. The fact sheet also included information about the availability of a Technical Assistance Grant for local community groups.
7/14/89	Disclosed EPA's request that Asarco conduct an RI/FS, and invited the community to join a community workgroup.
9/89	Provided update of all Superfund projects in Tacoma.
11/1/89	Summarized the first community workgroup meeting, and provided opportunity for property owners to request soil sampling.
2/12/90	Introduced EPA's Community Liaison, and provided an update of site activities and progress of the Community Workgroup.
2/90	Provided update of all Superfund projects in Tacoma including a status report on Ruston/North Tacoma.
5/2/90	Announced the final RI workplan and EPA's plans to contact private property owners for access for sampling. Contained frequently asked questions and EPA's responses. Updated ERA activities and the Community Workgroup.
6/8/90	Announced the beginning of soil sampling and introduced EPA's new project manager.
8/90	Provided update of all Superfund projects in Tacoma including a status report on Ruston/North Tacoma.
11/5/90	Summarized soil sampling results, provided TPCHD recommendations for reducing exposure to soil contamination, and invited residents to a special Community Workgroup meeting to discuss the sample results.
2/13/91	Provided update of all Superfund projects in Tacoma, including the ERA sites, and the status of the Ruston/North Tacoma RI. Also included information on EPA's Community Workgroup and community interviews which were underway.
5/6/91	Provided update of all Asarco Superfund projects including community interviews and Community Workgroup for the Ruston/North Tacoma Study Area.
8/6/91	Provided update of all Superfund projects in Tacoma including the Ruston/North Tacoma RI, the Coordinating Forum, and Ecology's soil collection service for Study Area residents.
10/91	Distributed brochure describing all of the Superfund activities related to the Asarco smelter including the Ruston North Tacoma Study Area, the smelter site investigation and demolition, and marine sediments. This brochure continues to be available to members of the community upon request, and is provided as a handout at all of EPA's public forums.

Table 2
LIST AND DESCRIPTION OF FACT SHEETS AND BROCHURES REGARDING THE RUSTON/NORTH TACOMA STUDY AREA

Date	Topic(s)
2/10/92	Announced 60-day public comment period on EPA's RI/FS and Risk Assessment reports and two public workshops.
3/92	Under a cooperative agreement with EPA, TPCHD developed two brochures related to handling and disposal of contaminated soil in both residential and commercial settings. These brochures were developed by TPCHD with input from EPA, Department of Ecology and the members of the Coordinating Forum. TPCHD distributed the residential brochures via a bulk mailing to the Study Area. The commercial brochures were also mailed to a variety of interested groups and local government departments including: labor unions, schools, local parks, utilities and zoning departments, and business organizations. These brochures are also available at the permit counters in Tacoma and Ruston.
3/92	Provided update of all Superfund projects in Tacoma including the status of the first 60-day public comment period for Ruston/North Tacoma.
6/92	Distributed brochure for property owners, realtors, appraisers, and lending professionals to provide additional information on EPA's policies on liability for cleanup costs.
7/92	Summarized property transaction seminar held in June 1992.
7/14/92	Updated all Asarco Superfund projects including the Study Area. Also contained a summary of a property transactions seminar held by EPA.
8/14/92	Summarized EPA's Proposed Plan for cleanup. Provided information about the 60-day public comment period and two public meetings during that period.
11/92	Updated all Superfund projects in Tacoma including a status report on EPA's progress in responding to public comments and developing a Record of Decision. An update of ERA activities was also included.
1/11/93	Updated all Asarco Superfund projects including the Study Area.

Table 3
COMBINED REMEDIAL INVESTIGATION AND FIELD INVESTIGATION REPORT DATA FOR SURFACE AND SUBSURFACE SOIL SAMPLES FROM THE STUDY AREA

Range of metal concentrations in surface soils at 0 - 1" (in ppm):	
Arsenic:	7.0 to 3,000
Antimony:	0.0 to <4.3
Copper:	92.7 to 12,800
Mercury:	0.57 to 23.0
Cadmium:	<0.43 to 13.4
Lead:	24.7 to 2,700
Silver:	<0.84 to 30.6
Range of metal concentrations collected at 6 - 10" (in ppm):	
Arsenic:	2.1 to 2,900
Antimony:	<4.4 to 14.4
Copper:	79.7 to 1,080
Mercury:	0.0 to 0.36
Cadmium:	<0.48 to 15.2
Lead:	34.0 to 429
Silver:	<0.48 to 2.9
Range of metal concentrations collected at 12 - 16" (in ppm):	
Arsenic:	1.9 to 1,380
Antimony:	<4.7 to 13.7
Copper:	33.5 to 1,220
Mercury:	0.10 to 4.3
Cadmium:	<0.47 to 6.5
Lead:	6.5 to 660
Silver:	<0.47 to 3.8

Table 4
SUMMARY OF ARSENIC EXPOSURE FACTORS

Exposure Model		Age Group	Body Weight	Contact Rate	Frequency	Duration	Bioavailablity[a]	Arsenic Concentration
Ambient Air Inhalation		Adults	70 kg	20m³/day	350 day/yr	30 yrs	0.30	30 ng/m³
Soil/Dust Ingestion		0-6 yrs 6-30 yrs	15 kg 70 kg	200 mg/day 100 mg/day	350 day/yr 350 day/yr	6 yrs 24 yrs	0.80 0.80	140 mg/kg 300 mg/kg 500 mg/kg 800 mg/kg (RME) 1600 mg/kg
Pica Soil/Dust Ingestion		0-6 yrs 6-30 yrs	15 kg 70 kg	500 mg/day 100 mg/day	350 day/yr 350 day/yr	6 yrs 24 yrs	0.80 0.80	140 mg/kg 300 mg/kg 500 mg/kg 800 mg/kg (RME) 1600 mg/kg
Slag/Dust Ingestion	slag dust	0-6 yrs 0-6 yrs	15 kg 15 kg	22.5 mg/day[b] 110 mg /day	350 day/yr 350 day/yr	6 yrs 6 yrs	0.40 0.40	10,000 mg/kg 100 mg/kg
	slag dust	6-30 yrs 6-30 yrs	70 kg 70 kg	11.25 mg/day[b] 55 mg/day	350 day/yr 350 day/yr	24 yrs 24 yrs	0.40 0.40	10,000 mg/kg 100 mg/kg
Dermal Contact		0-6 yrs 6-30 yrs 6-30 yrs	15 kg 70 kg 70 kg	3900 mg[c] 1900 mg[c] 5000 mg	350 day/yr 263 day/yr 87 day/yr	6 yrs 24 yrs 24 yrs	0.0015 0.0015 0.0015	140 mg/kg 300 mg/kg 500 mg/kg 800 mg/kg (RME) 1600 mg/kg

a Bioavailability factors are pathway specific according to the Baseline Risk Assessment.

b The slag/dust model incorporates a contact rate allocation factor that accounts for time and behavioral differences for indoor and outdoor exposures. The RME assumption is that 0.45 of the contact rate is associated with outdoor activities (i.e. slag and soil) and 0.55 is associated with indoor dust. The RME also assumes that 25% of the outdoor exposure is associated with slag at 10,000 mg/kg in the Baseline Risk Assessment.

c The dermal contact rate incorporates the area of skin exposed (cm^2) for winter and summer and a factor of 1.0 mg/cm^2 for adherence of soil particles to skin.

Definitions: kg = kilograms, m^3/day = cubic meter per day, ng/m^3 = nanograms per cubic meter, mg/day = milligrams per day, mg/kg = milligram per kilogram or parts per million (ppm), RME = reasonable maximum exposure.

Table 5
EXPOSURE FACTORS FOR THE GARDEN VEGETABLE EXPOSURE MODEL FOR ARSENIC

Vegetable Class	Age Group	Body Weight	Contact Rate[a]	Frequency[b]	Duration	Bioavailability	Plant Uptake Factor[c]	Soil Arsenic Concentration
Fruity	0-6 yrs 6-30 yrs	15 kg 70 kg	3.2 g/day 8.8 g/day	0.39 0.39	6 yrs 24 yrs	1.0 1.0	0.0014 0.0009 0.00066 0.0005 0.0003	140 mg/kg 300 mg/kg 500 mg/kg 800 mg/kg (RME) 1600 mg/kg
Leafy	0-6 yrs 6-30 yrs	15 kg 70 kg	0.3 g/day 1.4 g/day	0.11 0.11	6 yrs 24 yrs	1.0 1.0	0.02 0.02 0.02 0.02 0.02	140 mg/kg 300 mg/kg 500 mg/kg 800 mg/kg (RME) 1600 mg/kg
Root	0-6 yrs 6-30 yrs	15 kg 70 kg	1.5 g/day 2.5 g/day	0.19 0.19	6 yrs 24 yrs	1.0 1.0	0.0014 0.0009 0.00066 0.0005 0.0003	140 mg/kg 300 mg/kg 500 mg/kg 800 mg/kg (RME) 1600 mg/kg
Potatoes	0-6 yrs 6-30 yrs	15 kg 70 kg	8.7 g/day 23.5 g/day	0.11 0.11	6 yrs 24 yrs	1.0 1.0	0.0014 0.0009 0.00066 0.0005 0.0003	140 mg/kg 300 mg/kg 500 mg/kg 800 mg/kg (RME) 1600 mg/kg
Legumes	0-6 yrs 6-30 yrs	15 kg 70 kg	22.3 g/day 44.9 g/day	0.62 0.62	6 yrs 24 yrs	1.0 1.0	0.0014 0.0009 0.00066 0.0005 0.0003	140 mg/kg 300 mg/kg 500 mg/kg 800 mg/kg (RME) 1600 mg/kg

a Dry weight basis. Source: USEPA Methodology for Assessing Health Risks Associated with Indirect Exposure to Combustor Emissions, Interim Final, EPA/600/6-90/003, January 1990. See also Appendix G of the Baseline Risk Assessment.

b Diet fraction grown at home (see Appendix E of the Baseline Risk Assessment).

c Site specific factors (see Appendix E of the Baseline Risk Assessment).

Definitions: kg = kilograms, g/day = grams per day, mg/kg = milligram per kilogram or parts per million (ppm), RME = reasonable maximum exposure.

Table 6
SUMMARY OF AVERAGE DAILY DOSE AT VARIOUS SOIL ARSENIC CONCENTRATIONS

Soil Arsenic Concentration	Averaging Time	Exposure Model				
		Pica (mg/kg/day)	Soil/Dust (mg/kg/day)	Vegetable (mg/kg/day)		Dermal (mg/kg/day)
				3 classes[a]	5 classes[b]	
20 mg/kg (urban background)	30 yrs 70 yrs	1.2×10^{-4} 5.1×10^{-5}	5.8×10^{-6} 2.5×10^{-6}	2.7×10^{-6} 1.2×10^{-6}	1.8×10^{-5} 7.7×10^{-6}	2.4×10^{-6} 1.0×10^{-6}
140 mg/kg (50[th] percentile)	30 yrs 70 yrs	8.4×10^{-4} 3.6×10^{-4}	4.1×10^{-4} 1.8×10^{-4}	1.9×10^{-6} 8.1×10^{-6}	1.3×10^{-4} 5.4×10^{-5}	1.7×10^{-5} 7.1×10^{-6}
300 mg/kg (75[th] percentile)	30 yrs 70 yrs	1.8×10^{-3} 7.7×10^{-4}	8.8×10^{-4} 3.8×10^{-4}	3.1×10^{-6} 1.3×10^{-6}	1.8×10^{-4} 7.6×10^{-5}	3.6×10^{-6} 1.5×10^{-6}
500 mg/kg (90[th] percentile)	30 yrs 70 yrs	3.0×10^{-3} 1.3×10^{-3}	1.5×10^{-3} 6.3×10^{-4}	4.3×10^{-6} 1.9×10^{-6}	2.2×10^{-4} 9.6×10^{-5}	5.9×10^{-6} 2.5×10^{-6}
800 mg/kg (RME)	30 yrs 70 yrs	4.8×10^{-3} 2.1×10^{-3}	2.3×10^{-3} 1.0×10^{-3}	6.1×10^{-6} 2.6×10^{-6}	2.8×10^{-4} 1.2×10^{-4}	9.5×10^{-6} 4.1×10^{-6}
1600 mg/kg (99[th] percentile)	30 yrs 70 yrs	9.6×10^{-3} 4.1×10^{-3}	4.7×10^{-3} 2.0×10^{-3}	1.0×10^{-4} 4.4×10^{-5}	3.8×10^{-4} 1.6×10^{-4}	1.9×10^{-4} 8.1×10^{-5}

a 3 Classes = fruity, leafy and root

b 5 Classes = fruity, leafy, root, potatoes and legumes

Definitions: mg/kg/day = milligram per killogram per day,
mg/kg = milligram per kilogram or parts per million (ppm),
RME = reasonable maximum exposure.

Table 7
AVERAGE DAILY DOSE FOR ARSENIC IN THE SLAG/DUST AND AIR RME MODELS

Averaging Time	Exposure Model	
	Slag/Dust (mg/kg/day)	Air (mg/kg/day)
30 yrs	1.7×10^{-3}	2.5×10^{-6}
70 yrs	7.4×10^{-4}	1.1×10^{-6}

Definitions:
RME = reasonable maximum exposure,
mg/kg/day = milligram per killogram per day

Table 8
EXPOSURE PARAMETER AVERAGE VALUES FOR THE UBK MODEL
FOR 0 TO 6 YEAR OLD CHILDREN

Parameter	Value
Outdoor air lead ($\mu g/m^3$)	0.04*
Indoor air lead ($\mu g/m^3$)	0.032*
Time spent outdoors (hour/day)	3
Time weighted average ($\mu g/m^3$)	0.033
Breathing volume (m^3/day)	4.5
Lead intake from breathing air (µg/day)	0.14
Percent respiratory deposition/absorption	32
Lead uptake from air (µg/day)	0.045
Lead intake from diet (µg/day)	6.38
Percent gastrointestinal absorption	50
Lead uptake from diet (µg/day)	3.19
Outdoor soil lead (µg/g)	15 to 2700*
Indoor dust lead (µg/g)	15 to 2700*
Daily soil-dust ingestion rate (mg/day)	100
Weighing factors (soil/dust)	45/55
Lead intake from dust and soil (µg/day)	Variable
Percent gastrointestinal absorption	30
Lead uptake from dust and soil (µg/day)	Variable
Drinking water lead, U.S. average (µg/l)	4
Drinking water intake (l/day)	0.48
Lead intake from drinking water (µg/day)	1.92
Percent gastrointestinal absorption	50
Lead uptake from drinking water (µg/day)	0.96

* Site specific parameters. All others are EPA default values.

Source: adapted from USEPA Technical Support Document on Lead, ECAO-CIN-757, Jan. 1991, (Do Not Cite or Quote).

Definitions: UBK = Uptake Biokinetic Model, $\mu g/m^3$ = micrograms per cubic meter, m^3/day = cubic meter per day, µg/day = microgram per day, µg/g = microgram per gram or parts per million (ppm), mg/day = milligram per day, µg/l = microgram per liter, l/day = liter per day.

Table 9
ESTIMATED LEAD UPTAKE BY CHILDREN[a]
IN STUDY AREA

Soil Concentration (mg/kg)	Approximate Percentile[b]	Pathway Specific Intake[c]				Total Intake (µg/day)
		Air (µg/day)	Water (µg/day)	Diet (µg/day)	Soil/Dust (µg/day)	
20[d]	NA	0.045	0.96	3.19	0.6	4.8
250[e]	42	0.045	0.96	3.19	7.5	11.7
380	50	0.045	0.96	3.19	11.4	15.6
485	60	0.045	0.96	3.19	14.55	18.7
555	70	0.045	0.96	3.19	16.65	20.8
700	80	0.045	0.96	3.19	21.0	25.2
880	90	0.045	0.96	3.19	26.4	30.6
1060	95	0.045	0.96	3.19	31.8	36.0
1480	98	0.045	0.96	3.19	44.4	48.6
2700	100	0.045	0.96	3.19	81.0	85.2

a Zero to six year-old children
b Ranked for 41 data points (Remedial Investigation and Field Investigation Report)
c Based on UBK model output for specific soil concentrations
d Typical western U.S. soil background lead concentration
e Upper-percentile urban background lead concentration
NA = Not included as one of the 41 data points
Definitions: mg/kg = milligram per kilogram or parts per million (ppm),
µg/day = microgram per day

Table 10
ESTIMATED UPPER BOUND LIFETIME CANCER RISKS FROM EXPOSURE TO ARSENIC[a]

Exposure Pathway	Estimated Cancer Risk[b]
<u>Air inhalation:</u> (lung cancer)	5×10^{-5}
Air at 30 nanograms/cubic meter	
<u>Ingestion by:</u> (skin cancer:	
Soil/house dust at 800 ppm	2×10^{-3}
Garden vegetables at 800 ppm soil	5×10^{-5}
3 classes[c]	2×10^{-4}
5 classes[d]	1×10^{-3}
Slag/house dust	
Slag at 10,000 ppm	
House dust at 100 ppm	4×10^{-3}
Pica soil/house dust at 800 ppm	
<u>Dermal absorption:</u> (skin cancer)	7×10^{-5}
Soil at 800 ppm	

a Estimated cancer risks will vary depending on the soil arsenic concentration in individual yards. In this table, cancer risks at 800 ppm soil arsenic are used as an example to show the reasonable maximum exposure - the highest exposure reasonably expected to occur. Only five percent of the Study Area is expected to have soil arsenic concentrations exceeding 800 ppm. Risks will be less for those areas with lower soil arsenic concentrations.

b The cancer potency factor (slope factor) used for calculating risks for the ingestion and dermal absorption exposure pathways is 1.75 per mg/kg/day. The cancer potency factor (slope factor) used for calculating risks for the air inhalation exposure pathway is 50 per mg/kg/day. These factors were taken from the Integrated Risk Information System (IRIS).

c Fruity, leafy, and root.

d Fruity, leafy, root, potatoes, and legumes.

Table 11
ESTIMATED LIFETIME NONCANCER RISKS FROM EXPOSURE TO ARSENIC[a]

Exposure Pathway	Hazard Quotient[b]
<u>Ingestion by:</u>	
	2.9 to 7.8
Soil/house dust at 800 ppm	
Garden vegetables at 800 ppm soil	0.1 to 0.2
3 classes[c]	0.3 to 0.9
5 classes[d]	2.2 to 5.8
Slag/house dust	
Slag at 10,000 ppm	
House dust at 100 ppm	6.0 to 16.0
Pica soil/house dust at 800 ppm	
<u>Dermal absorption:</u>	0.1 to 0.3
Soil at 800 ppm	

a Estimated noncancer risks will vary depending on the soil arsenic concentration in individual yards. In this table, noncancer risks at 800 ppm soil arsenic are used as an example to show the reasonable maximum exposure - the highest exposure reasonably expected to occur. Only five percent of the Study Area is expected to have soil arsenic concentrations exceeding 800 ppm. Risks will be less for those areas with lower soil arsenic concentrations.

b As the Hazard Quotient rises above a value of "1", the potential for noncancer effects increases. A reference dose range of 0.3 ug/kg/day to 0.8 ug/kg/day was used in calculating these hazard quotients. This reference dose range was taken from the IRIS.

c Fruity, leafy, and root.

d Fruity, leafy, root, potatoes, and legumes.

TABLE 12

REMEDIAL ACTION OBJECTIVES AND REMEDIATION GOALS

REMEDIAL ACTION OBJECTIVES

Contaminant	Arsenic	Lead
Environmental Media	Soil	Soil
Exposure Pathway	Direct contact and incidental ingestion	Direct contact and incidental ingestion
Exposed Population	Current and future residents of north Tacoma and Ruston	Current and future residents of north Tacoma and Ruston
Remedial Action Objectives for Arsenic and Lead	Reduce potential exposure of current and future community residents to soil and dust so that these exposures will be within acceptable risk levels. Reduce the potential transport of soil contaminants inside homes or other buildings where exposures may occur.	

REMEDIATION GOALS

Contaminant	Arsenic	Lead
Goal	Reduce arsenic exposures to ensure that the upper-bound lifetime excess cancer risk to an individual is between 10^{-4} and 10^{-6}	Reduce exposures to lead to ensure that no individual has greater than a 5 percent chance of exceeding a blood lead level criterion of 10 µg of lead per deciliter of blood (10 µg/dL)
Contaminant Concentrations in Soil	230 ppm of arsenic	500 ppm of lead

TABLE 13
SUMMARY OF REMEDIAL ACTION ALTERNATIVES

Remedial Action Technologies/Options	Preferred Alternative	Feasibility Study Remedial Action Alternatives					
		1 No action	2 Limited Action	3 Sod and Asphalt Cap	4 One Foot Excavation and Onsite Storage	5 One Foot Excavation and Offsite Disposal	6 Excavation to Background Levels
No action		●					
Community protection measures	○		●	●	●	●	○
Sod/vegetation required	●			●	●	●	●
Underground utility construction implications	●				○	○	●
Temporary relocation	○						○
Soil cap	●				●	●	●
Asphalt cap (dirt alleys and parking areas)	●			●	●	●	●
Soil removal and backfill	●			●	●	●	●
Sampling to determine necessary depth of excavation	●						●
Off-site disposal	●			●	○	●	●
Environmental monitoring@	●			●	●	●	●
Fencing steeply sloped areas	●			●	●	●	●

Note:

● Indicates that technology is definitely applicable.

○ Indicates that technology may be applicable.

@ Environmental monitoring may be used to reassess the extent of contamination during the implementation of a remedy, to ensure the safety of cleanup personnel and residents during remedial action, to aid in the determination of the effectiveness of the remedial actions, or to create a baseline against which to measure exposure potential or reduction in lieu of remedial action.

TABLE 14

UNIT QUANTITY ESTIMATES FOR REMEDIAL ACTION LEVELS OF 230 ppm AND GREATER OF ARSENIC AND 500 ppm AND GREATER OF LEAD

Item	Preferred Alternative	Alternative 3, Asphalt Capping and Sodding	Alternatives 4 and 5, Excavation and Onsite Storage & Excavation and Offsite Disposal	Alternative 6, Excavation Until Background Concentrations of Arsenic and Lead are Achieved
Total number of acres as part of Alternative	273	273	273	273
Number of non-paved acres requiring remedial action+	109	109	109	109
Estimated number of residential lots included in action++	525	525	525	525
Soils removed/replaced at residential lots (cubic yards)+++	168,000	14,660	176,000	330,000
Sod required as cover (square yard)	528,000	528,000	528,000	528,000
Soils removed from alleys and unpaved parking lots (cubic yards)	11,000	11,000	11,000	11,000
Fencing required (linear feet)	3,500	3,500	3,500	3,500
Asphalt cap cover for alleys and parking lots (square yard)	66,000	66,000	66,000	66,000
Number of years to completion	7 years	1 year	7 years	12 years

Note: For Alternative 3 removal and replacement volumes are based upon placement of a 1 inch sod layer which is estimated to result in the removal of about two inches of soil over 50 percent of the area to be sodded.

For Alternatives 4 and 5 removal and replacement volumes are based upon a depth of excavation of 1 foot. The selection of 1 foot is based upon experience gained at similar sites, but the actual depth of excavation during remedial action may vary from this value.

\+ Value in table is approximately 40% of the total acreage. This fraction represents the portion of the total surface area not covered by homes, paved roads, and sidewalks. A complete description of the derivation of this percentage value is provided in the text, Section 2.4 of the feasibility study.

\+ + Number of homes within the designated total area. Estimate was made through inspection of aerial photographs of the site taken in 1988.

\+ + + Value represents volume of soil excavated and disposed. An equivalent volume of uncontaminated soil will be required as backfill.

Table 15	
EVALUATION CRITERIA	
EPA uses nine criteria to identify its preferred alternative for a given site or contaminant. With the exception of the no action alternative, all alternatives must meet the first two "threshold" criteria. EPA uses the next five criteria as "balancing" criteria for comparing alternatives and selecting a preferred alternative. After public comment, EPA may alter its preference on the basis of the last two "modifying" criteria.	
Threshold Criteria:	**1. Overall protection of human health and the environment** - How well does the alternative protect human health and the environment, both during and after construction? **2. Compliance with federal and state environmental standards** - Does the alternative meet all applicable or relevant and appropriate state and federal laws?
Balancing Criteria:	**3. Long-term effectiveness and permanence** - How well does the alternative protect human health and the environment after completion of cleanup? What, if any, risks will remain at the site? **4. Reduction of toxicity, mobility, or volume through treatment** - Does the alternative effectively treat the contamination to significantly reduce the toxicity, mobility, and volume of the hazardous substance? **5. Short-term effectiveness** - Are there potential adverse effects to either human health or the environment during construction or implementation of the alternative? How fast does the alternative reach the cleanup goals? **6. Implementability** - Is the alternative both technically and administratively feasible? Has the technology been used successfully on other similar sites? **7. Cost** - What are the estimated costs of the alternative?
Modifying Criteria:	**8. State acceptance** - What are the state's comments or concerns about the alternatives considered and about EPA's preferred alternative? Does the state support or oppose the preferred alternative? **9. Community acceptance** - What are the community's comments or concerns about the preferred alternative? Does the community generally support or oppose the preferred alternative?

Table 16
RUSTON/NORTH TACOMA -- SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

PART A: ALTERNATIVES AND CORRESPONDING ARARs

Description of FS Alternative	Applicable or relevant and appropriate requirements (ARARs) -- number corresponds to summary of statutory or regulatory requirements described below
Alternative 1 -- No action.	ARARs are not triggered for "no action" alternative.
Alternative 2 -- Limited action.	Under MTCA (see no. 2), limited action, or an action that relies primarily on inconstitutional controls or monitoring, is not acceptable where it is technically possible to implement a cleanup action alternative that utilizes a higher preference cleanup technology. If a component of a limited action remedy includes a soil collection service, see disposal requirements under no. 1.
Alternative 3 -- Containment of contaminated soil using asphalt capping and sodding.	See nos. 2, 5, 6, 7, 8, and 9. To the extent that excavation is conducted, see also 1, 3, and 4.
Alternative 4 -- Excavation of one foot of contaminated soil, backfilling with clean/uncontaminated soil, temporary storage of contaminated soil at Asarco smelter, and final disposal at a) Asarco smelter, or b) permitted land disposal facility.	See nos. 1 through 9.
Alternative 5 -- Excavation of one foot of contaminated soil, backfilling with clean/uncontaminated soil, disposal at permitted land disposal facility.	See nos. 1 through 9.
Alternative 6 -- Excavation of contaminated soil until background concentrations of arsenic and lead are achieved.	See nos. 1 through 9.
Preferred Alternative/Selected Remedy -- Excavation of contaminated soil to a maximum depth of 18 inches, backfilling with clean/uncontaminated soil, disposal or beneficial use on-site (if allowable under smelter cleanup) or disposal off-site in accordance with Ecology's final decision on petition for dangerous waste exemption.	See nos. 1 through 9.

Table 16

RUSTON/NORTH TACOMA -- SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

PART B: THE ARARs EXPLAINED

Statute or Regulation	Status	Requirement
(1) Dangerous Waste Regulations (WAC 173-303); Minimum Functional Standards for Solid Waste Handling (WAC 173-304).	Applicable to disposal of soil with concentrations of arsenic above 100 ppm **(WAC 173-303-103).** Relevant and appropriate to construction of storage or disposal areas on the smelter site (if allowable under smelter cleanup). State's area of contamination policy is a to-be-considered (TBC) rather than an ARAR.	WAC 173-303-141 requires that dangerous waste be taken to treatment, storage, or disposal (TSD) facility with RCRA permit or interim status authorization or facility that will legitimately treat or recycle waste. **[Note: Shaded language describes how the selected remedy will attain the requirements identified as applicable or relevant and appropriate.]** Ecology is evaluating Asarco's petition for exemption from the DW regulations. EPA expects that Ecology's decision on the exemption, when issued, will specify requirements for disposal of Ruston soil in an off-site facility. Ecology's dangerous waste requirements will be attained through compliance with Ecology's final decision. State's area of contamination policy states that dangerous waste may be consolidated, contained, or treated within the area of contamination without triggering the applicability of final disposal requirements, but such requirements may be relevant and appropriate.

Table 16
RUSTON/NORTH TACOMA -- SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

PART B: THE ARARs EXPLAINED (Continued)

Statute or Regulation	Status	Requirement
		WAC 173-303-660 specifies that "waste piles" (i.e., storage areas) shall be (1) covered to prevent wind dispersal and to prevent infiltration of rainfall, (2) include run-on and run-off control systems, and (3) include a drainage system to collect leachate within the pile. WAC 173-330-665 specifies requirements for landfills (i.e., disposal areas). Waste that is not a dangerous waste (e.g., contaminated vegetation) but is removed as a result of excavation should be disposed at a municipal landfill in compliance with minimum functional standards under WAC 173-304.
(2) Model Toxics Control Act (MTCA)(70.105D RCW; WAC 173-340).	Applicable to cleanup of contaminated soil.	Cleanup standards are described in WAC 173-340-700-707 and -740. Cleanup actions are described in WAC 173-340-360 (actions are ranked by preference -- treatment to disposal in landfill (on- or off-site) to containment to institutional controls). Institutional controls are described in WAC 173-340-440. For Ruston/North Tacoma site, EPA and Ecology have interpreted MTCA to require engineering methods (e.g., capping and/or soil removal) for properties above "action

Table 16
RUSTON/NORTH TACOMA -- SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

PART B: THE ARARs EXPLAINED (Continued)		
Statute or Regulation	Status	Requirement
		levels" -- arsenic concentration above 230 ppm and lead concentration above 500 ppm. "Replacement" soil (i.e., soil that is used to replace contaminated soil that is removed) must be below concentrations commonly found in urban areas -- 20 ppm arsenic and 250 ppm lead. Requirements under MTCA will be attained by removing soil up to 18 inches in depth at properties that exceed action levels and replacing it with soil that does not exceed urban background levels. For Ruston/North Tacoma site, MTCA requires institutional controls for properties with soil with arsenic concentration between 20 and 230 ppm and properties where soil above 230 ppm arsenic remains below a cap of "clean" soil. This requirement will be attained through implementation of an education program, use of a database of sample results, and other community protection measures (see Section 9.10 of ROD).

Table 16
RUSTON/NORTH TACOMA -- SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

PART B: THE ARARs EXPLAINED (Continued)

Statute or Regulation	Status	Requirement
(3) Clean Air Act -- National Ambient Air Quality Standards (NAAQS)(40 C.F.R. Part 50). State Ambient Air Quality Standards (WAC 173-470). Cleanup Standards To Protect Air Quality (WAC 173-340-750).	Relevant and appropriate to activities that may result in emissions of contaminants.	Requires that ambient concentrations of lead not exceed 1.5 milligrams per cubic meter based on quarterly average, that particulates not exceed 50 micrograms per cubic meter annually and not exceed 150 micrograms per cubic meter for any 24-hour period. This requirement will be attained through dust control measures and monitoring during excavation activities.
(4) Puget Sound Air Pollution Control Agency (PSAPCA) Regulation 1.	Applicable to activities that may result in emissions of fugitive dust and hazardous *contaminants, including arsenic.*	Regulation 1 requires use of best available control technology to control emissions of *fugitive dust.* This requirement will be attained through dust control measures and monitoring during excavation activities.
(5) Surface water cleanup standards (WAC 173-340-730); State water quality standards for surface waters (WAC 173-203).	Applicable to activities that may result in discharges of contaminants into surface waters.	Requires treatment, removal, or containment measures to reduce discharges of hazardous substances into surface water (e.g., runoff from excavated areas), consistent with water quality standards for surface waters not to be exceeded. This requirement will be attained through drainage protection measures and periodic monitoring of surface water in order to ensure standards are not exceeded as a result of cleanup actions.

Table 16
RUSTON/NORTH TACOMA -- SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

PART B: THE ARARs EXPLAINED (Continued)

Statute or Regulation	Status	Requirement
(6) Coastal Zone Management Act (16 U.S.C. § 1451) and Shoreline Management Act (90.58 RCW).	Applicable to development activities within 200 feet of shoreline.	Requires that development activities within 200 feet of shoreline be conducted in a manner consistent with approved state management programs. There are no surface water bodies on or in the immediate vicinity of the Study Area other than seasonal storm water drainage swells and gullies that flow into Commencement Bay.
(7) EPA Policy on Wetlands (40 C.F.R. Part 6, Appendix A). State designation of wetlands (WAC 173-22-040).	Considered for activities involving wetlands.	Requires determination of whether wetlands are present within site. If so, avoid adverse effects, minimize potential harm, and preserve and enhance wetlands to the extent possible. State-designated wetlands are regulated under the Shoreline Management Act (see no. 6 above). Whether wetlands are present will be determined during remedial design/ remedial action.
(8) Endangered Species Act (16 U.S.C. § 1651).	Applicable to endangered or threatened species or habitats.	Requires determination whether endangered or threatened species or habitats are present within the site. If so, procedures for conserving such species or habitats must be followed. Whether endangered or threatened species or habitats are present will be determined during remedial design/ remedial action.

Table 16 RUSTON/NORTH TACOMA -- SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS		
PART B: THE ARARs EXPLAINED (Continued)		
Statute or Regulation	Status	Requirement
(9) National Historic Preservation Act (16 U.S.C. § 470). Archaeological Sites and Resources Act (27.53 RCW).	Applicable to properties included or eligible for listing on the National or State Register of Historic Places or properties .	Requires determination of whether listed or eligible properties are present within the site. If so, procedures for preserving properties or mitigating adverse effects must be followed. Whether eligible properties are present will be determined during remedial design/ remedial action.

Table 17
ESTIMATED COSTS OF REMEDIAL ACTION ALTERNATIVES (IN MILLIONS OF DOLLARS)

Alternative	Capital Cost	O & M	Total 1	Total 2
2	NA	$3	$3	$3
3	$20	$7	$27	$24
4a	$49	$7	$56	$43
4b	$80	$7	$87	$67
5	$75	$7	$82	$61
6	$117	$2	$119	$85
Preferred	$78	$2	$80	$59

Notes for Table 17

Alternative 4a Costs are for temporary storage and permanent disposal at the Asarco smelter facility.

Alternative 4b Costs are for temporary storage at the Asarco smelter facility followed by permanent disposal at an authorized off-site facility.

"Total 1" reflects estimated cost of disposal at a hazardous waste facility.

"Total 2" reflects estimated costs of disposal at a non-hazardous waste facility (i.e., capital costs are estimated to be less under "Total 2" than under "Total 1").

APPENDIX A

RUSTON/NORTH TACOMA RESIDENTIAL STUDY AREA RESPONSIVENESS SUMMARY