Asarco Tacoma Smelter Site

Final Interim Action Plan for the Tacoma Smelter Plume

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Tacoma Smelter Plume Team
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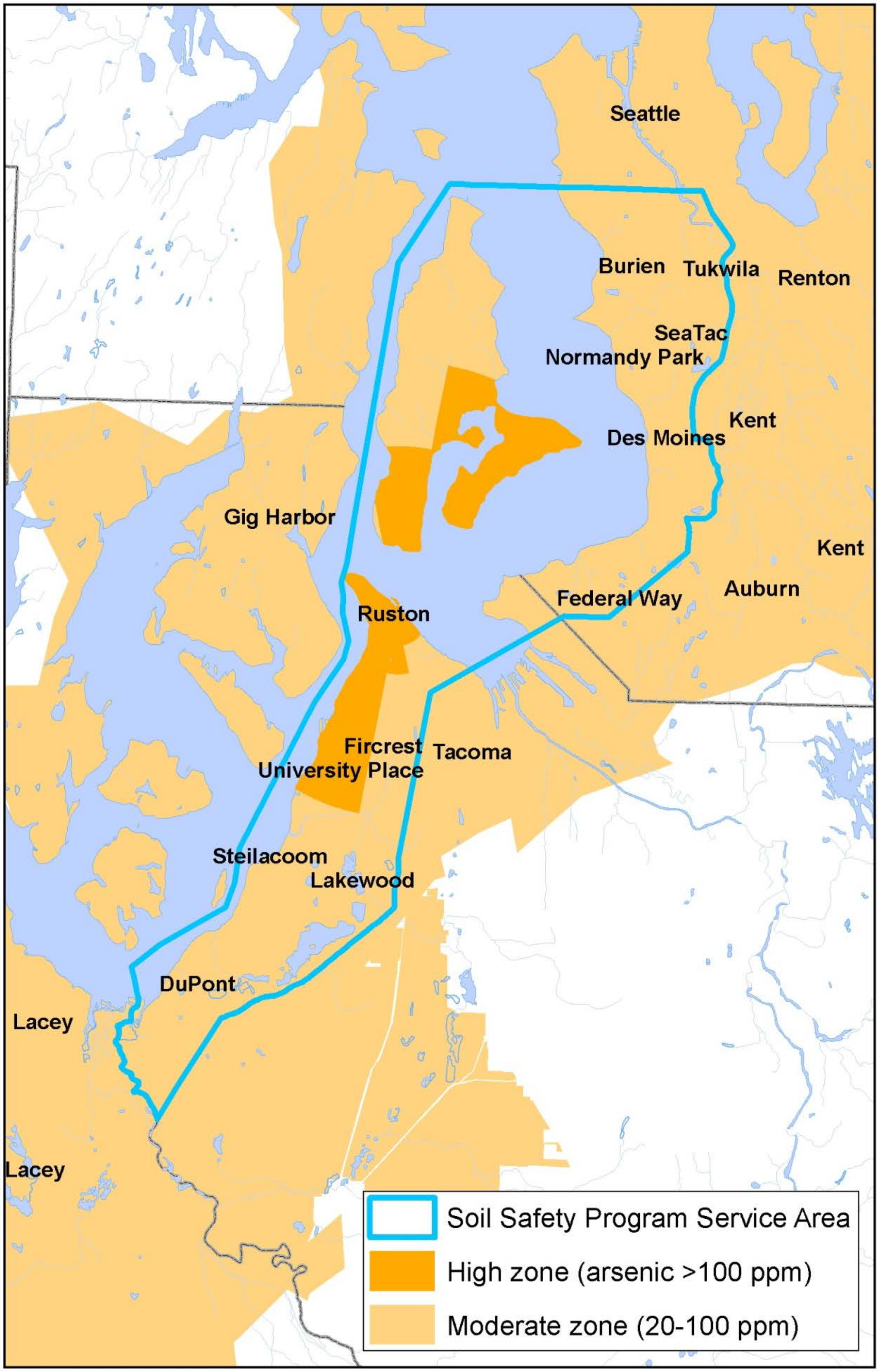
DEPARTMENT OF ECOLOGY
State of Washington


Seattle
Burien
Tukwila
Renton
SeaTac
Normandy Park
Kent
Des Moines
Gig Harbor
Kent
Federal Way
Auburn
Ruston
Fircrest
Tacoma
University Place
Steilacoom
Lakewood
DuPont
Lacey
Lacey
Soil Safety Program Service Area
High zone (arsenic >100 ppm)
Moderate zone (20-100 ppm)

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Executive Summary

The Interim Action Plan lays out what Ecology will do to manage risk and clean up some areas of the Tacoma Smelter Plume. Asarco's former plant in Tacoma polluted over 1,000 square miles with arsenic and lead. In late 2009, Ecology received $94 million from Asarco for cleanup as part of a bankruptcy settlement. The actions in this plan will lower risk for people living within the plume.

Ecology plans to take four main actions:

1. Cleaning up home yards in the worst areas of the plume.
2. Cleaning up play areas at schools, childcares, parks, camps, and multi-family public housing.
3. Educating people about risk and how to protect themselves.
4. Encouraging soil testing and cleanup during property development.

The plan focuses on two groups at greatest risk—people in areas in areas that may have the highest contamination and children. For these groups, Ecology plans to clean up yards and play areas. Ecology will also provide education and outreach and encourage voluntary cleanup.

Why Does It Matter?
Widespread soil arsenic and lead poses a risk to human health, especially for children. Arsenic contributes to cardiovascular disease, diabetes, and certain cancers. Lead can cause -developmental delays and behavioral problems in children.

Why Release a Cleanup Plan Now?
State cleanup law requires Ecology to write a cleanup plan for spending the settlement funds. Comments and questions from the October 20 – December 20, 2011 public comment periods helped to finalize this plan.

Layout of the Interim Action Plan and What to Comment On
Chapter 1 introduces the cleanup plan. Chapters 2-3 give the history of the plume and how Ecology is managing it. Chapter 4 describes how Ecology picked this general approach to cleanup. Chapters 8-10 cover topics required by state cleanup law, such as cleanup standards and other laws that apply to the cleanup.

Ecology's major decisions for you to comment on are the following chapters:

- **Chapter 5** goes into more detail on the four main actions listed above.
- **Chapter 6** describes how Ecology proposes sampling and cleaning up yards.
- **Chapter 7** covers "Phase Two" cleanup for areas not covered by this plan. It includes actions that Ecology needs more input on before starting.
- **Chapter 11** gives a set of five cleanup methods that can be used for Tacoma Smelter Plume contamination. These are called "model remedies." Appendix B gives a user-friendly guide to the model remedies.

Chapter 1 – Introduction and Summary

1.1 The Purpose of the Interim Action Plan Is to Manage Risk and Do Cleanup

This Interim Action Plan covers the Tacoma Smelter Plume portion of the Asarco Tacoma Smelter site. The Washington State Department of Ecology (Ecology) proposes four actions to address arsenic and lead soil contamination within the plume:

- Clean up yards through the proposed sampling and cleanup program.
- Clean up play areas through the existing Soil Safety Program.
- Raise awareness and promote behavior change through education and outreach.
- Encourage soil sampling and cleanup during property development.

Funding comes from the State of Washington's 2009 settlement with Asarco for the future costs of cleaning up the Tacoma Smelter Plume. The Interim Action Plan describes how Ecology will use the $94 million settlement to address the contamination and manage risk. The plan uses stakeholder input and lessons learned from working under the Tacoma Smelter Plume Management Plan (2006-2009). It also follows the intent of the Asarco settlement.

Tacoma Smelter Plume. For almost 100 years, Asarco ran a copper smelter in Ruston, Washington, a small town within the borders of the city of Tacoma. Air pollution from the smelter settled on surface soils (air deposition) over a vast region of the Puget Sound basin. The extent of contamination is over 1,000 square miles and is called the Tacoma Smelter Plume (see Appendix A.1 for a map). It covers parts of Pierce, King, Thurston, Snohomish, and Kitsap counties. Arsenic, lead, and other heavy metals remain in the soil as a result of this pollution.

Asarco Tacoma Smelter Site. The Asarco Tacoma Smelter site includes the Tacoma Smelter Plume and areas of the Commencement Bay Nearshore/Tideflats Superfund site. These areas, known as operable units (OUs), are the Asarco Smelter Facility (OU 02), Asarco Off-Property (OU 04), Asarco Sediments (OU 06), and Asarco Demolition (OU 07).

Phased Cleanup. The plume contains thousands of properties that may be contaminated. As a result, Ecology needs to do cleanup in stages, over many years. The Model Toxics Control Act regulation (173-340 WAC) has options for achieving cleanup. It offers the option of interim actions—partial cleanup actions that reduce a threat to human health or the environment. Ecology proposes two phases of interim actions. This document provides a plan for the first phase and outlines how Ecology will scope the second phase.

Interim Actions. Interim actions will lower risks to human health and the environment. Ecology proposes a mix of physical cleanup—digging, mixing, or capping—and institutional controls, which restrict access to contaminated soils. Section 1.3 describes how the Interim Action Plan fits under the Model Toxics Control Act framework. Section 1.4 lays out the general cleanup approach. Interim actions focus on children, who are the most vulnerable. Young children often come in contact with soil, put dirty objects in their mouths, and have greater sensitivity to arsenic and lead.

1.2 The Interim Action Plan Applies Only to the Tacoma Smelter Plume

This Interim Action Plan applies only to properties within the Tacoma Smelter Plume, with arsenic or lead contamination from air deposition from the former Asarco smelter. This plan selects action levels, cleanup levels, and cleanup methods based on the unique nature of the contamination. It is not for sites or properties with other contaminants, or arsenic or lead from a different source. For a map, see Appendix A.1 or visit http://www.ecy.wa.gov/programs/tcp/sites/tacoma_smelter/ts_hp.htm.

1.3 Model Toxics Control Act Framework

The U.S. Environmental Protection Agency (EPA) is cleaning up portions of the Asarco Tacoma Smelter site under the federal Superfund law. Ecology is cleaning up the Tacoma Smelter Plume part of the site under state cleanup law:

- Chapter 70.105D RCW, *Hazardous Waste Cleanup–Model Toxics Control Act*, and
- Chapter 173-340 WAC, *Model Toxics Control Act Cleanup Regulation*.

This plan includes model remedies (Chapter 11), which can be final cleanup actions for a single property. Therefore, regulations for both interim actions and final cleanup actions apply.

1.3.1 Interim Actions Are Partial Cleanup Actions

Interim actions will reduce the threat to human health. They address pathways through which children, residents, gardeners, construction workers, and other groups are exposed. An interim action is different from a final cleanup action because it only partly cleans up a site. In some cases, an interim action can meet the requirements for final cleanup. WAC 173-340-430(2) states that interim actions may

a) Achieve cleanup standards for a portion of the site;
b) Provide a partial cleanup, that is, clean up hazardous substances from all or part of the site, but not achieve cleanup standards; or
c) Provide a partial cleanup of hazardous substances and not achieve cleanup standards, but provide information on how to achieve cleanup standards for a cleanup; for example, an unproven cleanup technology demonstration project.

Interim actions must also be consistent with the final cleanup action and not exclude options for future cleanup. Ecology has not designed a final cleanup for the site. However, the proposed actions achieve full cleanup for some properties or play areas and allow for more cleanup in the future.

1.3.2 Properties Can Have Final Cleanup Actions

Ecology prefers permanent cleanup, where possible. The Interim Action Plan will not achieve final cleanup of the whole Asarco Tacoma Smelter site. Approaches such as outreach and education are not permanent fixes. However, some properties will have final cleanup actions from Ecology or through the Voluntary Cleanup Program. Final cleanup means removing, mixing, or capping all contaminated soils. This plan provides two ways to reach final cleanup:

1. **Yard sampling and cleanup program** (Chapter 6) – Ecology pays for and oversees yard cleanups in the most highly contaminated areas of the plume. Ecology may achieve final cleanup on some properties, if feasible.
2. **Voluntary Cleanup Program** – Land owners may use Tacoma Smelter Plume Model Remedies (Chapter 11) to clean up their own properties. Under the Voluntary Cleanup Program, Ecology can issue a No Further Action letter.

Final cleanups must be as permanent as possible. They must take into account the length of time until cleanup and public concerns. They must also meet WAC 173-340-360 requirements:

- Protection of human health and the environment.
- Compliance with cleanup standards.
- Compliance with applicable state and federal laws.
- Provision for compliance monitoring.

Ecology looks at the permanence of a cleanup option using seven factors: (1) overall protectiveness of human health and the environment; (2) long-term effectiveness; (3) short-term effectiveness; (4) permanent lowering of toxicity, mobility, and volume of the hazardous substances; (5) ability to be implemented; (6) cleanup costs; and (7) degree to which community concerns are addressed.

1.3.3 Model Remedies Streamline the Cleanup Process

Model remedies (WAC 173-340-390) streamline choosing cleanup actions for a site or type of contamination. One can choose final remedies without the feasibility study and disproportionate cost analysis required under WAC 173-340-350(8) and WAC 173-340-360(3), in that order.

1.4 Interim Action Plan General Approach

The Asarco Tacoma Smelter site is the largest and one of the most complex sites in the state. Site management has required a non-traditional approach to managing health risks (Chapter 3). For the past five years, the Tacoma Smelter Plume Management Plan (Ecology, 2007) governed this work. Ecology now proposes a wide-ranging approach that follows state cleanup process. It protects those most at risk, with the funding and staff Ecology has now.

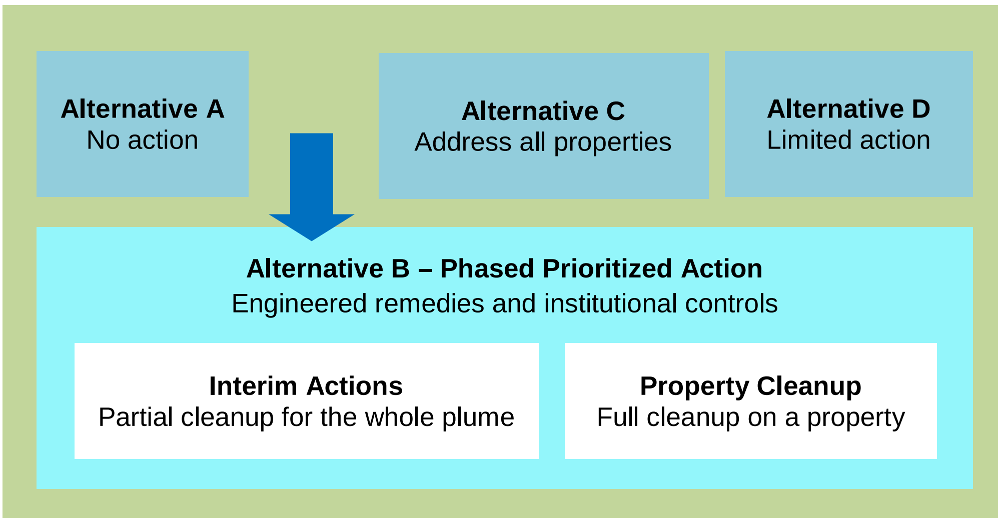
The Interim Action Plan meets state cleanup requirements and makes the process open to public input. It builds on early actions and uses lessons learned to evaluate options for

- Cleaning up the entire Tacoma Smelter Plume over many years; and
- Cleaning up individual properties within the plume.

Ecology looked at four options to address the entire plume, described in Chapter 4. The preferred option, Alternative B, uses a phased approach. It focuses first on play areas and properties where children play, and properties that may have the highest arsenic levels. Ecology will use certain interim actions for the whole plume, like outreach and education, and encouraging voluntary cleanup (Figure 1.1).

Chapters 5-7 discuss the four main parts of the Phase One work. Chapter 11 and Appendix B describe the "model remedies" that Ecology finds feasible and effective for property cleanup.

Figure 1.1 Alternatives Considered for the Tacoma Smelter Plume Interim Action Plan



1.5 Three Other Options Ecology Considered for the Interim Action Plan

Ecology considered four options for the structure of the Interim Action Plan (Figure 1.1). Ecology prefers Alternative B - Phased Prioritized Action. Chapter 4 provides more discussion of the reasons for choosing this alternative over the three others:

- **Alternative A - No Action.** Ecology has funding, staff, and expertise to take some actions. Stakeholders also support taking action.
- **Alternative C - All Properties Sampled and Remediated**. The large number of parcels, and limited funding and staff, make this approach impractical.
- **Alternative D - Limited Action**. Ecology looked at only providing institutional controls, such as ongoing outreach and education. Ecology and stakeholders feel that properties with higher contamination should have permanent cleanup.

1.6 Phases One and Two of Cleanup

The first stage of cleanup, Phase One, focuses on areas where children play and people live (see Figure 1.2). Phase One has four major proposed actions:

1. **Offer free yard cleanups** through the proposed yard sampling and cleanup program. The program covers the area most likely to have average[1] arsenic over 100 parts per million (ppm). Ecology calls this area the **high zone**. It includes the Ruston/North Tacoma Study Area, which is part of the Superfund site.
2. **Continue the Soil Safety Program** for play areas at licensed childcares, schools, parks, camps, and multi-family public housing.
3. **Provide outreach and education** to support actions 1-2 above. Educate people about protecting themselves from contaminated soils.
4. **Offer guidance and technical assistance** to:
    a. Local planning offices to encourage incorporating property sampling and cleanup when permitting development projects.
    b. Developers or land owners doing sampling and cleanup on their own.

Chapter 5 describes the Soil Safety Program, which began in 2005. Chapter 6 provides an outline for doing yard cleanups. Ecology will write a detailed program design in 2012, after public input on the Interim Action Plan.

Phase Two will look at areas not covered in Phase One (Figure 1.2). Phase Two covers some non-residential properties in the high zone (open space, natural areas, commercial, and industrial properties). However, most Phase Two properties are residential and undeveloped areas in the moderate zone. The Interim Action Plan includes some details on ideas for Phase Two actions. Ecology expects to release a Phase Two Interim Action Plan in 2014, which may include:

1. Continuing to encourage action on properties undergoing development.
2. Leveraging action through real estate transactions.
3. Streamlining approaches for Ecology determinations and approval of cleanup actions.
4. Evaluating properties managed or regulated by government agencies.
5. Identifying whether there is funding to address properties not included in Phase One.

[1] Throughout this document, average refers to the arithmetic mean

Figure 1.2 Ecology Cleanup Actions by Land Use and Tacoma Smelter Plume Zone

Ecology will sample and clean up properties in the Tacoma Smelter Plume based on land use and zone of the plume. The figure shows when Ecology will take the lead and provide funding, and when land owners, including other agencies, will need to take the lead.

Early Actions – Soil Safety Program

Completed: Existing school, childcare play areas in the Soil Safety Program Service Area

Phase One – Expand the Soil Safety Program

In Progress: New school and childcare play areas in the service area, existing public park, camp, and public multifamily housing play areas in high zones

Phase One – Yard Sampling and Cleanup Program

Existing Land Use:	Focus Area	High Zone[1]	Moderate Zone[2]
Single family residential	Properties	Ecology	Land owner
Private multifamily	Play areas	Ecology	Land owner

Phase Two – Future (Supplemental) Interim Action Plan

Land Use	Focus Area	High Zone[1]	Moderate Zone[2]
Existing school or childcare	Properties	Ecology	Land owner*
New park and camp	Play areas	Land owner*	Land owner
Undeveloped, zoned residential		Land owner*	Land owner
Open land, natural areas		Land owner*	Land owner
Commercial, industrial		Land owner	Land owner

**Ecology will consider later whether there is enough funding to address these areas.*

[1] High zone = average arsenic >100 ppm (max >200) or average lead >500 ppm (max >1,000)
[2] Moderate = average arsenic 20-100 ppm (max 40-200) or average lead 250-500 ppm (max 500-1,000)

1.7 Cleanup Methods Considered

Ecology proposes a blend of active cleanup and institutional controls (Figure 1.3). Ecology has already done a feasibility study for excavation, mixing, and two types of capping (see Appendix C). These may be used as model remedies **under certain conditions** (see Chapter 11).

The Soil Safety Program relies on excavation, and removal and capping where excavation cannot be done. Ecology tested soil mixing at schools in central Washington, and unsuccessfully tried using ferns to clean up test areas in Tacoma and on Vashon Island. Ecology has tested education and outreach as an institutional control. It does raise awareness and likely leads to behavior changes (TPCHD, 2009). Meetings with local planners and real estate agents helped narrow down options for zoning, permitting, and real estate approaches.

Figure 1.3 Remedies (Cleanup Methods) Considered for the Tacoma Smelter Plume

Engineered Remedies

Permanent remedies
- Excavation and removal*
- Excavation, ex-situ remediation, and reuse
- Mixing with clean soils*
- Phytoremediation (Chinese brake fern)
- Monitored natural attenuation
- Chemical stabilization
- Soil washing

Non-permanent remedies
- Excavation and on-site containment*
- Cap in-situ (soil cap or hard cap)*

Institutional Controls

- Fencing or physical barriers
- Signage or brochures
- Broad-based and targeted education and outreach
- Environmental covenants and deed restrictions
- Zoning overlays and permitting requirements
- Property transaction notification
- Policies for properties owned or managed by government agencies

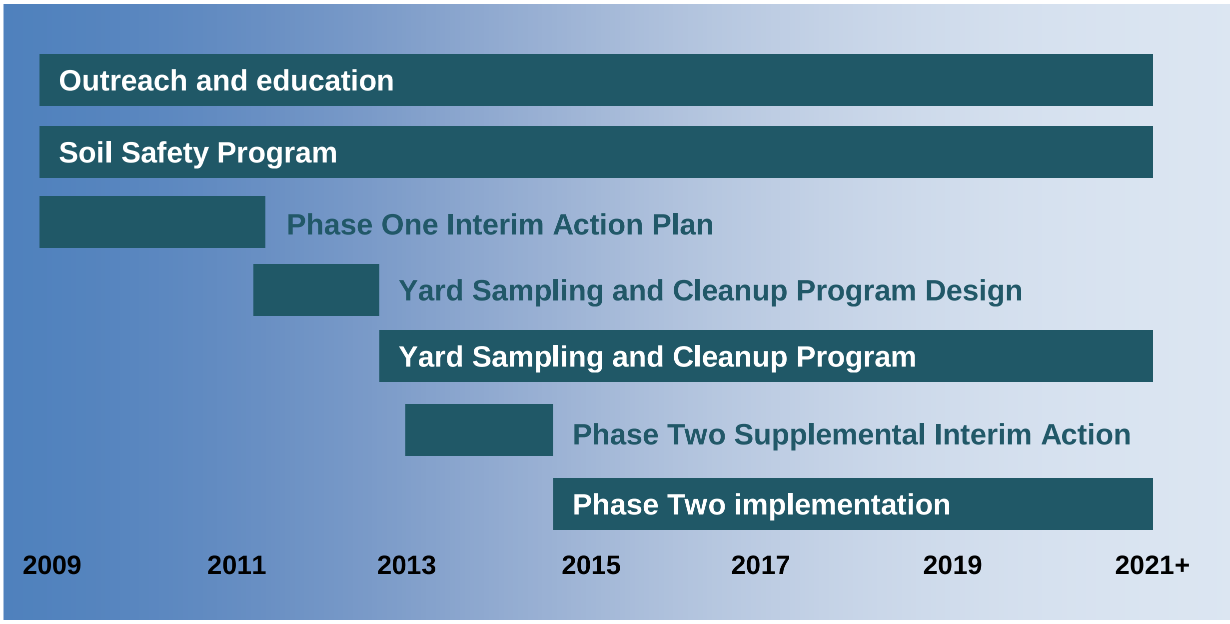
*Active remedies proposed in the Interim Action Plan (all institutional controls listed are being proposed)

1.8 Cleanup Timeframe

Because of the size and complexity of the site, Ecology may not be able to develop a final cleanup plan. The agency cannot do permanent cleanup on all properties. The Interim Action Plan sets the stage for managing risk over the long-term. Ecology will write a Phase Two Interim Action Plan to further address contamination. The Phase Two plan will rely on scoping and planning over the next few years (see Figure 1.4). Ecology will consider writing a final Cleanup Action Plan after Phase Two has begun. The public will have chances to comment on all future cleanup plans.

Ecology will do five year reviews of the Interim Action Plan work, per WAC 173-340-420, including the model remedies. Ecology will check how well non-permanent yard cleanups are protecting human health.

Figure 1.4 Tacoma Smelter Plume Interim Action Plan Phase One and Two Timeframe



Chapter 2 - Site Background and Description

2.1 Smelter History

Asarco's copper smelter ran for almost 100 years in Ruston, Washington. Ruston is a small town within the borders of the city of Tacoma. The Tacoma smelter opened in 1890 as a lead smelter. Asarco purchased the smelter in 1905 and began converting it to a copper smelter. After the 1912 closure of the Asarco Everett Smelter, the company added arsenic recovery facilities to the Tacoma smelter.

The Tacoma smelter specialized in processing ores with high arsenic levels. It recovered arsenic trioxide and metallic arsenic as by-products of copper smelting. The process also produced slag, a hard, glassy material containing high levels of arsenic, lead, and other metals. Copper smelting operations stopped in 1985, and the arsenic plant closed in 1986.

Asarco released smelter emissions through a smokestack. The company replaced the original smokestack in 1917. At that time, Asarco claimed the new stack was the largest in the world at 571 feet. Air pollution from the plant traveled with the wind and settled onto soils across large areas of the Puget Sound basin. The metals, mainly arsenic and lead, impacted surface soils. They came from both the smokestack and emissions escaping other areas of the smelter plant.

2.2 EPA Ruston/North Tacoma Study Area

In 1983, the U.S. Environmental Protection Agency (EPA) listed the Commencement Bay/Nearshore Tideflats Superfund site on its list of cleanup sites. This listing included the Asarco smelter site, broken into four "operable units" (OUs):

- Asarco Smelter Facility (OU 02).
- Asarco Sediments (OU 06).
- Asarco Demolition (OU 07).
- Asarco Off-Property (OU 04), also called the Ruston/North Tacoma Study Area (Appendix A.2).

In 1988, Ecology wrote a report on soil contamination outside of the smelter property. Using earlier studies, Ecology designed sampling to find patterns across an area expected to have about 100 parts per million (ppm) arsenic. The edges of this area were within 3/4 to one mile of the smelter. EPA later used it to focus their cleanup studies (USEPA 1992). EPA defines this area as the Ruston/North Tacoma Study Area in its cleanup plan (USEPA 1993). The cleanup plan is known as a Record of Decision (ROD).

The Ruston/North Tacoma Study Area is around 950 acres, surrounding the former smelter (see Appendix A.2 for map). The Study Area includes the town of Ruston and northern portion of the city of Tacoma. Arsenic concentrations in surface soils range from 2 to 3,000 ppm.

2.2.1 EPA's Action Level is 230 Parts Per Million Arsenic

In 1993, EPA issued the ROD for the Ruston/North Tacoma Study Area. It sets an "action level" for arsenic at 230 ppm, and 500 ppm for lead. This means EPA only takes action when soil is above these levels. The remedy chosen in the ROD includes:

- Sampling properties to find out if soil is above the action levels.
- Digging up contaminated soil and slag, and replacing it with clean soil and gravel.
- Asphalt capping or soil removal and gravel replacement for alleys and parking areas.
- Fencing and planting low lying shrubs in steep areas.
- Promoting community protection measures.

EPA uses Community Protection Measures to address remaining risks. These measures focus on educating people about the contamination. They address areas with arsenic between the state's cleanup level of 20 ppm and EPA's action level of 230 ppm.

EPA is only cleaning up soils in the Ruston/North Tacoma Study Area. The ROD notes that some properties outside of the Study Area may exceed action levels and require cleanup. It states that EPA will assess the need for more sampling and cleanup in the future.

Ecology does not believe that a 230 ppm action level protects human health and the environment. Ecology concurred with the EPA's 1993 cleanup plan. Ecology agreed that the long-term effect of the remedy depended on the extent of soil removal. However, during EPA's five-year review in 2000 (EPA 2000), Ecology noted that the 230 ppm action level did not comply with state law (Ecology 2000). Although the cleanup level is 20 ppm, the ROD requires Community Protection Measures instead of soil cleanup between 20 ppm and 230 ppm.

Ecology and EPA use similar risk assessment methods, but different acceptable human health risk levels (Appendix D). Ecology uses an acceptable risk range of one in one-million to one in one-hundred-thousand. EPA uses an acceptable risk range of one in one-million to one in ten-thousand.

The state cleanup level for arsenic (20 ppm) equates to a three in one-hundred-thousand excess cancer risk because it is based on background arsenic levels. EPA's action level for arsenic (230 ppm) equates to an excess cancer risk of one in two-thousand. EPA set this action level based on the large scope of the cleanup. Also, EPA believes that community protection measures address contamination between 20 and 230 ppm.

2.2.2 Managing Cleanup in the Ruston/North Tacoma Study Area

EPA is managing cleanup within the Ruston/North Tacoma Study Area. However, Ecology did cleanup at Ruston childcares with arsenic above state cleanup levels but below EPA action levels. Ecology took action here because children were at risk. EPA's work also includes outreach. EPA continues to mail letters and newsletter updates to homes in the Study Area.

Tacoma-Pierce County Health Department also does outreach in the Ruston area, using Ecology funding. Outreach efforts include cable television ads, mail surveys, community events, and childcare visits. The health department did a study (TPCHD 2007) that showed some residents, particularly newer ones, were unaware of the contamination.

2.3 TSP Site Discovery and Studies of Contamination

The start of the Asarco cleanup kindled interest in contamination beyond EPA's cleanup area. Some studies had data from the years the smelter was running and after it closed. Studies prior to smelter closure looked at airborne particles, soils, house dusts, plants, sediments, surface water, reservoir sludge, animals, and human urine and blood samples. Soil sampling included forested areas, roadside soils, yards, vacant lots, play fields, and gardens. However, many of the soil studies had a small number of samples and only covered small areas.

Between 1999 and 2001, Ecology and the local health departments in King and Pierce counties began studying soil contamination from Asarco smelter air emissions. These studies had large data sets, covered wide areas, and were done in a series. In both counties, targeted sampling of child play areas followed the broader "footprint" sampling. Footprint studies sampled in undisturbed forest soils (PHSKC and Glass 2000; Glass 2002; Glass 2004). Play area sampling targeted schools, parks, and childcares (PHSKC and Glass 2001; SAIC 2003; TPCHD 2004).

The studies focused on arsenic and lead. They also looked for trace metals such as antimony, indium, bismuth, cadmium, and mercury. The trace metal data helped Ecology show that Asarco was the source (Glass 2003a and 2003b).

In 2003, Ecology expanded the footprint studies to include Kitsap and Thurston counties. Samplers collected more data in all four counties. The Extended Footprint Study (PGG 2005) provided the data for making a map of the Tacoma Smelter Plume (Appendix A.1).

In 2010, Ecology did a study on plants and animals living in soils within the plume (Ecology 2011). The study looked at what levels of arsenic and lead were toxic to plants and animals. Results have aided in developing ecological soil cleanup levels (Appendix C).

2.4 Footprint Studies

The first phase of Tacoma Smelter Plume studies consisted of "footprint" sampling. Ecology wanted to find how far contamination went and how high the levels were. Footprint studies focused on less-disturbed forest soils because they often have higher levels of arsenic and lead. Disturbing soil tends to dilute the surface arsenic and lead with cleaner, deeper soils.

2.4.1 Initial Footprint Studies

Ecology did footprint studies for three regions, in the following order:

- Vashon-Maury Island, with some samples along the King County mainland shoreline.
- An area of several hundred square miles on the King County mainland, roughly northeast of the Tacoma smelter.
- An area of several hundred square miles in northwestern and western Pierce County.

The three footprint study designs were similar, but differed in some details. Parts of the study design that varied included:

- Metals analyzed – many of the Vashon-Maury Island samples included cadmium.

- Depth intervals sampled.
- Number and layout of soil borings to provide data on variability within sampling locations.
- How dense the sampling was (how many samples were taken in an area).

The Pierce County footprint study used many samples from yards in more urban areas near the smelter. Forested properties were rare in that area. Soils from people's yards provided more coverage of the more highly contaminated areas. The reports note that yard soils tend to be more disturbed than forest soils. Soil contamination patterns reflect those differences in that disturbed samples tend to have lower levels of arsenic and lead.

2.4.2 Extended Footprint Study

The first three studies did not find the full extent of soil contamination. Ecology worked with local health departments in King, Kitsap, Pierce, and Thurston counties to complete the Extended Footprint Study (PGG 2005). This study filled data gaps in King and Pierce counties and extended sampling into Kitsap and Thurston counties. The report also included data from the first three footprint studies.

The study ended up with 4,175 samples from 851 locations and 1,928 borings. These data gave Ecology a more complete picture of the Tacoma Smelter Plume. Arsenic was in over 99 percent of all samples, ranging from 0.48 ppm to 1,050 ppm. For comparison, natural background levels for the region are around 7 ppm. The Model Toxics Control Act Method A cleanup level is 20 ppm. Ninety-three percent of samples exceeded natural background and 55 percent exceeded the cleanup level for arsenic.

Lead was in over 97 percent of samples, ranging from 1 ppm to 6,670 ppm. Cadmium was detected in 45.7 percent of samples, ranging from undetected (at 0.5 ppm) to 15 ppm. Table 2.1 shows maximum arsenic and lead concentration by county.

The Extended Footprint Study provides data about how far and how deep the contamination goes. In general, arsenic levels were highest near the smelter and down wind. Dominant wind directions were towards southern Vashon-Maury Island and towards Tacoma and University Place. Levels tended to decrease farther from the smelter. However, levels varied greatly from place to place, even if they were near to each other. Maps made from these data cannot predict arsenic levels in places that have not yet been sampled. Depth profiles show higher levels of arsenic and lead in the top two inches of soil than in the 2-6 inch range.

Table 2.1 Extended Footprint Study Maximum Arsenic and Lead

Location	Maximum Arsenic	Maximum Lead
King County	460 ppm	1300 ppm
Pierce County	1050 ppm	6670 ppm
Thurston County	159 ppm	1110 ppm
Kitsap County	37 ppm	198 ppm

(PGG 2005)

2.5 Child Use Area Studies

The second phase of studies targeted child-use areas such as schools, preschools, parks, camps, and childcares. Some of these areas had highly disturbed soils and some did not. Landscaping or building can disturb soils and lower arsenic and lead levels. As a group, their soils were more disturbed than the forest soils in the footprint studies.

2.5.1 Child Use Area Study Design

Sampling at child-use areas followed a set approach. Local health departments collected soils in "decision units" defined by where children played and other property uses.

The first study, on Vashon-Maury Island, differed a little from the two later studies. It attempted to survey all child-use areas Ecology could find. The King and Pierce County studies (SAIC 2003; TPCHD 2004) limited the number of child-use areas sampled by setting study areas. The study areas in King and Pierce County only covered parts of those counties. They focused on areas likely to have higher soil arsenic and lead levels.

The Vashon-Maury Island study had more samples taken at deeper points in the soil. Ecology designed it to also compare arsenic and lead levels in undisturbed and disturbed soils. The two later child use area studies had a different purpose. Their purpose was to help make decisions about actions to protect young children. Ecology sampled beaches only in the Vashon-Maury Island study. All beach samples had low arsenic and lead levels. As a result, Ecology dropped beach sampling from the later studies.

2.5.2 Child Use Area Study Results

Vashon-Maury Island Child Use Area Study – This study used 1,503 soil samples from 34 play areas (PHSKC and Glass 2001). Sampled areas included public and private schools, public parks and beaches, childcares, preschools, and camps. Beach samples had maximum levels of 2.8 ppm arsenic and 19 ppm lead, which are low.

For non-beach areas, maximum levels of arsenic ranged from 8.9 to 130 ppm and maximum lead ranged from 12 to 900 ppm. These values were lower than in the earlier study of undisturbed forested areas. Still, over 70 percent of the non-beach sampling decision units had a maximum arsenic level over the 20 ppm state cleanup level.

As in the forest soils study, arsenic tended to be higher closer to the smelter. Samples generally showed higher levels in the top six inches of soil than at greater depths. However, about 30 percent of decision units showed higher levels below six inches. Development and soil disturbing actions may move arsenic and lead deeper. This study also shows that arsenic and lead levels vary greatly over small areas.

Mainland King County Child Use Area Study - This study used 2,532 soil samples from 97 child use areas (SAIC 2003). Sampled areas included public and private schools, public parks, and childcares. Only four properties had samples above 100 ppm arsenic. The maximum arsenic level was 189 ppm and maximum lead was 699 ppm. The highest average level for a decision unit was 41 ppm arsenic and 134 ppm lead.

Pierce County Child Use Area Study - This study analyzed 1,211 soil samples from 72 child use areas, including parks, public schools, and childcares (TPCHD 2004). Arsenic levels ranged from 0.94 to 691 ppm. Lead ranged from 1.32 to 1,040 ppm. Twenty-two percent of the samples had arsenic above the state cleanup level of 20 ppm. Eleven samples had lead above the state cleanup level of 250 ppm. Twenty child use areas had decision units where average arsenic was over 20 ppm.

These studies provided Ecology with a better picture of contamination in places where children might be at risk. They supported findings from the footprint studies. Levels vary greatly across small areas, and contamination is mainly in the top six inches of soil. The studies also informed whether actions should be taken to protect children.

2.6 Tacoma Smelter Plume Boundary - Extent of Contamination

Appendix A.1 shows the plume footprint. Visit Ecology's website to view a searchable map: http://www.ecy.wa.gov/programs/tcp/sites_brochure/tacoma_smelter/ts_hp.htm.[2]

The map shows the extent of the plume. It also shows areas where arsenic may be highest (Section 2.7). The plume covers more than 1,000 square miles and reaches more than 30 miles from the former smelter in Ruston. The Tacoma Smelter Plume has the following characteristics:

- Arsenic is the main contaminant[3]; therefore, soil arsenic levels define the extent.
- Properties closer to the smelter tend to have higher levels.
- Contamination generally follows wind patterns.
- Topography affects contamination; hilltops or ridges can be more contaminated.
- Levels are highly variable within small areas.
- Contamination is mostly found in the top six inches of soil.
- The highest levels tend to be in areas where the ground is not recently disturbed (forested areas, properties with homes built prior to 1970).

Due to limited sampling around the edges, Ecology does not know the precise boundary of the plume. The maps in Appendix A show boundaries drawn based on statistical estimates of arsenic levels.

2.7 Tacoma Smelter Plume Map – High Zone

There are not enough settlement funds to clean up the whole plume. Therefore, Ecology is using arsenic levels to plan where to clean up first. Ecology set a "high zone" based on where average arsenic levels are likely to be over 100 ppm (Appendix A.4). Contamination tends to follow wind patterns and decrease with distance. Ecology looked at arsenic sampling data and

[2] Ecology plans to update this map around the end of 2012. It will likely have a different format and color-coding from the version in Appendix A. The new map will use additional soil sampling data to provide better estimates of arsenic levels.

[3] Within the plume, arsenic is typically found in a 1:4 ratio with lead. However, the Method A direct contact arsenic cleanup level is more than 10 times lower than the cleanup level for lead. Lead rarely exceeds the cleanup level in places where arsenic does not, making arsenic the main contaminant.

their distance and direction from the former smelter. The analysis reflects conservative estimates of arsenic levels. Actual levels will vary greatly.

Ecology overlaid the plume map with land use and assessor's data to estimate how many parcels were in those areas. Table 2.2 shows the number of parcels estimated to be within high and moderate areas, across the plume.

Arsenic and lead levels also inform when Ecology will take action—"action levels"—and what type of cleanup method can be used—"remediation levels". Appendix D explains action levels. Chapter 10 gives remediation levels for the model remedies.

Table 2.2 Parcels by Land Use and Map Zone

	High Zone	Moderate Zone
Developed	18,000	**636,300**
Undeveloped	2,000	**96,500**
Total Parcels	**20,000**	**732,800**

Chapter 3 –Tacoma Smelter Plume Management (2000-2010)

3.1 State and Federal Roles in Managing Cleanup

EPA, Ecology, and health departments were concerned about the extent of smelter impacts and health risks. In April 2000, EPA and Ecology agreed that the state would address contamination outside of the Ruston/North Tacoma Study Area. This larger area of contamination is the Tacoma Smelter Plume. Ecology is addressing it under the Model Toxics Control Act.

In June of 2000, Asarco approached EPA with an offer. Asarco would clean up Vashon-Maury Island and other places with soils above the EPA's action levels (see Section 2.2). Asarco made this offer in a letter to the EPA Region 10 Administrator (Asarco 2000). EPA declined the offer and reaffirmed that Ecology was the lead agency for this part of the cleanup. EPA's letter also notes that the Superfund site action levels might not apply to Vashon-Maury Island.

Ecology is taking another look at EPA's approach for managing the Ruston/North Tacoma Study Area. Since Ecology concurred with EPA's 1993 Record of Decision (ROD), much has changed. We know more about the risks of arsenic and lead. Stakeholders have provided advice on how to address this type of contamination (Section 3.3). Ecology has also learned from the past ten years of managing the Tacoma Smelter Plume. The state's current approach differs from EPA's in terms of cleanup action levels and how institutional controls will be used.

3.2 Ecology's Early Management Approach

3.2.1 Naming Asarco the Potentially Liable Person

Ecology's approach to the Tacoma Smelter Plume portion of the Asarco Tacoma Smelter site has been different than any other site the agency has managed. The very large size of the site and the lack of participation by the Potentially Liable Person—Asarco—have required different strategies. Ecology began investigating the site with a series of footprint and child use area studies (Section 2.3-2.5). Ecology compiled The Credible Evidence Report (Glass 2003) that pinpoints Asarco as the source of contamination, and covers

- **Pathways** – There is a pathway from the smelter air emissions to soil contamination in the region.
- **Spatial patterns** – The pattern of arsenic and lead is closely linked to wind patterns and distance from the smelter.
- **Trace element patterns** – Other metals released from the smokestack are found with arsenic and lead. Their levels are correlated with arsenic and lead levels.
- **Consistency with other smelter studies** – The contamination patterns are very similar to those seen around other smelters worldwide.
- **Absence of other high-emissions sources** – The Asarco smelter appears to be the main regional source for arsenic. No other source was found to have such widespread impacts.

On January 9, 2004, Ecology notified Asarco of its status as the potentially liable person for the Tacoma Smelter Plume. Asarco responded with a letter denying responsibility for any area outside of the Ruston/North Tacoma Study Area (Asarco 2004).

3.2.2 Remedial Investigation and Feasibility Study Process

Under the state cleanup process, the potentially liable person normally conducts a remedial investigation and feasibility study. The remedial investigation looks at the nature and extent of the contamination, which defines the site boundary. Next, the feasibility study weighs cleanup options. Ecology uses results from these studies to choose the best cleanup methods for the site. One can also take interim actions (partial cleanup actions) to address threats to human health or problems that may worsen over time.

Asarco did not do a remedial investigation or feasibility study for the Tacoma Smelter Plume. Instead, Ecology began collecting data and addressing health risks. The large size of the site and limited funding prompted Ecology to focus first on managing risk (Section 3.4). Ecology's work was largely guided by advice from the Area-Wide Soil Contamination Task Force.

3.3 Area-Wide Soil Contamination Task Force

3.3.1 Task Force Overview

Area-wide soil contamination is low-to-moderate levels spread over large areas, from several hundred acres to many square miles. Most other cleanup sites are smaller and have higher levels of contamination. Area-wide issues have been caused by past air emissions from metal smelting plants, lead-arsenate pesticides used in the early to mid-1900s, and leaded gasoline. Long-term cleanup will require novel approaches.

In 2001, the Washington Legislature set aside $1.2 million for a task force to study area-wide issues. The Washington State Departments of Agriculture, Ecology, Health, and Community, Trade & Economic Development took the lead. They put together a 17-member Area-Wide Soil Contamination Task Force. The group developed a state-wide strategy for area-wide arsenic and lead soil contamination, including the Tacoma Smelter Plume.

In June 2003, the task force made their recommendations in a report (AWTF 2003). Ecology used many of their guiding principles to build the Tacoma Smelter Plume Management Plan (Section 3.4.3).

3.3.2 Area-Wide Task Force Recommendations

The task force developed a list of six principles to guide action (AWTF 2003):

- Balance cost, practicality, and effectiveness.
- Consider that risks from area-wide soil contamination are lower than from other sites.
- Lower exposure to area-wide soil contamination.
- Focus on children.
- Take action based on the level of risk.
- Make decisions locally.

The main theme of the task force report is education as a way to manage risk. State agencies should work with local governments to make people aware of the risks and promote healthy actions. Healthy actions include hand washing, removing shoes before entering the house, washing children's toys, and maintaining good soil cover.

Another theme is to focus on children. Local health departments use Ecology funding to provide outreach, largely for children and the adults that care for them. The Soil Safety Program (see Section 3.4.2) also focuses on children by cleaning up child play areas. See Appendix G for more detail on how Ecology has used the task force advice.

3.4 Early Actions

3.4.1 Outreach and Education (2000-2010)

Ecology and health departments began outreach and education before the Area-Wide Soil Contamination Task Force was formed. The purpose was to:

1) Alert the public to the possible risks.
2) Promote healthy actions.
3) Gain access to properties for soil sampling studies.
4) Get input from the public.
5) Put together messages for talking about risk.

Starting in 2000, Ecology provided grant funding to Public Health-Seattle & King County and Tacoma-Pierce County Health Department. Their work included assessing local outreach needs and putting together programs and brochures to meet those needs. They helped with public meetings and events, trained teachers and health care workers, and responded to questions. The health departments also surveyed baseline awareness about the Tacoma Smelter Plume. This helped to later assess the impact of outreach and education techniques.

From 2000 to 2004, Ecology funded the Island Remediation and Public Participation Center. The center supported the Heavy Metals Remediation Committee, a volunteer group of the Vashon-Maury Island Community Council. The committee advised Ecology on how to share the results of the Vashon-Maury Island Child Use Area Study (PHSKC and Glass 2001) with the public. It advised Ecology and the health department on outreach tools and programs. The committee also explored related heavy metal contamination issues such as arsenic-treated wood use in playgrounds.

3.4.2 Soil Safety Legislation (2005-2010)

In April 2005, the state legislature passed a law to further protect children from arsenic and lead contamination. The Area-Wide Soil Contamination law (Chapter 70.140 RCW), which sunsetted in December 2009, required

- Finding all schools and childcares in the program service area (Appendix A.3).
- Looking at which schools and childcares had play areas with soil in them.

- Doing soil sampling of play area soils.
- Cleaning up play areas with soils above state cleanup levels for arsenic or lead.

As a result of the law, Ecology, the health departments, and other stakeholders designed a Soil Safety Program (Landau Associates 2006). The program started in 2006 and completed all required sampling by 2009. The program has continued to address new childcares as they open. Ecology will clean up play areas with arsenic over 20 ppm average or 40 ppm maximum or lead over 250 ppm average or 500 ppm maximum (Table 3.1).

Pierce County continues to do their own soil sampling, but Ecology is using a contractor in King County. Since 2006, Ecology has cleaned up most of the play areas with arsenic or lead above state cleanup levels (Table 3.1).

Until 2010, Ecology used state funds from the Local Toxics Control Account for sampling and cleanup. In April 2010, the Soil Safety Program expanded to include parks, camps, and multi-family public housing. The expanded program uses funding from the Asarco bankruptcy Cleanup Settlement Account (Section 3.5). Every two years, the legislature gives Ecology funding out of this account.

Table 3.1 Soil Safety Program Action Levels for Arsenic and Lead

Contaminant	Average (all samples)	Maximum (single sample)
Arsenic	20 ppm	40 ppm
Lead	250 ppm	500 ppm

3.4.3 Tacoma Smelter Plume Management Plan (2006-2011)

Ecology developed the Tacoma Smelter Plume Management Plan (Ecology 2007) with input from the health departments. It will guide the management of the site until the Interim Action Plan is final. Ecology's early actions have been to:

1. **Improve Public Awareness** of soil contamination and healthy actions to reduce risk.
2. **Characterize Soil and Implement Protective Measures** by collecting data to support cleanup decisions.
3. **Improve Institutional Capabilities** for responding to arsenic and lead in soil.

Outreach and Education - Ecology used the task force principles (Section 3.3.2) to build the management plan. As a result, outreach and soil cleanup efforts focus on children and high-contamination areas. Ecology is not enforcing cleanup at residences, and is encouraging voluntary action for properties with moderate contamination. Ecology's goals and progress for each of the three objectives are in Table 3.2.

Health departments have focused their resources on improving public awareness. Ecology funds Public Health-Seattle & King County, Tacoma-Pierce County Health Department, and Thurston County Public Health and Social Services. They use the funding to run a variety of outreach programs. Surveys from Pierce County suggest that broad outreach efforts have been successful. Up to 50 percent surveyed reported seeing a television ad about the Tacoma Smelter Plume. King County has focused on childcares, schools, and groups working on children's health issues. Thurston County blends soil safety outreach into existing environmental health and childcare programs.

One major challenge to raising public awareness is the size of the Tacoma Smelter Plume. Another challenge is reaching the diverse groups that might be at risk. Mass media tools like ads are costly, while more focused outreach to childcares and schools takes time. Future outreach must balance these factors to best use funding.

Soil Safety Program - The Soil Safety Program has been a success. Health departments got access for soil sampling at nearly every school and licensed childcare. They were also able to provide outreach once sampling results were ready. Ecology has finished play area cleanups at most schools and childcares that needed it. The legislature continues to fund the program. The Soil Safety Program's 2008 Legislative Report (Ecology 2009) provides detail about program outcomes.

Improving Institutional Capabilities – Ecology is looking for ways to raise awareness and reduce risk through the everyday work of local governments and other agencies. In 2007 and 2008, Ecology met with local planning offices and real estate agents in Pierce and King Counties. Ecology also held training sessions with childcare licensing staff at the Department of Early Learning in 2008. In 2011, Ecology hired a Technical Assistance Coordinator, who is meeting with local planning and permitting offices on actions they can take.

Agencies and local governments mostly support outreach and are open to exploring policies that deal with soil contamination issues. Lessons learned include:

- **Formal rule changes or legislative processes can take a long time.** Department of Early Learning expects that new rules might take several years to put in place.
- **Policy changes can put large costs on agencies, businesses, and individuals.** For example, requiring soil sampling when selling real estate would be costly and might discourage buyers.
- **Local planning and permit offices could request or require sampling and cleanup as a permit condition for development projects.** Developers could do soil cleanup as part of their projects, while digging, grading and landscaping.
- **Making soil safety rules requires new resources.** Local planning offices would need technical support and help reviewing sampling and cleanup work.
- **Basic education and outreach is a good approach.** It can empower people to ask about the soil when they buy a home. It may also prompt land owners, builders, lenders, and insurers to give more thought to soil contamination issues. Also, agency staff, real estate agents and local planners work with the public. They can help educate others.

Table 3.2 Tacoma Smelter Plume Management Plan Implementation Steps and Progress

Objective	Major Implementation Steps	Progress
1. Improve public awareness	Develop a broad-based public awareness campaign with Pierce and King County health departments.	Health departments in King, Pierce and Thurston counties have outreach programs with a wide range of activities. Much of the work has focused on childcares and schools within the Soil Safety Program. Other efforts have included: • Television ads and other mass media. • Outreach through local events. • A soil safety curriculum. • Childcare provider trainings. • Home Environmental Assessments. • Targeted outreach to minority or disadvantaged residents.
	Work with health departments to build partnerships with organizations and agencies, particularly in non-English speaking communities.	
	Support outreach to schools.	
	Support outreach to childcares.	
	Develop and distribute soil sampling and cleanup guidance.	This guidance is available at http://www.ecy.wa.gov/programs/tcp/sites_brochure/dirt_alert/other_info/brochures.htm
	Develop a plan to inventory parks, camps, and multi-family housing with child use areas.	Ecology addressed parks, camps, and public multi-family housing in 2010-2011. Ecology will address private multi-family housing in Phase One.
2. Characterize soil and implement protective measures	Sample soils at school and childcare play areas and do cleanup for high and moderate levels of contamination.	Sampling is complete at all schools and licensed childcares in the Soil Safety Program. Most play area cleanups of high or moderate contamination are complete. All of these received outreach about healthy actions. The Soil Safety Program is addressing new schools and childcares and existing parks, camps, and public multi-family housing.
	In the long term, characterize soil and implement protective measures at parks, camps, and multi-family housing.	
3. Improve institutional capabilities	Improve and streamline Ecology's technical assistance and review processes related to arsenic and lead soil contamination.	Ecology hired a Technical Assistance Coordinator to work with local planning and permit offices, land owners, and consultants. Tacoma Smelter Plume Model Remedies will guide the technical assistance by Ecology staff.
	Consider soil contamination in managing schools and childcares; training for teachers and caregivers.	Ecology is working with the WA Department of Early Learning to incorporate soil safety actions into licensor training, and to explore making soil sampling and cleanup a condition of licensing. Ecology provided input and is tracking revisions to environmental health and safety rules for Washington public schools. Rule changes are a chance to include soil safety measures when building and maintaining schools.
	Consider soil contamination when building and maintaining schools.	

	Work with real estate agents and professional organizations to address soil contamination through training, buyer notification, and disclosure.	Ecology asked real estate agents in University Place and on Vashon-Maury Island about where soil safety outreach could be done when selling or buying a home. Ecology plans to do outreach through trainings and professional associations. Phase Two will explore ways to deal with contamination through real estate sales.
	Coordinate with EPA, military bases, and tribes to address contamination on land under their jurisdiction.	Tacoma-Pierce County Health Department (TPCHD) sampled childcares on Fort Lewis Army Base. Fort Lewis did cleanup at one childcare under an agreement with Ecology. Ecology and EPA are working on a long-term plan for further addressing the Ruston/North Tacoma Study Area.
Other	Coordinate with EPA on outreach and messaging in the Ruston/North Tacoma Study Area.	Ecology and TPCHD provide outreach to residents within the Study Area. TPCHD did a survey of public awareness and use of healthy actions. Ecology, TPCHD and EPA are working on a long-term plan for outreach in the area.

3.5 Asarco Settlement and Draft Interim Action Plan (2007-2011)

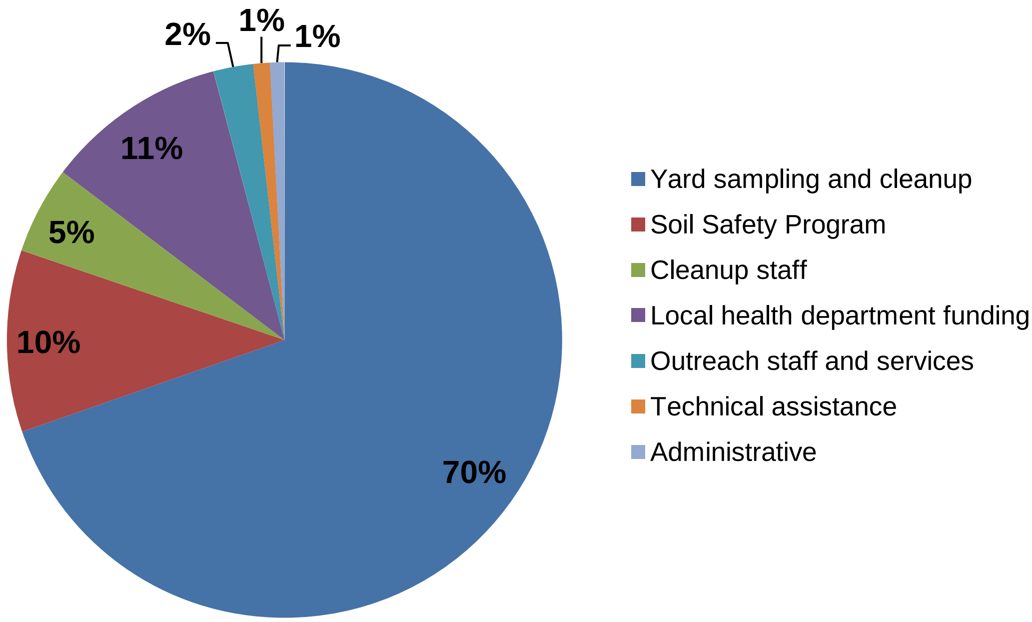
Asarco filed for bankruptcy in 2005. In September 2007, Ecology joined eight other states in filing claims for more than $1 billion in environmental damages and cleanup costs. In December of 2009, the State of Washington received $94 million for future costs of cleaning up the Tacoma Smelter Plume. Ecology began planning for the Asarco funds in 2007. State cleanup law requires that final cleanup actions be guided by a Cleanup Action Plan, which must go out for public comment. Ecology developed this Interim Action Plan as a first major step towards cleanup, while also allowing for public input.

In 2008, the Washington Legislature passed a law creating the Cleanup Settlement Account (Chapter 70.105D.130 RCW). This account holds money from court orders or settlements, and interest earned, for cleaning up specific sites. The legislature must appropriate the funds every two years. Ecology can use account funds for:

- Soil sampling and cleanup.
- Outreach and education.
- Technical assistance.
- Administrative oversight.

Ecology put together a financial plan for using Asarco funds over 10 years. It is based on the work in the Interim Action Plan. In early 2012, Ecology updated spending plans to reflect new information about cleanup costs. The agency will continue to update spending plans every two years.

Figure 3.1 Asarco Settlement Spending Breakdown for the Tacoma Smelter Plume



Estimate as of June 2012. Yard and Soil Safety Program costs are contractor costs. Cleanup staff covers Ecology staff to manage multiple contracts and work crews doing soil sampling and cleanup in neighborhoods, parks, camps, schools, and childcares. It also includes database management, drawing up cleanup designs, and working with property owners. Local health department funding is mainly for outreach work. Outreach services include surveys and mass media advertising.

3.6 SEPA Scoping and Evaluation (2009-2010)

Interim actions require a State Environmental Policy Act (SEPA) review. Because the plan is large and complex, Ecology did early scoping. The early scoping informed whether to issue a determination of significance or mitigated determination of non-significance. Ecology held a SEPA scoping comment period from February 2 to March 20, 2009. The scoping notice asked for comments on possible environmental and community impacts of the plan. At that time, Ecology had not yet finished the plan and provided only a brief outline of the actions.

Based on comments and further study of the impacts of the project, Ecology is issuing a Mitigated Determination of Non-Significance for the plan. The main impacts will likely come from the yard cleanup work. Any major impacts can be lessened by taking measures such as controlling dust, noise, and traffic at the worksites.

See Appendix E for the SEPA early scoping document, determination form, and checklist.

Chapter 4 – Evaluation of Interim Action Plan Alternatives

4.1 Overview

Cleanup methods are chosen by weighing cleanup options against criteria in the Model Toxics Control Act regulation (WAC 173-340-360(2)). This chapter discusses the criteria used to weigh the options for dealing with the overall Tacoma Smelter Plume. It also gives the reasons for choosing Alternative B – Phased Prioritized Action. Alternative B has two phases, described in Chapters 5-7.

4.2 Options for Managing Risk and Cleaning Up the Whole Plume

The Asarco Tacoma Smelter site covers over 1,000 square miles and includes thousands of parcels with many land uses. This site has limited resources in relation to its size, and complex stakeholder and public needs. Ecology took this into account when looking at options. Ecology also followed Model Toxics Control Act requirements and Area-Wide Soil Contamination Task Force advice.

4.2.1 Broader Strategic Alternatives

Ecology looked at four options. Appendix F has a summary of how Ecology weighed these options based on the criteria.

Alternative A – No Action - “No action” is not an effective or reasonable option. Some areas of the plume have very high levels of contamination and Ecology has the funding to do cleanup.

Alternative B – Phased Prioritized Action - This action is a baseline for comparing other options. This approach has two phases (see Figure 4.1). Phase One focuses on sampling and cleanup for properties where people are at greatest risk of exposure, including homes, childcares, schools, camps, and parks. Phase One also continues education and outreach, and encourages cleanup during development. For Phase Two, Ecology plans to explore requiring soil sampling and cleanup during development, and encouraging action through real estate transactions. Other strategies include streamlining cleanup approval and working with other agencies to address properties they manage.

Alternative C – All Properties Sampled and Remediated - Ecology looked at cleaning up the entire plume. Given the number of parcels, limited funding, and Area-Wide Soil Contamination Task Force advice, this is not a practical or cost-effective approach.

Alternative D – Limited Action - Ecology looked at using only institutional controls, such as property use restrictions, zoning overlays, and outreach. Environmental covenants or deed restrictions could warn future land owners about contamination and explain what to do about it. Local planning offices could use a zoning overlay, similar to a flood hazard overlay. Ecology rejected this option out of concern that parcels with higher contamination should be addressed with more permanent solutions.

Figure 4.1 Summary of Proposed Alternative B Actions

Phase One	Phase Two
Starting in 2011-2012 • Yard sampling and cleanup program for areas most likely to have average arsenic over 100 ppm. • Encourage sampling and cleanup during the development process, and support local government permitting offices that require or encourage action. • Continue outreach and education for the general public, and to support the other two Phase One actions.	Starting by 2015 • Continue to require or encourage action on land undergoing development. • Require or encourage action through real estate sales. • Streamline Ecology determinations and cleanup approval. • Develop long term strategies for land managed or regulated by other agencies. • As funds allow, clean up land uses or areas on properties (outside of play areas, for example) not addressed in Phase One.

4.2.2 Model Toxics Control Act Evaluation Requirements

Model Toxics Control Act (MTCA) threshold requirements state that the preferred alternative shall:

- Protect human health and the environment.
- Comply with cleanup standards.
- Comply with applicable state and federal laws.
- Provide for compliance monitoring.

Other requirements, after meeting the threshold requirements, include

- Making sure cleanup is permanent and practicable (can be done with the resources available).
- Completing cleanup in a reasonable time frame.
- Consider public concerns.

Appendix F describes the MTCA criteria for choosing cleanup actions (WAC 173-340-360). Ecology compares each option to the most permanent solution. This helps show the pros and cons of each option and decide which is the most permanent option that is still practicable.

4.2.3 Evaluation Results

Ecology compared the four alternatives to the MTCA criteria. Alternative B is the most feasible approach, given the size of the site and funding from the Asarco settlement. This approach also provides a process to address longer term actions through Phase Two scoping. Ecology's evaluation of Alternative B is shown in Table 4.1. The criteria in the table are from WAC 173-340-360 (3)(f).

Table 4.1 Evaluation of Alternative B – Phased Prioritized Action

Evaluation Criteria	**Alternative B (Preferred Alternative) – Phased Prioritized Action**
Overall protectiveness of human health	Permanently removes arsenic and lead from most parcels with the highest contamination and where the most vulnerable people are at risk of exposure. Non-permanent remedies have institutional controls such as environmental covenants, signage, and education. These measures greatly reduce contact with contaminated soils.
Protectiveness – environment	Ecology's ecological evaluation (see Appendix C) finds that cleanup levels are protective of ecological receptors, except where contamination is left in place. In some cases, leaving open areas will have a net ecosystem benefit.
Permanence	Ecology will clean up most parcels with the highest contamination. Ecology will use soil excavation and removal for a permanent cleanup, wherever possible. Some parcels with high levels may have non-permanent cleanups, with institutional controls such as environmental covenants. Properties with moderate contamination are addressed over time through mostly voluntary actions and using model remedies.
Cost	Costs include soil sampling and remediation (mainly excavation, removal, and soil disposal). Other costs include staff to manage the cleanup, outreach work, and Phase Two planning and implementation. The Asarco settlement will cover most of these costs.
Effectiveness over the long term	This alternative is effective over the long term for most of the parcels and land uses impacted by high contamination, since most will have permanent cleanups. Non-permanent remedies have institutional controls to ensure they are effective in the long term.
Management of short term risks	Ecology will reduce short term risks using best management practices and measures outlined in the SEPA checklist (Appendix E). Measures include protecting human health and managing storm water runoff and escaping dust.
Technical and administrative implementability	The number of parcels makes this a complex alternative, but prioritizing and phasing makes it manageable. Funding for this alternative comes from the Asarco settlement. Tacoma Smelter Plume Model Remedies will reduce the complexity of cleanup on many parcels.
Consideration of community concerns	Ecology has been doing ongoing stakeholder work with local governments, agencies, and other groups. Ecology will consider public comments in finalizing the Interim Action Plan and designing the yard sampling and cleanup program.

4.3 Further Justification for the Preferred Alternative

The Model Toxics Control Act (WAC 173-340-360 (2)) states

> *Because cleanup actions will often involve the use of several cleanup action components at a single site, the overall cleanup action shall meet the requirements of this section. The department recognizes that some of the requirements contain flexibility and will require the use of professional judgment in determining how to apply them at particular sites.*

Thus, the design of the Interim Action Plan is also based on the advice of the Area-Wide Soil Contamination Task Force and lessons learned from Ecology's past work to address the plume. Sections 4.3.1 to 4.3.4 describe four major considerations for selecting an overall cleanup approach.

4.3.1 Protecting Human Health

Ecology is using a wide range of approaches to address human health risk. The more intensive approaches involve physical cleanup of contaminated soils. The less intensive approaches educate individuals about how to protect themselves and their families, and encourage land owners to take action. Ecology will address the parcels in the high zone (average arsenic over 100 ppm, Appendix A.4), through the Soil Safety Program and yard sampling and cleanup program. The agency will also focus on places where children play.

Outside of the high zone (average arsenic 20-100 ppm), Ecology will rely on outreach and voluntary action. Ecology will clean up play areas outside the high zone but inside the Soil Safety Program Service Area.

4.3.2 Practicality in Relation to Complexity of the Site

It is not practical to address the whole site at once, due to the number of properties and large volume of soil. It is also not practical or cost-effective to do permanent cleanup on all properties with arsenic or lead exceeding state cleanup levels. Phased prioritized action and property cleanups balance short-term effectiveness and cost with long-term effectiveness and permanence.

The proposed approach leverages private and public funding, and maximizes use of limited Asarco settlement funds and State Toxics Cleanup Account funds. The phasing of the cleanup allows for more research and public comment on options for Phase Two. However, it does not delay Phase One actions, particularly the yard sampling and cleanup program.

4.3.3 Consistent With Public Concerns

Ecology considers the advice of the Area Wide Soil Contamination Task Force as representing some key public concerns. More recent stakeholder input has many of the same concerns, but has generated new ideas. The Interim Action Plan addresses public concerns in different ways:

- Land uses included in Phase One sampling and cleanup are consistent with the task force's guiding principles and the 2005 Area-wide soil contamination law (Chapter 70.140 RCW). They both address areas of high contamination and child use areas.

- Outreach and education incorporates task force advice and guiding principles that focus on controlling exposure.
- Phase Two scoping will look at the feasibility of many of the task force recommendations, including addressing soil contamination through development and property sales.
- Leveraging action through other organizations, for parcels in the moderate zone, is also consistent with task force advice.

See Appendix G for a list of task force recommendations and which ones the Interim Action Plan will address. The Public Participation Plan (Appendix H) describes how Ecology will gather public input on the Interim Action Plan.

Ecology used the task force's guiding principles (AWTF 2003) to plan early actions under the Tacoma Smelter Plume Management Plan. Ecology also used them to build the Interim Action Plan. As written by the task force, the guiding principles are:

- **A balanced approach is needed.** Responses to area-wide soil contamination should be effective, practical and affordable.
- **Lower adverse health risk.** Risks from area-wide soil contamination appear to be relatively low when compared to risks at sites with higher concentrations of contaminants.
- **Focus on controlling exposure.** It is prudent to take effective, practical, and affordable steps to minimize the potential for exposure to area-wide soil contamination.
- **Focus on children.** Efforts should focus on children, because they are believed to be the human population most sensitive to elevated levels of lead and arsenic in the environment.
- **Responses increase as exposure increases.** Responses to area-wide soil contamination should be commensurate with the level of risk associated with potential exposures and should increase as potential exposure increases.
- **Decisions should be made locally.** Decisions about how to address area-wide soil contamination should be made locally.

The Interim Action Plan takes a balanced approach. It allocates the most resources to people and areas at highest risk. It uses alternatives to active cleanup for areas and people at lower risk. All proposed actions achieve the goal of lowering exposure to contaminated soils, particularly for children.

Local health departments will work with Ecology on decisions about outreach strategies. Right now, local planning offices must decide whether to require soil sampling and cleanup as part of the development process. Ecology will continue to gather public input and consider public concerns as part of the final Interim Action Plan. The agency will also ask for input in research for Phase Two.

4.3.4 Considerations Based on SEPA Evaluation

Appendix E discusses the main environmental impacts and considerations for designing the Ecology-managed yard sampling and cleanup program. The impacts of Alternative B, while large, can be lessened. They include:

- **Transportation:** Bringing in equipment and trucking away soils will cause traffic impacts. They can be lessened by planning truck routes to reduce miles driven, informing neighbors, and avoiding using large trucks on small streets.
- **Public Services and Facilities:** Ecology estimates a manageable volume of soil will go to local landfills because the program will run over ten years or longer.
- **Air Quality**: Soil cleanup can cause dust to escape the site. Soil-moving equipment and trucks also release exhaust. Air impacts can be lessened by watering down soils to avoid dust and reducing vehicle trips and idling.
- **Water Quality:** Best management practices can prevent runoff of contaminated soils during cleanup. These include, but are not limited to, covering soil stockpiles, avoiding sloped areas, building structures to control runoff, and preserving or replacing vegetation.

These impacts would be much larger if Ecology were to try to clean up all parcels within the plume. The no action and limited action alternatives would avoid these environmental impacts. However, soil contamination left in place could still impact air and water quality, and Ecology would have less leverage to require mitigation.

4.4 Alternatives Considered but Not Selected

Ecology looked at three alternatives that were considered but did not select them: no action; sampling and cleaning up all properties in the plume; and taking limited action. This section describes the main reasons Ecology did not choose the other options. See Appendix F for a table of each option compared against the MTCA criteria for selecting cleanup actions.

4.4.1 Alternative A: No Action

Ecology would take no further action to address contamination in the Tacoma Smelter Plume. The agency rejects this option for the following reasons:

- It is inconsistent with Area-Wide Soil Contamination Task Force advice (AWTF 2003)**.** The task force presented a range of options for addressing contamination—Ecology has used many of these and many are still viable options for action.
- It is inconsistent with intent of the Model Toxics Control Act. It is not protective of human health and would leave people exposed to high levels of arsenic and lead.
- It does not address areas and people at greatest risk of exposure.
- There is funding for cleanup, outreach, and technical assistance from the Asarco settlement.

4.4.2 Alternative C: All Properties Sampled and Remediated

Ecology would clean up or require cleanup of all parcels in the plume. This option assumes cleanup for all parcels over the arsenic cleanup level of 20 ppm arsenic. The agency rejects this option for the following reasons:

- Ecology does not have enough funding to sample and clean up all parcels in the plume.
- It is not practical or desirable for Ecology to require that all land owners within the plume clean up their properties.

- It is neither practical nor a good use of resources to attempt to clean up such a large area involving hundreds of thousands of parcels.
- Cleaning up all parcels would create a large environmental impact. If excavation and removal was the main cleanup method, Ecology would have to send a very large volume of soil to landfills. There is likely not enough landfill space, nor is this the best use of landfill space.
- It is not consistent with Area-Wide Soil Contamination Task Force advice for addressing area-wide contamination**:**

  Beyond the broad-based education and awareness-building…the Task Force does not recommend that additional remediation responses are needed at every individual property with low-to-moderate arsenic and lead soil contamination, unless exposure potential exists for children or the likelihood for enhanced exposure potential exists for adults through activities such as gardening. (AWTF 2003)

Requiring sampling and cleanup for **some** properties, through local government action, will be evaluated during Phase Two (see Chapter 7).

4.4.3 Alternative D: Limited Action

Ecology would rely only on institutional controls, such as outreach, environmental covenants or deed restrictions, and hazard zoning overlays. Ecology looked at this option as a way to address the whole plume with very limited funding. It assumes that Ecology would not be able to fund soil sampling or cleanup. Land owners would have to pay for work on their own properties. The agency rejects this option for the following reasons:

- It is not consistent Area-Wide Soil Contamination Task Force advice. Institutional controls do not protect people well enough in areas of highest contamination.
- Ecology does have funding from the Asarco settlement to clean up some parcels with the highest contamination.
- Based on input from local planning offices and local officials, zoning overlays and deed restrictions may not be practical or politically feasible. Ecology will explore them as an option for Phase Two (see Chapter 7).

Chapter 5 – Phase One Actions

5.1 Introduction to the Four Main Phase One Actions

Ecology chose a phased approach to addressing the Tacoma Smelter Plume (Chapter 4). The four Phase One actions are to:

1. **Start a yard sampling and cleanup program.** Design and manage a free program for sampling yards in the high zone (Appendix A.4), where average arsenic may be over 100 ppm. Offer free cleanup of yards if arsenic or lead are over the Ecology action levels (Section 6.4.1). The program would be voluntary.

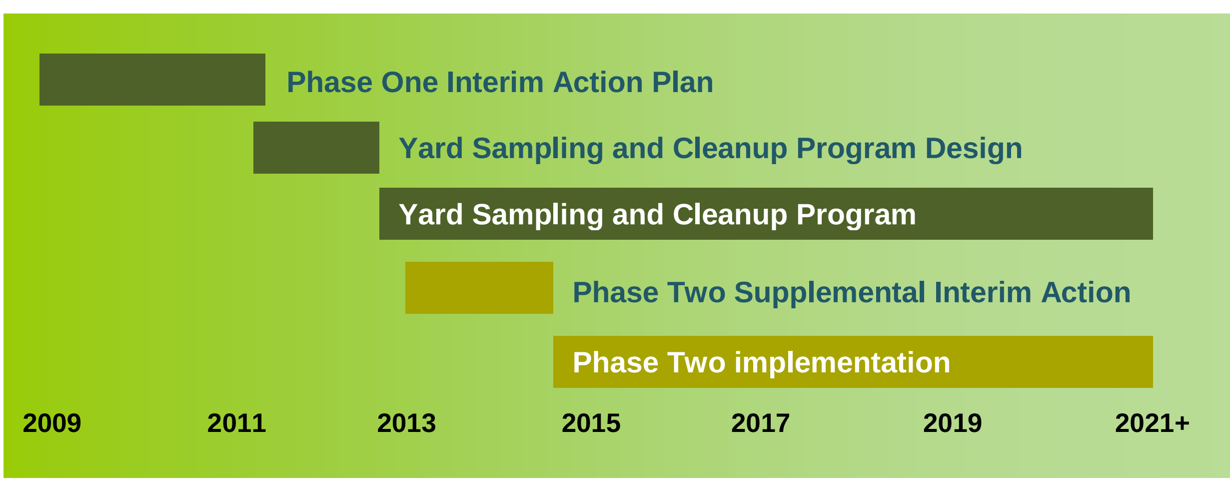
2. **Continue the Soil Safety Program.** Sample and clean up play areas in the program service area. Include new schools and childcares and existing parks, camps, and multi-family public housing. Work with park districts to incorporate cleanup into any planned renovations. Provide outreach, brochures, and play area signage.

3. **Support local government and land owners to address property being developed.**
   a) Provide guidance and technical assistance to local government planning and permit offices. Encourage sampling and cleanup for new developments.
   b) Provide guidance and technical assistance to developers and land owners doing sampling and cleanup.

4. **Continue outreach and education.** Support actions 1-3 above, and continue broad-based education to people in the Tacoma Smelter Plume.

Ecology proposes spending $64 million over 10 years on yard sampling and cleanup in the high zone (Appendix A.4). Ecology will design the program after taking public comment on the Interim Action Plan. Sampling would begin in late 2012 (Figure 5.1). Phase One also continues the Soil Safety Program, education and outreach, and technical assistance.

Figure 5.1 Interim Action Plan Timeline



5.2 Guiding Principles: Target Children and Areas of Highest Contamination

The Interim Action Plan uses the guiding principles of the Area-Wide Soil Contamination Task Force and the Tacoma Smelter Plume Management Plan (see Chapter 3 and Appendix G). The following points guided the choice of Phase One actions:

- Sample and clean up areas most likely to have high soil contamination (Appendix A.4).
- Address places where children play, are present on a regular basis, and have the greatest risk (schools, childcares, multi-family housing, parks, camps, and homes).
- Reach out to those with daily contact with young children (parents, teachers, childcares).
- Do the most with funding.
- Take environmental justice into account when deciding where to spend money and what to do first. Make sure that disadvantaged areas or groups are addressed.

5.3 Continue the Soil Safety Program

In 2006, Ecology started the Soil Safety Program for play areas at schools and licensed childcares (see Section 3.4.3). Ecology defined a service area (Appendix A.3, darker blue line). It includes areas most likely to have maximum arsenic over 100 ppm. The program will continue to address play areas at new schools and childcares in the service area. In 2010, Ecology expanded the program to include play areas at existing parks, camps, and public multi-family housing.

The Soil Safety Program now uses an updated service area map (Appendix A.3, lighter blue line). On a case-by-case basis, Ecology may address play areas that are outside the new service area but inside the old one.

As of September 2011, Ecology has sampled play areas at most parks, camps, and public multi-family housing within the service area (Table 5.1). Play areas with soils over Soil Safety Program action levels (Table 3.1) qualify for cleanup. Table 5.2 shows how Ecology is addressing different play area types within the Soil Safety Program. Ecology is currently working with park districts and camps to create cleanup plans.

Table 5.1 Soil Safety Program Accomplishments (through September 2011)

Facility Type	Assessed	Sampled	Cleanup Needed	Cleanup Complete	Cleanup Proposed
Childcare	834	712	81	81	0
School	220	182	27	24	3
Park	176	149	24	3	21
Camp	4	2	2	0	2
Public Housing	11	4	0	0	0
Total	**1246**	**1049**	**134**	**108**	**26**

The Soil Safety Program has used the action levels from Table 5.2 for the past five years. School and childcare play areas are used often by large numbers of children. Public multi-family housing serves lower income populations. Housing agencies are assumed to have fewer resources to clean up contamination on their own.

Ecology is using the same Soil Safety Program action level used for schools and childcares at the parks, camps, and public multi-family housing play areas. The action level is the cleanup level for arsenic and lead. Ecology will clean up play areas to the Model Toxics Control Act Method A cleanup level. This is 20 ppm average arsenic (40 ppm max), and 250 ppm average lead (500 ppm max).

Table 5.2 Phase One Action – Soil Safety Program (2010-2021+)

	Arsenic or Lead Level in Soil Safety Program Service Area (see Appendix A.3 map)	
Land Use	**Arsenic >20 ppm or Lead >250 ppm**	**Arsenic <20 ppm and Lead <250 ppm**
New school and licensed childcare play areas	Ecology interim actions using Soil Safety Program design	No cleanup needed, outreach and education still encouraged to protect children who may be exposed at home
Existing parks, camps, and public multifamily play areas	Ecology interim actions using the Soil Safety Program design and 2010 addendum	No cleanup needed, outreach and education available upon request

Based on public input on the draft Interim Action Plan, Ecology is adding more actions to the Soil Safety Program. Within the high zone (Appendix A.4.1 map), the program will now assess if there are child play areas at existing:

- Places of worship.
- Preschools.
- Private parks, including ones managed by home owners associations.
- Community centers and public facilities.

Ecology will count the additional play areas and look at the size and cost of soil sampling and possible cleanup. If the number of play areas is small and easily identified, Ecology will try to include the play areas in the Soil Safety Program now. If not, the later Phase Two Interim Action Plan will include them (Chapter 7).

5.4 Start a Yard Sampling and Cleanup Program

Ecology plans to spend around $64 million on a voluntary yard sampling and cleanup program. The program will focus on places most likely to have high arsenic levels (over 100 ppm). It will also target the high use areas of residential properties, including where children play.

The yard program may take 10 or more years to reach all homes in the high zone. The number of yards addressed and the length of the program depend on how much money the legislature gives Ecology. It also depends on the interest the account earns and how the cost of sampling and cleanup changes over time.

Ecology will clean up smaller properties, up to a quarter acre. For properties larger than a quarter acre, cleanup will only address high use areas such as play areas, gardens, or pathways. Table 6.1 in Chapter 6 shows where Ecology will and will not do sampling and cleanup. See Chapter 6 for more details about how the yard sampling and cleanup program would work.

5.5 Support Local Government and Land Owners to Clean Up Properties Under Development

For development projects with high or moderate levels, Ecology's approach is the same. Ecology encourages land owners to do sampling and cleanup during the project, as was advised by the Area-Wide Task Force. Ecology will work with local governments to encourage action through their permitting processes. Ecology will provide model remedies guidance (Appendix B) and technical assistance to local governments, developers, and land owners. This action focuses on residential development but can be applied to other land uses.

Ecology currently provides technical assistance to:

- **Local government planning and permitting offices.** Ecology provides State Environmental Policy Act (SEPA) comments for Pierce and Thurston Counties only. The comments note that the property is within the Tacoma Smelter Plume and that soils should be sampled.
- **Developers and land owners.** Ecology gives informal assistance, such as reviewing sampling plans and results, and guidance on cleanup measures. Land owners can also get technical assistance through the Voluntary Cleanup Program.

Phase Two of the Interim Action Plan will focus on how to address contaminated soils during development and real estate sales (Chapter 7). However, Ecology recognizes that:

- Properties will continue to be developed before long-term solutions can be designed.
- Some land owners in the high zones will want to re-develop their properties before they are reached by Ecology's yard program.
- Many properties will not qualify for the Ecology yard sampling and cleanup program.

Therefore, Ecology will continue to provide technical assistance. The following proposed actions can help planners and land owners or developers now:

- Ecology will provide consistent sampling and cleanup guidance through the Tacoma Smelter Plume Model Remedies (Appendix B).
- Ecology will continue to provide informal technical assistance to local governments and land owners. Land owners who want a No Further Action determination must still enter the Voluntary Cleanup Program.

- Ecology will continue to provide a map showing contamination zones and will work with local jurisdictions to include this overlay in their Geographic Information Systems.
- Ecology will provide outreach and education to local planning departments, with a focus on using the model remedies guidance with permit applicants.
- Ecology will also evaluate the model remedies guidance and do more fact-finding with local governments and developers.
- Ecology's Southwest Regional Office will continue to provide SEPA comments on soil sampling for properties in the plume.
- The agency is exploring providing comments for similar development projects in King County (covered by Ecology's Northwest Regional Office).

5.6 Continue Outreach and Education

A complete outreach and education program will include broad-based and targeted activities by local health departments, Ecology, and other stakeholders. Ecology will continue funding health departments for the majority of outreach work (Section 3.4.1 and 3.4.3). Ecology expects to provide ongoing funding for outreach and education after the Asarco settlement is spent.

Broad-based outreach includes mass media ads, direct mailings, and local events. Targeted outreach will focus on children and their caretakers, gardeners, ethnic groups, disadvantaged communities, and more. Ecology will also do outreach to support the yard sampling and cleanup program and to local planners and developers.

Local Health Departments - Ecology will continue funding health departments to provide education and outreach in Pierce, King, and Thurston counties to:

- Reach every person in the Tacoma Smelter Plume.
- Target outreach to people at higher risk, such as children and those in the high zones.
- Identify new groups to target and new outreach methods.
- Educate new tenants and homeowners in impacted areas.
- Reach out to gardeners and landscapers.
- Work with EPA to increase outreach to the Ruston/North Tacoma Study Area.

Ecology will work with health departments on roles and responsibilities. Health departments will develop work plans each biennium and revise them as needed – at least every year. Work plans will include methods to evaluate and report on outreach and education. Health departments will also allow for stakeholder input on work plans and the effect of their efforts.

Ecology-Managed Outreach - Ecology will continue to manage broad-based outreach. This includes television and online ads, fact sheet mailings, and surveys to measure awareness and behavior change. Ecology will also provide targeted programs such as outreach to disadvantaged communities and childcare provider trainings.

Yard Sampling and Cleanup - Ecology plans to use outreach to support yard sampling and cleanup. Outreach will help people in affected areas understand the program and give Ecology access for sampling. People can also use healthy actions to reduce their risk, even when they are not at home.

Development - Planners and developers will receive targeted outreach. Ecology will create brochures, web resources, and other outreach tools.

Real Estate Agents - Several real estate agents have asked Ecology to put together more outreach materials and programs to teach them about soil contamination issues. Ecology plans to do outreach to real estate agents in the future. Phase Two will explore ideas such as building a training course or requiring that soil contamination brochures be given to all home buyers.

Other Stakeholders - Depending on the group or person, outreach tools may include brochures and fact sheets, direct mailings, ads, local events, or trainings. Ecology hopes to find more stakeholder groups during the public review process for the Interim Action Plan.

Chapter 6 – Yard Sampling and Cleanup Program

This chapter describes the proposed yard sampling and cleanup program, which Ecology will fund using the Asarco settlement. It will cover residential properties within the most highly contaminated areas of the Tacoma Smelter Plume. Ecology will offer soil sampling and cleanup when soils are over the action level of 100 ppm arsenic or 500 ppm for lead. Ecology will write a more detailed program design after finalizing the Interim Action Plan. This program design will go out for public comment.

6.1 Yard Sampling and Cleanup Is Based on Map Zone and Land Use

Ecology proposes choosing where to start yard sampling and cleanup based on:

- Map zone—where arsenic levels may be over 100 ppm.
- Land use (see Table 6.1).

Generally, Ecology will address areas likely to have high contamination and land uses where children are at greatest risk. Within a property, there may be areas that are more heavily used—gardens, paths, lawns—or where children play. Depending on the land use and property size, Ecology may focus only on high use areas. This will ensure that limited funding goes to the areas that need it most.

Map Zone: Appendix A shows maps of the Tacoma Smelter Plume (A.1) and high zones (A.4.1 – A.4.3). The **high zone**[4] is the area where average arsenic may be over 100 ppm. The high zone covers parts of north and west Tacoma, Ruston, Vashon-Maury Island, Fircrest, and University Place. Levels are highest near the smelter, and decrease with distance. Contamination levels also generally follow a north-northeast and south-southwest axis in terms of wind direction.

Ecology will likely begin in the Ruston/North Tacoma Study Area, which has known high contamination. Ecology does not agree with EPA's action level of 230 ppm arsenic, and plans to address properties with arsenic between 100 and 230 ppm. See Section 2.2 for more on EPA's Asarco Superfund cleanup approach and Ecology's response.

Ecology will not clean up yards with moderate contamination—arsenic 20-100 ppm or lead 250-500 ppm. However, Ecology will clean up yards in the **moderate zone** if the owner samples and finds high levels of arsenic or lead contamination. High levels are arsenic over 100 ppm or lead over 500 ppm.

Land Use: Ecology will also take action based on land use. The program proposes to address the following land uses in this order:

1. Existing private multi-family housing in the high zone (Appendix A.4).
2. Existing single-family homes in the Ruston/North Tacoma Study Area (Appendix A.2).
3. Existing single family homes outside of the Study Area, in the high zone.

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[4] This map is still in development and we expect to have a refined high zone boundary by the end of 2012. We are using a larger dataset and more complex statistical methods to better estimate the high zone.

This order may change based on public input. Over 17,000 properties may qualify for yard sampling (see Table 6.2). Ecology will refine this number as part of the program design process.

The program excludes undeveloped land or natural areas, and commercial, industrial, and agricultural lands, even those with high arsenic or lead. Ecology may address undeveloped lands undergoing development as part of Phase Two. Ecology also encourages land owners to clean up most of these property types during development.

Table 6.1 Yard Sampling and Cleanup Program – When Ecology Will Take Action

	High Zone (average arsenic >100 ppm)			Moderate Zone (average arsenic 20-100 ppm)		
Land Use	**Who samples?**	**Cleanup if results are high**	**Cleanup if results are moderate**	**Who samples?**	**Cleanup if results are high**	**Cleanup if results are moderate**
Existing private multi-family housing play areas	Ecology	Ecology	Land owner	Land owner	Ecology	Land owner
Existing single-family residential*	Ecology	Ecology	Land owner	Land owner	Ecology	Land owner

*For average-sized lots, Ecology will address the whole property. For properties over a quarter acre (11,000 square feet), Ecology will only address high use areas.

Table 6.2 Estimated Residential Parcels in the High Zone, by Jurisdiction

Jurisdiction	Estimated Parcels
Town of Ruston (EPA Superfund Site)*	315
North Tacoma (EPA Superfund Site)*	2,350
City of Tacoma (outside of EPA Superfund Site)	5,690
City of University Place	6,450
Vashon-Maury Island	2,415
Total	**17,220**

*Ecology will see if arsenic contamination over 100 ppm remains on properties.

6.1.1. Reasons to Focus on Areas of Highest Contamination

Ecology decided to clean up areas likely to have high contamination because this is where people are at greatest risk. The action level is 100 ppm average arsenic (200 ppm maximum) and 500 ppm average lead (1000 ppm maximum). For contamination higher than these levels on residential properties, Ecology is uncomfortable relying on education and outreach to protect human health.

See Appendix D for more on how Ecology set the action levels.

6.1.2. Reasons to Focus on Land Uses with Play Areas

This approach protects children, who are at greatest risk of exposure and adverse impacts. Children have smaller, less developed bodies, and behaviors that can increase potential exposure. Young children spend more time closer to the ground and have behaviors that increase the likelihood of accidentally ingesting soils. Cleaning up yards and play areas at childcares and schools can reduce children's exposure to contaminated soil.

Ecology ranked land uses based on the amount of time children may spend there. This approach is consistent with the advice of the Area-Wide Soil Contamination Task Force (2003).

1. **Existing multi-family housing play areas** - Multi-family housing play areas often serve many children. Multi-family housing includes apartments and mobile home communities. Many housing complexes are in lower income neighborhoods. Economic, language, or cultural barriers may make it harder to do outreach to residents. Ecology has already sampled public multi-family housing under the Soil Safety Program.

2. **Existing single family housing in the Ruston/North Tacoma Study Area** – EPA is cleaning up this area. However, many yards have remaining contamination over 100 ppm and below 230 ppm arsenic. Ecology expects that the study area will have the highest percentage of properties needing cleanup. Single family homes may have fewer children playing in the yard than multi-family residences.

3. **Existing single family housing outside of Ruston/NorthTacoma Study Area** - Single family homes may have fewer children playing in the yard.

This approach also fits and expands on the Tacoma Smelter Plume Management Plan and Soil Safety Program. The Soil Safety Program cleaned up school and childcare play areas to reduce risk for a large number of children who spend time at these facilities. The expanded program now includes parks, camps, and public multi-family housing.

6.1.3 Other Approaches Ecology Looked At but Did Not Choose

Geographic Area - Ecology considered including areas of moderate contamination, with average arsenic from 20-100 ppm. However, Ecology does not have the funding or staff to manage physical cleanup of the entire plume. The impacts of removing so much soil might outweigh the benefits of addressing fairly low levels of contamination. For example, the work would greatly increase truck traffic and fill landfill space needed for municipal waste. Sampling and cleanup would also take a long time, perhaps 100-200 years.

Focusing on the high zone is consistent with the advice of the Area-Wide Soil Contamination Task Force (2003). Plus, Ecology will still clean up play areas over 20 ppm arsenic or 250 ppm lead under the Soil Safety Program.

Land Use - Ecology looked at including other land uses in the program:

- Existing school and childcare properties, beyond just play areas.
- New parks and camps.
- Commercial and industrial properties without play areas.
- Undeveloped land and natural areas.
- Agricultural land and nurseries.

For schools and childcares, the rest of the property poses less risk than play areas. Childcares designate play areas during the licensing process and must restrict children to these areas. Every two years, Ecology will look at whether there are funds to address the remaining property.

For new parks and camps, Ecology expects land owners will do sampling and cleanup during development. In many cases, grading, digging, and construction will lead to soil cleanup. However, it is unlikely that development alone will achieve cleanup. The area may be too large to do an affordable cleanup. Every two years, Ecology will look at whether there are enough funds to address new parks and camps.

The yard sampling and cleanup program will not include commercial and industrial properties, undeveloped land and natural areas, or agricultural land. However, these land uses are covered by broad-based outreach. This is consistent with advice of the Area-Wide Soil Contamination Task Force. These land uses do not pose as large a risk to children or other vulnerable populations. Many of these properties can be addressed through private funding, development, or Ecology's Voluntary Cleanup Program. Ecology will look at this again in Phase Two.

6.2 Considerations for the Detailed Yard Sampling and Cleanup Program Design

Ecology will work with stakeholders like local officials, neighborhood councils, and other groups during the yard sampling and cleanup program design process. Ecology plans to put a draft program design out for public comment in 2012. The agency will then refine and finalize the design based on public input. Along with any issues brought up during the public comment period, Ecology will also address:

- **Administration** - Ecology's Toxics Cleanup Program will manage the cleanup, funding, staffing, and contracts. One goal is to make the Asarco settlement funds last for the ten-year program timeframe. Ecology will also decide whether any policy or regulatory changes are needed.

- **Sampling and Cleanup Processes** - Ecology will write a soil sampling design and quality assurance project plan. The Tacoma Smelter Plume Model Remedies (see Chapter 11) will help guide sampling and cleanup processes. Other decisions include what work to contract out, how to track sampling and cleanup results, and how to track contaminated soils left in place.

- **Outreach and Education** - Ecology will cover how to approach land owners and what outreach they will receive during sampling and cleanup. The design will also describe how Ecology will provide land owners with sampling results and cleanup documentation.

- **Managing Environmental Impacts** - The program design will provide details on how to lessen environmental impacts listed in the SEPA Checklist (see Appendix E).

- **Residential Cleanup Area** - With larger lots over a quarter acre (11,000 square feet), Ecology will likely focus on high use areas. Institutional controls will address remaining contamination. The program design will better define high-use areas and decide how less used areas should be addressed.

6.3 Soil Sampling

The Tacoma Smelter Plume map (see Appendix A.1) shows the general pattern of arsenic levels. The map uses a limited number of sample results to predict where soils might have over 100 ppm arsenic. The levels also vary greatly from property to property. As a result, Ecology must sample each property to tell if cleanup is needed and in what areas.

6.3.1 Sampling Sequencing

Ecology proposes sampling properties in the high zone, following the criteria in Section 6.1. Ecology will likely sample a few city blocks at a time and quickly clean up yards where average arsenic exceeds 100 ppm. This means that a number of cleanups may happen at the same time within a neighborhood. Doing sampling and cleanup at the same time may be more efficient and reduce the length of time a neighborhood is impacted.

Ecology looked at first sampling all properties in the high zone, then developing a cleanup plan for all of them at once. Ecology rejected this approach because it could take years to finish sampling. The yards most likely to have high levels need to be cleaned up sooner. The downside to doing sampling and cleanup at the same time is that it is harder to predict the overall cleanup cost. However, the Soil Safety Program does provide data about the percent of properties that may need cleanup. These data form the basis for early cost estimates for sampling and cleanup.

Ecology will create a detailed plan for sequencing sampling and cleanup. The plan will use public input and advice from local governments. It will also take into account:

- A refined estimate of where arsenic is likely to be over 100 ppm (in progress as of October 2011).
- Data from the Soil Safety Program and home soil testing in Pierce and King Counties.
- Data from EPA's sampling and cleanup of the Ruston/North Tacoma Study Area.
- Housing ages and development histories. Homes built after 1970-1980 are less likely to have high levels because the smelter shut down in 1985. Recently developed areas may have lower levels due to soil disturbance during grading, building, or landscaping.
- New data gathered when the yard sampling part of the program begins.

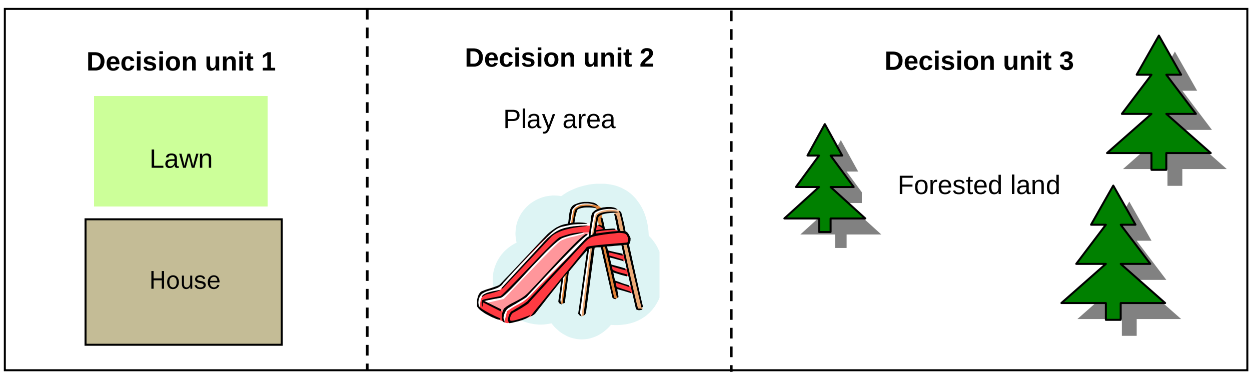
6.3.2 What Part of the Property Ecology Will Sample

This depends on the property type and size.

During sampling, Ecology will divide each property into “decision units.” Each decision unit may have a different history or current use. For example, if the lawn is not used as much as the play area, it would be a different unit (Figure 6.1). Likewise, areas that have been forested for a long time tend to have higher levels. They might also be a separate unit. The number of decision units on a property depends on the land size and uses.

Based on land use, Ecology may take more samples in different decision units (see Section 11.5). The number of samples also depends on the size of the unit. Generally, Ecology will not sample or clean up areas that are paved or under existing structures. Ecology will use the sampling results for each decision unit in the cleanup process.

Figure 6.1 Examples of Sampling Decision Units on a Property With Three Different Uses



6.4 Cleanup Process

6.4.1 Action Level

Ecology has set action levels for arsenic and lead that trigger cleanup (Appendix D.5):

- Average arsenic >100 ppm
- Maximum arsenic >200ppm
- Average lead >500 ppm; or
- Maximum lead >1000 ppm.

The action levels only apply to the yard sampling and cleanup program. They are not for independent cleanups or the Soil Safety Program. Ecology is using these levels to ensure that the yards with the worst contamination are cleaned up. **However, Ecology will still meet the cleanup levels of 20 ppm for arsenic and 250 ppm for lead for any cleanup.**

Yards with sampling results in the moderate range (20-100 ppm arsenic or 250-500 ppm lead) do not qualify for the Ecology-funded program. However, Ecology will provide outreach about healthy actions and how land owners can do their own cleanup, if they choose. Ecology will also continue to encourage cleanup during development projects and provide technical assistance.

6.4.2 What Areas of the Property Ecology Will Clean Up

Ecology proposes full property cleanup on small lots. On larger lots, Ecology will only clean up the high use areas. Low use areas on larger lots will have documentation showing where contamination remains. They may also have signage, education, fencing, or other barriers. There are three reasons for limiting cleanup on larger lots:

- They may have natural areas that would be destroyed by cleanup.
- Active cleanup costs more than institutional controls and is better suited to areas where humans are exposed.
- Some areas with larger parcels have no local landfills (Vashon-Maury Island) or limited landfill space.

In general, Ecology will clean up all accessible soil that exceeds the action levels. Accessible soils are those not covered by

- Permanent structures.
- Asphalt or concrete paving, such as sidewalks, driveways, patios, and parking areas.
- Other cap materials sufficiently covering the contamination.

Ecology will also not clean up areas that are too difficult or dangerous to reach, such as under decks or sheds, or along steep slopes.

6.4.3 Cleanup Methods

Ecology will work with the land owner to develop a cleanup plan. Owners provide information about the uses of the property and where people might be at risk. Ecology also needs their input for restoring the yard and choosing effective institutional controls. Ecology plans to hire a contractor to do the sampling and cleanup, but will oversee the work and cleanup decisions.

Ecology will likely use some of the Tacoma Smelter Plume Model Remedies (see Chapter 11) for yard cleanups. Only two model remedies—excavation and certain types of capping—can be used for properties with over 100 ppm average arsenic or 500 ppm lead. Ecology prefers excavation because it is the most permanent cleanup method.

With excavation and removal, Ecology will remove contamination to a depth where soils meet the state cleanup level (see Chapter 10). The depth will depend on soil sampling results, but Ecology will typically remove at least 12 inches and replace it with clean soil. In some cases it may not be feasible to dig deep enough to reach all contaminated soils.

Ecology may leave contamination in place under a hard cap (asphalt or concrete) or a geotextile liner covered with soil. Ecology will only leave contamination that is above the action level if it is under a hard cap or a two-foot soil cap. In these cases, the geotextile liner serves as both a barrier to contaminated soils and, if it is exposed, a warning that more soils need to be added.

6.4.4 Sampling, Restoring Landscaping, and Documenting the Cleanup

Sampling - Ecology will do sampling to show that excavation removed all contamination. The sampling happens before the area is backfilled with clean soil.

Restoration - Once soil cleanup is complete, Ecology will work with the land owner to restore landscaping. However, it must meet local landscaping and zoning codes. Ecology may leave trees and shrubs in place or remove them. In the program design, Ecology will make provisions for large trees and shrubs where digging cannot be done without damaging the roots. Ecology will also make provisions to remove and replant, or replace plants of special concern to the land owner.

Restoration will include replacing lawns and landscape plants, and restoring fences or walls that were removed or damaged during the cleanup. Ecology may fence areas that are too steeply sloped to be excavated, or plant them with low lying shrubs. Ecology will note where these areas are and explain how to limit exposure to the soils. Ecology will work with land owners to ensure that lawns, trees, shrubs, and other landscaping are successfully established.

Documentation - Ecology will provide land owners with a binder recording sampling results and the cleanup process. It will describe where contamination remains and how to limit exposure. Ecology will strongly encourage land owners to pass this binder on to future owners. Ecology will keep sampling and cleanup information in an Ecology-managed database that will be available to the public.

6.4.5 Institutional Controls

Institutional controls enhance non-permanent cleanup methods, such as capping, where contamination is left in place. They can include legal tools like environmental covenants or deed restrictions to warn future land owners. These tools also restrict activities such as digging or construction in areas with remaining contamination. Other controls include barriers to accessing a contaminated area—fencing or plantings—and signs, brochures, and public outreach. See Section 11.6 for more details. Active cleanup is not always possible, so Ecology is relying on institutional controls to achieve cleanup on some properties.

Ecology does not plan to require an environmental covenant for non-permanent or partial cleanup actions under the Yard Sampling and Cleanup Program. However, Ecology will give the land owner a binder with sampling and cleanup records (see Section 6.4.4).

Ecology will maintain a public database. It will have all sampling data, cleanup actions, and institutional controls for each property in the program. Land owners may file a voluntary deed restriction to document any non-permanent cleanup actions, such as capping. Land owners may want to consult with an attorney before pursuing a deed restriction.

Ecology will also provide outreach and education. Outreach can make new owners aware of contamination, even if they were unaware of a deed restriction on their property. As part of Phase Two, Ecology will explore other ways to ensure new land owners have access to this information.

The basic framework for using institutional controls is in the Tacoma Smelter Plume Model Remedies (see Chapter 11). However, Ecology will provide further detail in the program design.

Ecology will evaluate the effectiveness of institutional controls as part of the periodic review process (WAC 173-340-420) for the Interim Action Plan.

6.4.6 Managing Environmental Impacts

Excavation and other soil moving can lead to exposures and releases of contaminants to air and surface water. Ecology will require contractors to use best management practices during soil excavation and removal, including:

- Dampening soil to keep dust down.
- Avoiding over-watering to prevent erosion or off-property migration of contaminated soil.
- Avoiding steeply sloped areas that are more prone to erosion.
- Covering soil piles, or surrounding them with berms to reduce soil runoff.
- Sending loaded trucks through a wash station to remove contaminated soils from tires and truck bodies to avoid tracking materials offsite.
- Covering soil loads before leaving the work site.

Under Washington's worker safety regulations, contractors must limit worker exposure to dust and soils. The Department of Labor and Industries has training requirements for people working in contaminated sites, governed by WAC 296-62, the General Occupational Health Standard.

6.5 Program Timeframe

The yard sampling and cleanup program will take at least 10 years to reach all residential properties in the high zone. Program design will begin in early 2012 and sampling will likely begin in late 2012. Cleanup will need to be staggered to occur several months after sampling. This will allow Ecology to work with land owners and contractors on cleanup plans.

Ecology expects to sample and clean up the private multi-family housing play areas within the first six years. Ecology also plans to address the Ruston/North Tacoma Study Area within the early years of the program. The rest of the properties will likely receive sampling and cleanup starting after 2014. Ecology will develop a detailed timeline as part of the program design. See Figure 5.1 for a basic timeline.

Chapter 7 – Phase Two Actions

7.1 General Approach for Phase Two

Phase Two of the Interim Action Plan will focus on options for areas not included in Phase One (Chapter 5). The majority, though not all, of these properties are likely to have moderate contamination (average arsenic 20-100 ppm). Ecology has four approaches that will require more research and public input before they can be used. They involve a blend of institutional controls and encouraging or requiring active cleanup:

1. Address soil contamination through development and property sales.
2. Streamline approval of cleanups.
3. Work with other government agencies to address properties they manage or regulate, especially childcares and schools.
4. At least every two years, check whether there is funding to address:
   a) Play areas at existing places of worship, preschools, private parks, community centers, and other public facilities.
   b) Entire properties at schools, childcares, parks, camps, and multi-family housing.
   c) New parks and camps.
   d) Undeveloped land becoming residential.

Ecology is asking for input on the proposed strategies now. Around 2014, a second Interim Action Plan will propose the Phase Two actions. Over the past three years, Ecology has met with many local governments, real estate agents, and state agencies. These stakeholders will be involved in the scoping and planning of Phase Two. Ecology is looking for feedback on:

- Ways to encourage sampling and cleanup.
- Whether Phase Two actions are feasible.
- How stakeholders or the public might react.
- If local governments have legal issues with the actions.
- If funding or other help is needed.
- Areas for further research.

Table 7.1 shows proposed Phase Two actions by land use and map zone. Ecology expects that Phase Two will continue for many years, although the goal is to institutionalize many of the actions over time. In the meantime, land owners or other agencies will need to address these properties on a case-by-case basis.

Table 7.1 Phase Two - Proposed Actions by Land Use and Estimated Contamination

High zone = average arsenic >100 ppm (max >200)
Moderate zone = average arsenic 20-100 ppm (max 40-200)

Land use	High Zone*	Moderate Zone*
Play areas at places of worship, preschools, private parks, community centers, and public facilities	At least every two years, evaluate funding to address sampling and cleanup of the play areas on these properties.	Encourage cleanup, but action at land owner's expense.
Property development with a focus on residential	Encourage (or require) action through planning and permitting offices. At least every two years, evaluate funding to address undeveloped land being developed for residential use.	Same as high zone, but requiring action may not be realistic. This is consistent with Area-Wide Soil Contamination Task Force advice. Encourage cleanup, but action at land owner's expense.
Existing residential	Educate land owners through real estate transactions. Provide informational trainings for real estate agents. Develop more outreach tools for residents. Explore requiring sampling and cleanup prior to sale.	
Existing schools, childcares, parks, camps, and public and private multi-family properties**	Within the Soil Safety Program Service Area (Appendix A.3), at least every two years, evaluate funding to address the entire property.	
New park, camp, public multi-family housing	Encourage cleanup, but action at land owner's expense. At least every two years, evaluate funding to address play areas or the entire property. Applies only to those within the Soil Safety Program Service Area.	
Undeveloped, vacant land and natural areas	Not addressed except through broad-based outreach.	Not addressed except through broad-based outreach.
Public buildings, land without play areas	Encourage cleanup but action at jurisdiction's expense.	Encourage cleanup, but action at jurisdiction's expense.
Roads and other rights of way	Encourage cleanup, but action at jurisdiction's or land owner's expense***.	Encourage cleanup, but action at jurisdiction's or land owner's expense.
Commercial and industrial	Encourage cleanup but action at land owner's expense.	Encourage cleanup, but action at land owner's expense.
Agricultural	Offer sampling to community gardens, but no cleanup. Commercial agricultural addressed through broad-based outreach.	Not addressed except through broad-based outreach.

* Education and outreach covers all properties in both high and moderate zones.
** Properties where play areas were addressed during Phase One.
*** Ecology will address parking strips or planting areas associated with residential properties through the yard sampling and cleanup program (Chapter 6).

7.2 Phase Two Scoping: Property Development and Real Estate Transactions

The Area-Wide Soil Contamination Task Force had ideas for integrating sampling and cleanup into land use permitting and real estate sales. It advised that developers should do sampling and cleanup as part of their development plans. It also suggested using State Environmental Policy Act (SEPA) review and local permit processes to reach developers of projects that trigger SEPA, such as plat development. Real estate strategies included using a disclosure form similar to the one for lead-based paint, and training for real estate agents.

Ecology met with local planners and real estate agents to explore using the task force recommendations. The meetings raised many legal, political, administrative and resource issues. This prompted Ecology to defer some of these actions until Phase Two to allow for more research and consideration.

Phase Two scoping will include finding legal and administrative mechanisms for requiring sampling and cleanup during development. Local governments may lack the authority to require cleanup, while Ecology lacks a way to fund, oversee, and track cleanup during development. Ecology must also see whether there will be enough funding for cleaning up whole properties or land uses not included in Phase One.

7.2.1 Why Focus on Development and Real Estate?

Addressing soil contamination during development and real estate sales are long-term solutions. Over time, these approaches could impact thousands of properties in moderate and high zones that Phase One actions will not cover. Ecology does not have the funding to address all land uses in the high and moderate zones. Phase Two actions are appropriate for the level of risk in moderate zones.

Doing sampling and cleanup during development makes sense. Land owners can include cleanup in existing plans that already involve moving soil. Cleanup costs less to do during development than once a parcel is already developed. Encouraging action allows decisions to be made at a local level. Planning departments can choose how or whether they will require sampling and cleanup and use the model remedies guidance to assist customers.

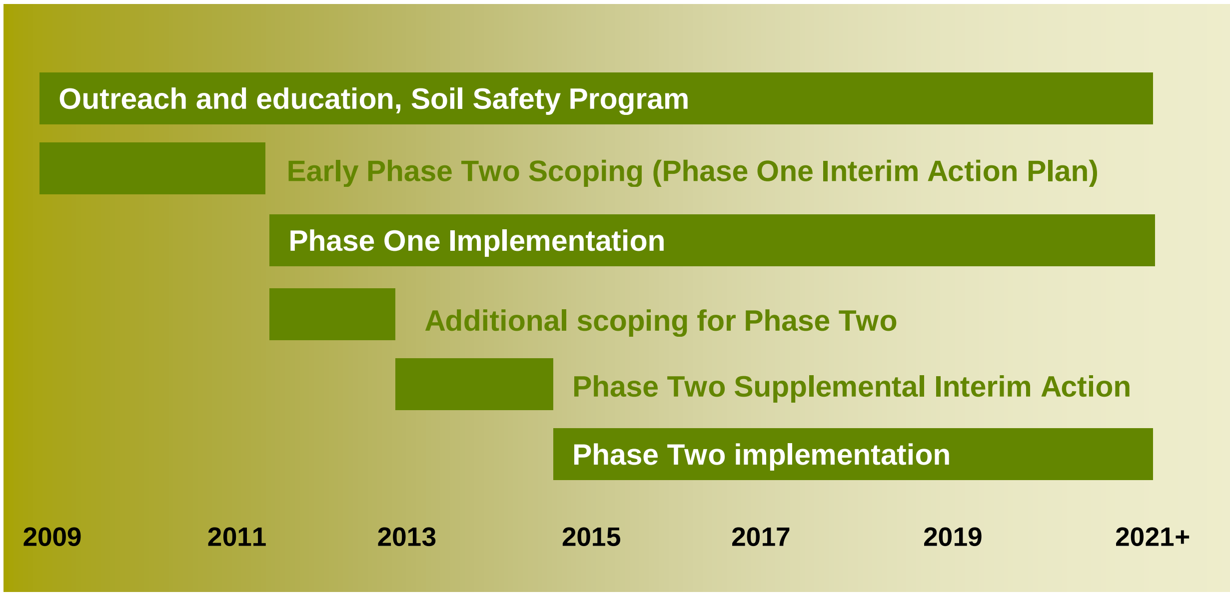
7.2.2 Plans for Further Research

Ecology has a two-part approach to researching how to address contamination during development and real estate sales:

1. As a part of the public review process for this Interim Action Plan.
2. Through an ongoing process after the Phase One Interim Action Plan is finalized.

The Interim Action Plan only describes Ecology's general approach to Phase Two actions. The agency would like comments on these proposed actions. Staff will do more research once Phase One is underway. Ecology plans to set up more meetings with local governments, real estate agents, developers, and other stakeholder groups. Ecology will ask these stakeholders to review more detailed proposals for Phase Two. The Phase Two Supplemental Interim Action Plan will then go out for public comment, possibly by 2014 (Figure 7.1).

Figure 7.1 Phase Two Timeline



7.2.3 Proposed Actions for Development and Real Estate

Many of the options listed below were in the Area-Wide Soil Contamination Task Force report (AWTF 2003). Ecology identified some through stakeholder meetings. Ecology has already used some actions, and is developing others.

For development projects, Ecology is looking at continuing to

- Encourage soil sampling and cleanup through local permitting processes.
- Work with local governments to develop threshold levels to prioritize properties.
- Educate staff and provide model remedies guidance (Appendix B) to developers when they apply for a permit.
- Offer technical assistance to local governments and developers.
- Encourage local governments to include sampling and cleanup requirements in local rules and comprehensive plans (as hazard zones, for example), building permit applications, and through the State Environmental Policy Act (SEPA) process.

Ecology is also considering new actions to

- **Require** local governments to create a Tacoma Smelter Plume “hazard zone” similar to an earthquake or flood zone.
- **Require** local permitting agencies, through state law, to require soil sampling and cleanup for projects that trigger SEPA review.
- **Require** land owners, through state law, to sample and cleanup their property when they are doing any earth moving that triggers a grading permit—whether or not the activity triggers a SEPA review.

- Develop a Tacoma Smelter Plume Stormwater General Construction Permit. The permit would have best management practices for construction projects over one acre in size.
- Revise the SEPA checklist form (197-11 WAC) to ask about Tacoma Smelter Plume contamination.

Options for addressing contamination through real estate sales are to

- Raise awareness through continuing education courses required for real estate agent relicensing.
- Create a pamphlet or form similar to the one for lead based paint, and use state law to require real estate agents to provide it to buyers.
- Require sellers, through state law, to sample soils prior to sale, at least in high zones.
- Require, through state law, deed notices for remaining soil contamination on a property.
- Develop a system for owners to track independent cleanups and show they meet cleanup standards.

7.3 Phase Two Scoping: Streamlined Approaches for Approving Cleanup Actions

Certain actions can help streamline the process of approving cleanups. If a land owner needs a written opinion from Ecology that no further action (NFA) is needed, they must enter the fee-based Voluntary Cleanup Program. This is Ecology's way of documenting that no further cleanup is needed. However, Ecology may be able to develop a simpler approval process for Tacoma Smelter Plume cleanups using the new model remedies. Ecology may also

- Offer more technical assistance to local governments, developers, and land owners.
- Provide locally-based technical assistance, such as a pool of consultants or Ecology staff assigned to local government offices.
- Certify contractors and consultants to do soil sampling and cleanup that meets Tacoma Smelter Plume Model Remedies guidelines.

7.4 Phase Two Scoping: Properties Managed or Regulated by Other Government Agencies

Integrating soil contamination issues into other agencies' day-to-day work is a vital long-term strategy. Key agencies include

- Department of Early Learning (DEL).
- State Board of Health (SBOH).
- Office of the Superintendent of Public Instruction (OSPI).
- Local park districts.
- City and county public works and roads divisions.
- Department of Labor and Industries.
- Washington Department of Transportation (WSDOT).

Ecology has also worked with tribes and military bases. The Nisqually Tribe, Fort Lewis, and McChord Air Force Base have land that falls within the moderate zone. Tacoma-Pierce County Health Department (TPCHD) worked with Fort Lewis to gain access to schools and childcare centers for soil sampling. Fort Lewis used its own funding to cleanup one childcare center play area.

Ecology is already working with DEL on making soil sampling and cleanup a condition of childcare licensing. Ecology and DEL are also educating DEL licensors about soil contamination.   The licensors are good contacts as they can check on play area cleanups (like that wood chip caps are maintained) when doing childcare inspections. Ecology will continue to address childcares for at least 10 years.

Ecology has also worked with SBOH and OSPI on the new School Rule revision. The rule requires environmental sampling during siting for new schools. SBOH has adopted new sections of Chapter 246-366 WAC and Chapter 246-366A (environmental health and safety standards for schools). Due to lack of funding from the state legislature, OPSI cannot use the new sections until July 1, 2013. As part of Phase Two, Ecology will look at whether there is funding left to address new schools.

TPCHD worked with Tacoma Metro Parks to install signs at some parks. Ecology plans to work with other park districts.

Labor and Industries has guidance for area-wide soil contamination, which Ecology refers to in the model remedies guidance. Ecology is interested in working with WSDOT and local roads and public works departments on policies for projects done within the Tacoma Smelter Plume.

7.4.1 Proposed Actions for Properties Managed by Other Agencies

Ecology proposes a set of actions for working with other agencies:

- Require, through state law, soil sampling and cleanup for projects involving soil moving at facilities managed by state agencies and local governments.
- Provide agencies with outreach tools.
- Help agencies with best management practices to address soil contamination.
- Work with agencies to address contamination during new park and school development.

Asarco settlement funds can address new schools and childcares over the next 10 years. However, Ecology needs a longer-term plan. OSPI, SBOH, and DEL support integrating soil sampling and cleanup into the school construction and childcare licensing process. Agencies are concerned about requiring it, though, due to the administrative burden and cost. In Phase Two, Ecology will explore these options for schools and childcares:

- Set aside funding for sampling and cleanup of future schools and childcares.
- Assume that State Toxics Control Account funds can be used in future years. This is how Ecology funded the Soil Safety Program before the Asarco settlement.
- Provide no funding after 2021 and assume schools and childcares will manage and fund cleanup themselves. OSPI and DEL would regulate soil sampling and cleanup through school construction and childcare licensing requirements.
- Require sampling and cleanup at new schools and childcares through legislation.
- Provide matching grants for sampling and cleanup at new schools and childcares.
- Provide funding for sampling and cleanup at new childcares only or new schools only.

7.5 Phase Two Scoping: Funding to Address Other Land Uses

At least every two years, Ecology plans to evaluate whether funding will be available to clean up areas not covered under Phase One. These areas include:

- Entire school and childcare properties.
- New park, camp, and public multi-family housing play areas or properties.
- Entire existing private multi-family housing properties.
- Undeveloped properties being developed for residential use.

The Soil Safety Program is cleaning up school and childcare play areas, but not the rest of the property. Play areas are a priority because they present the greatest risk to children. In Phase One, the Soil Safety Program addresses existing parks, camps, and multifamily public housing, but not new facilities. Possible approaches for future parks and camps include

- Providing funds to assist government managers and private land owners with sampling and cleanup for undeveloped properties that are being developed into parks and camps.
- Working with local governments to encourage them to include requirements for sampling and cleanup of new parks, camps and multifamily public housing during the process of environmental review and permitting.
- Working with local parks departments to incorporate sampling and cleanup into local park capital improvement plans and processes.

Ecology will address high-use areas at multi-family residences in Phase One. The agency has not yet worked with multi-family properties and need more research on what portion of properties tend to be high use. This will help Ecology decide if it is practical to clean up just high use areas or the whole property.

Ecology will also address properties under development in Phase One, through voluntary action paid for by the land owner or developer. Based on available funding, Ecology will explore a possible grant or loan program to address these properties.

Chapter 8 – Tacoma Smelter Plume Policy

8.1 Overview

This chapter explains how Ecology will regulate properties impacted by only Tacoma Smelter Plume contamination. The Model Toxics Control Act regulation (WAC 173-340) addresses contaminated sites. In the Tacoma Smelter Plume, many square miles of land and thousands of properties may be affected. Therefore, Ecology is setting five site-specific policies for properties affected by Tacoma Smelter Plume contamination. This chapter does not cover administrative details related to tracking property contamination and cleanup. This will be included in the yard sampling and cleanup program design.

The Interim Action Plan uses both active cleanup and institutional controls on properties and for the whole site. The structure of the cleanup and the nature of the site require clarification of how the Model Toxics Control Act is applied. This chapter also describes Ecology's enforcement policies and requirements for those participating in the yard sampling and cleanup program (Chapter 6).

These policies are largely influenced by recommendations from the Area-Wide Soil Contamination Task Force. Tens of thousands of properties may have Tacoma Smelter Plume contamination. Enforcing cleanup on each property would be very difficult for Ecology to manage, and would place a large burden on land owners. The task force recommended enforcement forbearance, particularly for areas with moderate area-wide contamination.

Tacoma Smelter Plume-specific policies are underlined in the following sections. See Table 8.1 for a list of these policies.

8.2 Reporting

WAC 173-340-300 requires that releases of hazardous substances be reported to Ecology. Ecology then determines if the release requires further action. The agency tracks releases requiring further action on the Confirmed and Suspected Contaminated Sites List (CSCSL). Ecology has determined that the Tacoma Smelter Plume release requires further action, and has placed the Tacoma Smelter Plume on the CSCSL (see Section 8.3).

<u>Ecology requires reporting for any properties with a single sample of arsenic over 20 ppm or lead over 250 ppm. Ecology will not track the individual properties on the CSCSL, unless they enter the Voluntary Cleanup Program (see Section 8.3).</u>

Reporting allows Ecology to look at whether the contamination is due to the Tacoma Smelter Plume or another source. Homeowners may be eligible for free soil sampling and cleanup under the yard sampling and cleanup program. They can also get guidance and technical assistance for cleanup.

Other contamination above cleanup levels may not be associated with the Tacoma Smelter Plume. However, if it is within the Tacoma Smelter Plume, it must still be reported.

8.3 Confirmed and Suspected Contaminated Sites Listing

Ecology has listed the Tacoma Smelter Plume on the Confirmed and Suspected Contaminated Sites List (CSCSL).

Ecology will not list properties as units of the Tacoma Smelter Plume on the Confirmed and Suspected Contaminated Sites List, with two exceptions:

1) Ecology will list properties that enter the Voluntary Cleanup Program only for Tacoma Smelter Plume contamination. Ecology will list them as units of the Asarco Tacoma Smelter site.
2) Ecology will list properties within the site that enter the Voluntary Cleanup Program for other types of contamination as a separate site. Ecology will note them as being associated with the Tacoma Smelter Plume.

8.4 Site Ranking and Hazardous Sites List

Ecology has not ranked the Tacoma Smelter Plume under the Washington Ranking Method (WAC 173-340-330). The Tacoma Smelter Plume is part of the Asarco Tacoma Smelter site. The site includes units of the Commencement Bay Nearshore/Tideflats Superfund site. On the State Hazardous Sites List, Ecology gives Superfund sites a rank of "0." This shows that the site is a high priority, but not subject to the State ranking method. The Tacoma Smelter Plume also has a rank of "0."

Except for rare cases (see Section 8.5), Ecology will not rank properties that have only Tacoma Smelter Plume contamination or include them on the Hazardous Sites List.

8.5 Enforcement

Generally, Ecology will not enforce against residential land owners within the Tacoma Smelter Plume. This is Policy 540A-Enforcement, Section 6 (Ecology 2004b). Generally, Ecology will not enforce against non-residential land owners for cleanup of Tacoma Smelter Plume contamination.

Land owners must meet certain conditions for Ecology not to enforce cleanup:

- The land owner's activities do not lead to a release or threatened release of hazardous substances requiring cleanup.
- They report the release of a hazardous substance. This includes Tacoma Smelter Plume arsenic above 20 ppm or lead above 250 ppm.
- They provide access to the property. They cooperate with any investigation or cleanup.
- They comply with any institutional controls for the property.

Ecology may still refer a property for ranking and administrative action if it is necessary to protect human health or the environment. This might occur if children are playing in areas with known contamination, and the land owner does not clean up the area or limit exposure. It may also occur if a development is planned in a highly contaminated area but does not include cleanup measures.

8.6 Voluntary Cleanup Program Determinations

Land owners may clean up Tacoma Smelter Plume contamination voluntarily. They may also request a No Further Action (NFA) determination from Ecology through the Voluntary Cleanup Program. Ecology's determination is property-specific and depends on what release was cleaned up. It also depends on whether the property has

1. Tacoma Smelter Plume contamination only.
2. Contamination from the Tacoma Smelter Plume and another release, and they are not commingled.
3. Commingled contamination from the Tacoma Smelter Plume and another release.

If a property has Tacoma Smelter Plume contamination only, Ecology can issue a Property NFA for final cleanup.

If a property has contamination from the Tacoma Smelter Plume and another release (that does not extend beyond the property boundary), and the contaminants are not mixed together (commingled) there are three options. Ecology can issue a Property NFA for the plume contamination only, a Site NFA for the other contamination only, or both for a complete cleanup.

One can assume that the releases have not commingled if the other release did not affect the top two feet of soil. Generally, Tacoma Smelter Plume contamination is in the upper 1-2 feet of soil, and does not impact ground water.

If a property has commingled contamination from the Tacoma Smelter Plume and another source (that does not extend beyond the property boundary), there are also three options. Ecology can issue a Property NFA for the plume contamination only, a Site NFA for the other contamination, or both. However, the Site NFA requires testing for and cleaning up plume contamination within the soil footprint of the other release.

One can assume that the releases have commingled if the other release affected the top two feet of soil.

Contact Ecology for information about Voluntary Cleanup Program cleanups within the Asarco Tacoma Smelter site: http://www.ecy.wa.gov/programs/tcp/vcp/vcp2008/vcpContacts.html.

Table 8.1 Tacoma Smelter Plume Policies

Category	Policy
Reporting	Ecology requires reporting for any properties with arsenic over 20 ppm and lead over 250 ppm.
Confirmed and Suspected Contaminated Sites listing	Ecology will not list properties as units of the Tacoma Smelter Plume on the Confirmed and Suspected Contaminated Sites List, with two exceptions: 1) Ecology will list properties that enter the Voluntary Cleanup Program only for Tacoma Smelter Plume contamination. Ecology will list them as units of the Asarco Tacoma Smelter site. 2) Ecology will list properties within the site that enter the Voluntary Cleanup Program for other types of contamination as a separate site. Ecology will note them as being associated with the Tacoma Smelter Plume.
Site Ranking and Hazardous Sites List	Ecology has not ranked the Tacoma Smelter Plume under the Washington Ranking Method (WAC 173-340-330). The Tacoma Smelter Plume is part of the Asarco Tacoma Smelter site. The site includes units of the Commencement Bay Nearshore/Tideflats Superfund site. On the State Hazardous Sites List, Ecology gives Superfund sites a rank of "0." This shows that the site is a high priority, but not subject to the State ranking method. The Tacoma Smelter Plume also has a rank of "0." Except for rare cases (see Section 8.5), Ecology will not rank properties within the plume or include them on the Hazardous Sites List.
Enforcement	Generally, Ecology will not enforce against residential land owners within the Tacoma Smelter Plume. This is Policy 540A-Enforcement, Section 6 (Ecology, 2004b). Generally, Ecology will not enforce against non-residential land owners for cleanup of Tacoma Smelter Plume contamination.
Voluntary Cleanup Program	If a property has Tacoma Smelter Plume contamination only, Ecology can issue a Property NFA for final cleanup. If a property has contamination from the Tacoma Smelter Plume and another release (that does not extend beyond the property boundary), and the contaminants are not mixed together (commingled) there are three options. Ecology can issue a Property NFA for the plume contamination only, a Site NFA for the other contamination only, or both for a complete cleanup. If a property has commingled contamination from the Tacoma Smelter Plume and another source (that does not extend beyond the property boundary), there are also three options. Ecology can issue a Property NFA for the plume contamination only, a Site NFA for the other contamination, or both. However, the Site NFA requires testing for and cleaning up plume contamination within the soil footprint of the other release.

Chapter 9 – Applicable or Relevant and Appropriate Requirements

9.1 Overview

The Model Toxics Control Act (MTCA) regulation requires that all cleanup actions comply with state and federal law. It states that "applicable state and federal laws" shall include legally applicable requirements and those that Ecology decides are "relevant and appropriate" (WAC 173-340-710(1)).

This chapter discusses the applicable or relevant and appropriate requirements (ARARs) for the Interim Action Plan. It also covers independent actions under Tacoma Smelter Plume Model Remedies. This chapter does not go into detail on local rules due to the large number of cities, towns, and counties in the plume.

This chapter also describes what Ecology has to take into account when choosing a cleanup approach. WAC 173-340-710(4) gives guidelines for deciding whether certain requirements are relevant and right for a cleanup. If there are any conflicts between this chapter and the language of the regulation, the regulation shall govern. For more detail on what is required, see the regulations themselves. Ecology will include new requirements when needed.

9.2 Applicable or Relevant and Appropriate Requirements and Exemptions

Certain state laws apply to Tacoma Smelter Plume cleanup. Local rules also apply (see Section 9.4). Ecology will decide how to meet these requirements in the yard sampling and cleanup program design. ARARs for this Interim Action Plan include:

- RCW 43.21 C, *State Environmental Policy Act*.
- Executive Order 05-05, Archeological and Cultural Resources.
- Chapter 70.94 RCW, *Washington Clean Air Act*.*
- Chapter 70.95 RCW, *Solid Waste Management, Reduction, and Recycling*.*
- Chapter 70.105 RCW, *Hazardous Waste Management*.*
- Chapter 90.48 RCW, *Water Pollution Control.**
- Chapter 90.58 RCW, *Shoreline Management Act of 1971*.*
- Local regulations for shoreline management, grading and stormwater management.
- Chapter 296-848 WAC, Inorganic Arsenic Rule, Department of Labor and Industries.

* *MTCA exempts Ecology from process requirements of certain state laws (noted above). It also exempts Ecology from laws authorizing local permits or approvals for cleanup actions done by Ecology (RCW 70.105D.090). However, Ecology must meet the substantive requirements.*

No federal laws apply to this project, except those for where authority has been delegated to the state for water pollution control and hazardous waste management.

9.3 State Regulations

9.3.1 RCW 43.21 C State Environmental Policy Act

Ecology did early scoping in early 2009 and used feedback to make a Mitigated Determination of Non-Significance. See Appendix E for the early scoping results, checklist, and determination. They describe how the Interim Action Plan meets SEPA requirements.

9.3.2 Executive Order 05-05, Archaeological and Cultural Resources

SEPA and the Governor's Executive Order No. 05-05 require state agencies to look at impacts to cultural resources during their environmental reviews. The yard sampling and cleanup program will take into account cultural resources and comply with laws, regulations, and guidance. The plume may impact the Nisqually, Puyallup, Muckleshoot, Tulalip, Snoqualmie, Squaxin Island, and Suquamish tribes.

Ecology is working with interested tribes and Washington State Department of Archaeology and Historic Preservation (DAHP) on a Cultural Resources Protocol. Ecology will provide the protocol to stakeholders, including the tribes cited above and DAHP.

9.3.3 Air Emissions

Chapter 70.94 RCW, *Washington Clean Air Act* governs air emissions. Arsenic and lead releases to air should be prevented or controlled. Best available control technologies should be used. During the yard sampling and cleanup program, Ecology will

- Control escaping dust by watering down soils during the cleanup.
- Reduce vehicle exhaust and greenhouse gas impacts by minimizing truck trips and careful route planning.
- Ensure that soil-moving vehicles are only idled when needed.

9.3.4 Solid and Hazardous Waste Management

Within the Tacoma Smelter Plume, waste classification of soil depends on arsenic or lead level. Soil failing the Toxicity Characteristic Leaching Procedure (TCLP) test is federally-designated hazardous waste and state dangerous waste under WAC 173-303-070(3). These soils are subject to state and federal disposal and tracking requirements for dangerous and hazardous wastes.

So far, levels of arsenic and lead found in Tacoma Smelter Plume soils have not been high enough to cause a failure of the TCLP test (see Appendix I). Therefore, Ecology assumes that the soils from yard and play area cleanups will not be state or federal dangerous or hazardous waste. Landfills may still require TCLP tests before disposal.

Ecology will manage soils from its cleanups as "contaminated soils." This is defined in the state Solid Waste Handling Standards (WAC 173-350-100) as

> *Soils removed during cleanup of a hazardous waste site, or a dangerous waste facility closure, corrective actions or other cleanup activities and which contain harmful substances but are not designated dangerous wastes.*

These wastes may go to any “permitted” landfill that can accept non-hazardous waste. Some landfills are permitted under Subtitle D of Public Law 94-580, the Resource Conservation and Recovery Act. Wastes may also go to some limited-purpose landfills, pemitted under Washington Administrative Code 350 and 351. For the yard sampling and cleanup program, Ecology will use appropriate landfills. Ecology will get waste disposal authorizations when required for disposal.

Soils with arsenic lower than the cleanup level of 20 ppm are not regulated by the Model Toxics Control Act, the Dangerous Waste Regulations, or the Solid Waste Handling Standards. However, many local governments have their own, stricter solid waste laws, which require authorization for soil disposal. Some may restrict disposal of soils below 20ppm arsenic.

King County Solid Waste Division considers these soils a “special waste.” Any disposal at a King County facility must go through its Waste Clearance Process. Contaminated soil must receive a clearance from Public Health—Seattle & King County.

Those doing their own cleanups or getting rid of contaminated soils or construction debris must use a Subtitle D landfill. Contaminated soils may not go to fill-dirt sites, construction debris landfills, or composters.

9.3.5 Water Discharge

Chapters 90.48 RCW, Water Pollution Control Act, and 90.54 RCW, Water Resources Act govern water discharge. Arsenic and lead releases to water should be treated or prevented. Ecology will use best management practices to reduce stormwater runoff during its cleanups. Ecology also advises these actions for land owners doing their own cleanups (Appendix B).

Ecology requires a General Construction Stormwater Permit for any cleanups where construction impacts over an acre of land. Ecology may include a companion order for additional monitoring not covered under the general permit. The agency will consider developing a Tacoma Smelter Plume Stormwater General Construction Permit.

9.3.6 Health and Safety

Washington State Department of Labor & Industries laws and regulations govern health and safety at worksites. The Inorganic Arsenic Rule (Chapter 296-848 WAC) governs work within the Tacoma Smelter Plume and other areas with soil arsenic contamination.

Ecology will prepare a Health and Safety Plan as part of the yard sampling and cleanup program design. Safety measures include protective clothing and gloves, masks for dusty conditions, and a place to wash their hands. Employers must ensure workers’ safety and should work with the Washington Department of Labor and Industries.

9.4 Local Requirements

Substantive local requirements cover grading, controlling drainage at construction sites, and work in rights-of-way. The detailed yard sampling and cleanup program design will explain how Ecology will comply with local requirements. This includes grading, dust control, stormwater control, health and safety, disposing of soil, controlling noise, and protecting trees. Ecology will meet the substantive requirements of any other local permits needed.

WAC 173-340-710 (9) exempts Ecology from the process requirements of certain laws, such as getting permits. Ecology can do this as long as it meets the substantive requirements. Independent cleanups are not exempt and must have the permits they need from their local jurisdiction.

9.5 New Requirements

Ecology will consider new state and federal laws as part of the periodic review under WAC 173-340-420. Ecology will assess cleanup actions in light of the new requirements and decide whether the cleanup action still protects human health and the environment.

Chapter 10 – Cleanup Standards

10.1 Where Cleanup Standards Apply

This chapter describes cleanup levels, remediation levels, and points of compliance for the Tacoma Smelter Plume. Cleanup standards for this Interim Action Plan apply to air deposition from the Asarco Tacoma smelter. They apply to work done under Ecology's yard sampling and cleanup program, independent cleanups, and cleanups done with agency oversight. Ecology is proposing interim actions—partial cleanup—throughout the plume. However, properties within the Tacoma Smelter Plume can achieve final cleanup.

10.2 Indicator Hazardous Substances

Indicator hazardous substances are a subset of hazardous substances found at a site. They describe the nature of contamination and help in setting cleanup requirements for the site. Arsenic and lead are the indicator hazardous substances for this site.

Past studies found other elements, but mostly in trace amounts (Glass 2003a). They include zinc, copper, cadmium, selenium, nickel, mercury, antimony, manganese, chromium, and silver. Arsenic and lead often exceeded state cleanup levels, while the other elements typically did not. If other metals did exceed cleanup levels, the arsenic or lead would, too, unless they were from a different source than the Tacoma Smelter Plume. Cleanups driven by arsenic and lead will address all other hazardous substances from smelter emissions.

10.3 Cleanup Levels

10.3.1 Soil

Ecology will use Model Toxics Control Act Method A soil cleanup levels for unrestricted land use. This is 20 milligrams per kilogram[5] (mg/kg) for arsenic and 250 mg/kg for lead. Ecology chose a cleanup level for unrestricted land use because many properties within the plume are residential, especially in the high zone. Chapter 173-340-704 WAC states that Method A may be used to set cleanup levels at sites that have few hazardous substances and that are either:

a) Undergoing routine cleanup actions; or
b) Have numerical standards in the Model Toxics Control Act Method A tables for all indicator hazardous substances present in the media of concern (soil, groundwater).

Although the site is large and complex, routine soil cleanup actions like excavation and capping will work for most properties. Ecology assumes that:

- The nature of contamination by air deposition is similar from property to property.
- Arsenic and lead generally do not affect groundwater (see Section 10.3.2).
- Arsenic and lead have Method A numeric cleanup levels.

[5] Ecology uses parts per million (ppm) as an equivalent to milligrams per kilogram for soil levels.

Table 740-1 of MTCA lists the Method A soil cleanup levels for unrestricted land use. The table value for arsenic is based on protecting human health and groundwater, but adjusted for natural background. The table value for lead prevents unacceptable blood lead levels.

The cleanup levels for arsenic and lead also protect soil biota such as worms, plants, and wildlife. See Appendix C for more on ecological cleanup levels and how Ecology set the Tacoma Smelter Plume cleanup levels.

10.3.2 Groundwater

Ecology is not setting groundwater cleanup levels for the Tacoma Smelter Plume. Groundwater cleanup levels are based on the "highest beneficial use" and the "reasonable maximum exposure." For most areas of the plume, ground water's highest beneficial use is as drinking water. The reasonable maximum exposure is ingesting drinking water or other home uses.

The Model Toxics Control Act Science Advisory Board looked at the issue of groundwater. The board concluded that area-wide soil levels of arsenic below 200 mg/kg and lead below 1000 mg/kg were unlikely to pose a significant threat to groundwater (SAB 2006).

The board used a conservative leaching model to estimate impacts of area-wide soil contamination, and three main pieces of evidence:

1. Soil profile data show that area-wide arsenic and lead have not migrated (moved) significantly over a span of 50 years.
2. Drinking water systems on Vashon-Maury Island—an area with high Tacoma Smelter Plume soil contamination—do not show impacts to groundwater[6].
3. Modeling shows arsenic and lead have not migrated significantly in terms of depth. Arsenic and lead from the plume have low mobility, except in soils with high organic content, biodegradable organic compounds like petroleum, and very low pH and waste material (SAB, 2006).

Few areas within the plume exceed 200 mg/kg for area-wide arsenic and 1000 mg/kg area-wide soil lead. Ecology believes that protecting groundwater requires no further measures beyond those that protect human health. Ecology will clean up areas with high arsenic and lead levels, mainly by excavation and removal. See Appendix C for more on groundwater.

10.4 Remediation Levels

Remediation levels help in managing cleanup (WAC 173-340-355). Cleanup actions can involve a blend of technologies and methods. Often, the cleanup action does not remove all of the contamination from a site. A remediation level is the level of a hazardous substance in a medium, such as soil, at which certain cleanup actions may be used. Ecology set remediation levels for the Tacoma Smelter Plume Model Remedies only (Table 10.1).

[6] A 2007 drinking water system study on Vashon and Maury Islands showed that all but one well sampled did not exceed the 10 microgram per liter drinking water standard (King County 2008). The one well had arsenic levels over 40 micrograms per liter and is likely from natural arsenic in the ground.

Table 10.1 Tacoma Smelter Plume Model Remedies Remediation Levels

Remedy	Arsenic	Lead
Mixing	Average ≤40 ppm	Average ≤500 ppm
Consolidation or capping in place with a type 1 cap*	Average ≤100 ppm Maximum <200 ppm	Average ≤500 ppm Maximum <1000 ppm
Consolidation and capping with a type 2 cap*	Average ≤200 ppm	Average ≤1,000 ppm

* See Section 11.6.2 for descriptions of the two cap types.

There are no remediation levels for excavation and removal, capping in place with a type 2 cap, and institutional controls only. See Appendix C for more background.

10.5 Point of Compliance

A cleanup *standard* is the numeric cleanup level and a point of compliance. The point of compliance is where in the affected media, such as soil, the cleanup level must be met. The point of compliance for Tacoma Smelter Plume contamination is the maximum depth of the contamination (2-15 feet).

The point of compliance for protecting human health from direct contact with soils is 15 feet below ground surface (WAC 173-340-740(6)). Fifteen feet is the depth of soil that could be dug up and distributed at the soil surface during development work. The point of compliance for protecting ecological receptors is six feet below ground surface.

Tacoma Smelter Plume contaminants typically reach 24 inches at most below ground surface. They could be deeper if the ground surface was covered with fill, or mixed to deeper depths.

Some cleanup approaches cap or isolate hazardous substances. These approaches do not meet the cleanup levels at the point of compliance. Ecology has decided that some properties in the plume will not meet the cleanup level at the point of compliance because the cleanup involves capping. See Chapter 11 and Appendix C for more on capping cleanup methods and their remediation levels and points of compliance.

WAC 173-340-740(6)(f) states that a cleanup involving capping may comply with the cleanup standards, if it:

- Is as permanent as is practical, using WAC 173-340-360.
- Is protective of human health and terrestrial ecological receptors (plants and animals).
- Has institutional controls that prevent actions interfering with the containment.
- Has compliance monitoring and periodic reviews to ensure the long term integrity of the containment system.
- Describes contaminants remaining on site in the cleanup action plan.

Appendix C discusses how the capping methods meet Model Toxics Control Act requirements.

Chapter 11 – Tacoma Smelter Plume Model Remedies

11.1 Overview

Model remedies are remedies designed for a specific site or type of contamination (WAC 173-340-390). They streamline and accelerate the selection of cleanup actions, with a preference for permanent remedies. Users do not need to conduct a feasibility study and disproportionate cost analysis because Ecology has already evaluated cleanup options. **However, they must meet the requirements of the model remedies in order to receive written approval from Ecology.** This chapter gives the complete Tacoma Smelter Plume Model Remedies, including characterization sampling, remediation, and compliance sampling. Detailed instructions, examples, and forms are available in the Model Remedies Guidance (Appendix B).

Ecology developed the Tacoma Smelter Plume Model Remedies to provide a streamlined approach to addressing contamination within the Tacoma Smelter Plume. Air deposition of arsenic and lead from the former smelter is similar across the site. In undisturbed areas, it is mostly in the upper six inches of soil. The arsenic and lead have low mobility—they do not move downward through the soil over time. Based on these characteristics, Ecology selected four model remedies that are appropriate to use under certain conditions:

- Excavation and removal.
- Mixing.
- Capping in place.
- Consolidation and capping.

Levels of arsenic and lead vary with property history and land use. Some remedies are not effective above certain levels. Ecology is still developing a model remedy for natural areas. In certain cases, soil cleanup could be more harmful to the environment than leaving contamination in place.

The model remedies can be used for:

- Independent cleanup, particularly during property development.
- The Voluntary Cleanup Program or other cleanup done under Ecology oversight.
- Ecology-managed programs, such as the yard sampling and cleanup program and Soil Safety Program.

Because the contamination is so extensive and potentially impacts over 730,000 properties, Ecology is using the model remedies and the associated guidance to encourage independent cleanup. Independent cleanup can take place without Ecology involvement. However, if a land owner wants a written opinion from Ecology that no further action (NFA) is needed, they must enter the Voluntary Cleanup Program. Table 11.1 describes independent cleanup options, Ecology's role, and when model remedy requirements must be followed.

Table 11.1 Use of the Tacoma Smelter Plume Model Remedies by Type of Independent Cleanup

Type of Cleanup	Ecology's Role	Use of the Model Remedies
No written opinion needed, not in Voluntary Cleanup Program	▪ Model Remedies Guidance ▪ No review of cleanup work ▪ No written opinion ▪ Free, limited technical assistance	Ecology encourages using model remedies to assure protection for current and future land owners.
Need Ecology's written opinion, in Voluntary Cleanup Program	▪ Model Remedies Guidance ▪ Review of cleanup work ▪ Written opinions and possible site visits ▪ Free technical assistance	Must follow model remedies, or do a feasibility study on a different cleanup method to receive No Further Action (NFA) opinion. If a different cleanup method is chosen, Ecology must approve of the method. Must document steps taken to follow the model remedies.

The Tacoma Smelter Plume Model Remedies Guidance (Appendix B) is designed mainly for independent cleanups. The guidance may also be used to assist Voluntary Cleanup Program oversight, and local planning offices that require permit applicants to sample and remediate during property development. It offers instructions for developers, contractors, consultants, and land owners. Soil sampling does not use any special tools or technical expertise. Most remediation can be integrated with existing development or development plans.

11.2 Feasibility Study Design

The Feasibility Study (Appendix C) analyzes the cleanup options Ecology considered, and explains how the agency chose the four remedies. A number of methods will clean up arsenic and lead soil contamination. Ecology screened out some of these methods based on site-specific effectiveness, expense, and practicality. Some can still be used for Tacoma Smelter Plume cleanups. However, they require a separate feasibility study and disproportionate cost analysis to get a No Further Action letter from Ecology. An example is mixing soils with arsenic levels over 40 ppm. Ecology used the remaining methods to develop four model remedies.

11.3 Applicability

Tacoma Smelter Plume Model Remedies are applicable only to properties with Tacoma Smelter Plume contamination within the Tacoma Smelter Plume. They do not cover other types of releases of hazardous substances. Some model remedies apply only to certain soil arsenic and lead levels (see Table 11.6). Land owners can use Ecology's Facility Site Atlas to see whether they are within the plume—click on the map link at http://www.ecy.wa.gov/toxics/tacoma-smelter.html.

11.4 Common Components of the Model Remedies

This section provides descriptions of component technologies that are used in more than one model remedy.

11.4.1 Institutional Controls

Institutional controls restrict access to contaminated areas. This prevents direct contact with contamination and prevents site activities that could make the cleanup less effective. Institutional controls include:

- **Site access restrictions**, which prevent or discourage people from coming into a contaminated area. The most common access restrictions are fencing and warning signs. Fencing can prevent access by the general public. One can use warning signs along with fencing, or alone in areas such as parks, where public access is normal.

- **Land use restrictions**, which are legal measures, such as environmental covenants. They warn future land owners of site contamination. They also prevent activities or land uses that could make the cleanup less effective, such as removing or digging through a cap. Land use restrictions can discourage direct contact, but unlike site access restrictions, they do not provide a physical barrier to contact.

Environmental covenants or clauses in sales contracts can ensure ongoing monitoring and maintenance even when land ownership changes.

11.4.2 Compliance Monitoring

The model remedies are designed to meet MTCA compliance monitoring requirements (WAC 173-340-410). Compliance monitoring consists of:

- Protection monitoring.
- Performance monitoring.
- Confirmational monitoring.

Ecology's Model Remedies Guidance (Appendix B) discusses monitoring requirements further.

The main contaminants of concern, arsenic and lead, do not pose a groundwater risk at the soil levels that would remain on-site after cleanup (Appendix C Section 2.4.2). Therefore, the model remedies do not require groundwater monitoring.

Protection Monitoring - Protection monitoring confirms that human health and the environment are adequately protected during cleanup work. Cleanups should have protection monitoring that fits the remedy. The details of this monitoring should be site-specific and documented in writing.

Performance Monitoring: Performance monitoring confirms that cleanup work meets cleanup standards or other performance standards. Ecology requires performance monitoring if a land owner wants agency approval of their cleanup. Remedies that involve soil removal require soil sampling and analysis to show that the soil remaining after removal meets cleanup levels. Soil mixing requires soil sampling and analysis to show that the arsenic and lead levels in the mixed soil meet cleanup levels.

Performance monitoring for capping remedies includes

- Sampling and analysis to show that soil arsenic and lead levels are below remediation levels for the cap type (Figure 11.1).
- Inspection or monitoring to ensure that the cap materials meet the required specifications, such as geotechnical properties or lack of contamination.
- Inspection or monitoring to confirm that cap installation meets design requirements, such as thickness and slopes.

Confirmational Monitoring: Confirmational monitoring checks the long-term effectiveness of the remedy after completion of cleanup. Ecology requires confirmational monitoring for any remedy where contaminated material remains after cleanup. For caps, this includes periodic inspection. Ecology does not require confirmational monitoring for soil mixing or excavation and off-site disposal because soil remaining on site will meet cleanup levels.

11.5 Soil Sampling

Ecology set soil sampling protocols based on the characteristics of Tacoma Smelter Plume contamination, which address MTCA compliance monitoring requirements. Contamination is typically in the top six inches of soil, except where soils have been disturbed. The arsenic and lead do not move downward through the soil to groundwater. Thus, mainly surface soil samples can characterize a property. The point of compliance will typically be to the maximum depth of contamination (see Chapter 10).

This section describes characterization, compliance, stockpile, and imported soil sampling methods for Tacoma Smelter Plume contamination. It gives a minimum number of characterization or compliance samples required to show that a property or decision unit meets state cleanup levels. Some of the model remedies require stockpile sampling before off-site disposal or reuse on the property. Imported soil sampling ensures soil caps meet cleanup levels.

11.5.1 Characterization Sampling

Characterization sampling determines the level and extent of soil contamination, or if there is no contamination above state cleanup levels.

Decision Units: The property may first be divided into multiple decision units. These are areas of a property that might have different patterns of contamination or different current or future uses. Land use and the development history can affect patterns of contamination. Future uses may factor into selecting the cleanup method. For example, buildings and pavement make a good cap, but Ecology strongly prefers excavation for a residential yard or play area. A property may also be a single decision unit.

Within the Tacoma Smelter Plume, contamination varies depending on the level of soil disturbance. Areas that have been undisturbed for 20 years or more, such as a forested area, are more likely to have elevated arsenic and lead. They should be treated as separate decision units from portions of a property that have recently been scraped, graded, or otherwise disturbed. Portions of a property being developed for future residential use or as play areas should be treated as separate decision units. This allows for denser sampling in areas where people, particularly children, are more likely to be exposed.

Areas that are paved and will continue to be paved do not need sampling. However, where a No Further Action determination from Ecology is needed, these areas must be documented in an environmental covenant for the property (see Section 11.7). All characterization sampling must be documented, including, at minimum, information requested in Ecology's Tacoma Smelter Plume Model Remedies guidance forms (Appendix B). All samples are discrete, which means the soils for one sample come from a single sampling location.

Number of Sample Locations: A minimum number of sample locations is needed to adequately characterize a decision unit. The number depends on its size, map zone—where the property is in the Tacoma Smelter Plume—and proposed type of land use (Table 11.2). Samples will need to be taken from multiple depths in each decision unit (see sample depth discussion below). The number of samples is based on the **intended** land use types. For example, an undeveloped piece of property (open land or forest) will be developed into a residential plat. A land owner would need to take the number of samples needed for a residential property, not a forested or open land property.

Table 11.2 Number of Characterizations Sample Locations per Decision Unit

Sampling Area Size	**Residential, Parks, Commercial** Samples needed by map zone*		**Forest and Open Land** Samples needed by map zone*	
Acres	**Arsenic >100 ppm**	**Arsenic 20-100 ppm**	**Arsenic >100 ppm**	**Arsenic 20-100 ppm**
0.25	10	8	8	8
1	20	16	16	12
5	40	32	30	24
10	60	48	40	32
20	80	64	50	40
100	120	90	70	60
>100	120 + 1 per 5 acres	90 + 1 per 5 acres	70 + 1 per 10 acres	60 + 1 per 10 acres

** See Ecology's Facility Site Atlas to see whether a property is in the high zone, where arsenic may be over 100 ppm.*

Sample Depth: Characterization samples must be taken from:

- The top 0-6 inches of soil, after clearing away grass, leaves, loose gravel, or debris on the surface at all sampling locations;
- The 6-12 inch depth in at least 25% of the sample locations.
- If duff is present, sample the duff.

Final cleanup must address the maximum depth of contamination. For properties where fill dirt, topsoil, or sod was added in the past, deeper samples may be needed to determine the depth of the original contaminated soil layer, and the deeper clean soil layer. Where contamination is expected, denser sampling across the decision unit, or at depth, may inform cleanup choices.

Sampling Protocol: Sample locations should be laid out in a grid that covers that largest area of the decision unit possible. At each location, each depth should be taken as a discrete sample—samples should not be composited. Grass, leaves, or other debris should be cleared from the ground surface.

Analysis: Accredited labs should use methods 6010, 6020, 6200, or 7060 for arsenic and methods 6010, 6020, 6200, or 7421 for lead. They should be able to screen the sample to two millimeters, report results on a dry weight basis, and provide a quality review of the data and a summary of the quality control results.

Evaluation: A two part rule[7] is used to determine whether arsenic or lead meet cleanup levels for a decision unit:

1. The average (arithmetic mean) of all samples for the decision unit is at or below 20 ppm for arsenic and 250 ppm for lead; and
2. The maximum of all samples for the decision unit is at or below 40 ppm for arsenic and 500 ppm for lead.

Decision units failing either of these criteria at any depths sampled will require remediation.

11.5.2 Compliance Sampling

Compliance sampling is needed to meet the MTCA requirement of performance monitoring. It is used to confirm that cleanup standards or other performance standards have been met. Compliance sampling is used to show whether a decision unit meets Tacoma Smelter Plume cleanup standards after remediation.

Sampling is only needed for decision units with excavation or mixing remedies. Sampling may be done by decision unit, or all contiguous decision units with the same remedy may be treated as one decision unit. All compliance sampling must be documented, including, at minimum, information requested in Ecology's Tacoma Smelter Plume Model Remedies guidance forms (Appendix B). Samples must be discrete (Section 11.5.1).

Number of Sample Locations: The minimum number of sample locations per decision unit depends on its size and map zone (Table 11.3). Sample locations should be laid out in a grid with maximum coverage of the decision unit.

[7] These Model Remedies do not require calculating the 95% upper confidence limit (UCL) on the mean.

Table 11.3 Minimum Number of Compliance Sample Locations per Decision Unit

Sampling Area Size	Samples Needed	
Acres	**Mapped arsenic > 100 ppm***	**Mapped arsenic <100 ppm***
0.25	10	8
1	20	16
5	40	32
10	60	48
20	80	64
100	120	90
>100	120 + 1 per 5 acres	90 + 1 per 10 acres

** See Ecology's Facility Site Atlas to see whether a property is in the high zone, where arsenic may be above 100 ppm.*

Sample Depth: Sampling depth depends on the remedy used. Each depth requires a separate sample.

- Excavation requires compliance sampling from 0-6 inches below the excavated surface to demonstrate that the newly exposed surface meets cleanup levels. This includes excavation for consolidation and capping.
- Mixing requires compliance sampling throughout the mixing depth profile, at six-inch intervals below the surface.
- Capping does not require compliance soil sampling. Before placing a soil cap, the imported soil should be sampled to determine that it meets cleanup levels. See imported soil sampling (11.5.4) for the requirements.

Analysis: Accredited labs should use methods 6010, 6020, 6200, or 7060 for arsenic and methods 6010, 6020, 6200, or 7421 for lead. They should be able to screen the sample to 2 millimeters, report results on a dry weight basis, and provide a quality review of the data and a summary of the quality control results.

Evaluation: A two part rule is used to determine whether arsenic or lead meet cleanup levels for a decision unit:

1. The average of all samples for the decision unit is at or below 20 ppm for arsenic and 250 ppm for lead; and
2. The maximum of all samples for the decision unit is at or below 40 ppm for arsenic and 500 ppm for lead.

Decision units failing either of these criteria will require further remediation. Further excavation or mixing will require a second round of compliance sampling.

11.5.3 Stockpile Sampling

As a part of performance monitoring, stockpile sampling may be required with several of the model remedy options, such as: excavation with offsite disposal; consolidation and capping; and mixing. Sampling of stockpiled soils provides information supporting management decisions, whether those stockpiled soils are to be exported off-site, reused onsite, designated for onsite consolidation, or treated by mixing. A Waste Disposal Authorization may require excavated soils to be sampled. This process uses composite sampling.

Number of Composites and Subsamples: The number of composite samples needed depends on the stockpile volume and level of arsenic on the property. One can use the characterization sampling results or, if no characterization results, use the Facility Site Atlas map to determine the predicted level of arsenic. Larger stockpiles and soils from the zone of higher contamination, or with average arsenic over 100 ppm, require more composites (see Table 11.4). All composite samples should have six subsamples.

Table 11.4 Number of Composite Samples per Stockpile

Stockpile Volume (cubic yards)	Number of Composites (Arsenic >100 ppm)*	Number of Composites (Arsenic <100 ppm)*
<500	2	2
500-999	4	4
1,000—4,999	8	6
5,000—9,999	14	10
10,000—19,999	20	14
>20,000	20+1 per 4,000 cubic yds	14+1 per 5,000 cubic yds

** See Ecology's Facility Site Atlas to determine whether a property is within the zone where arsenic is predicted to be above 100 ppm.*

Sampling Protocol: Stockpiles should be divided evenly into segments, with one composite sample per segment. Subsamples within each composite should be divided evenly among surface, mid-depth, and deep soils.

Analysis: Accredited labs should use methods 6010, 6020, 6200, or 7060 for arsenic and methods 6010, 6020, 6200, or 7421 for lead. They should be able to screen the sample to 2 millimeters, report results on a dry weight basis, and provide a quality review of the data and a summary of the quality control results.

Evaluation: Each composite result for each stockpile segment should be compared directly to the cleanup levels of 20 ppm for arsenic and 250 ppm for lead.

Stockpiles or segments of stockpiles above the cleanup levels should be disposed of at an appropriate disposal facility. If reused on the property, they will need to be capped to meet model remedies requirements. If arsenic is at or below 40 ppm, contaminated stockpiles may be mixed with clean soils and retested to ensure that arsenic is at or below 20 ppm.

11.5.4 Imported Soil Sampling

As part of performance monitoring, imported soil must be tested before backfilling or capping. Imported soil must be tested for arsenic and lead, and, depending on the source of imported soil, other potential contaminants such as petroleum products or pesticides.

Number of Composites and Subsamples: For projects less than six months long, collect one set of data from the imported soil source. This should include three 6-point (six subsample) composites. If the project is of longer duration, then collect a new set of three 6-point composites every six months. If the source of imported soil changes, then collect a new set of three 6-point composites.

Analysis: Accredited labs should use methods 6010, 6020, 6200, or 7060 for arsenic and methods 6010, 6020, 6200, or 7421 for lead. They should be able to screen the sample to 2 millimeters, report results on a dry weight basis, and provide a quality review of the data and a summary of the quality control results.

Ecology maintains a list of labs accredited to perform specific analytical methods for analysis of other potential contaminants such as petroleum and pesticides.
http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html

Evaluation: Each composite result should be compared directly to the cleanup levels of 20 ppm for arsenic and 250 ppm for lead.

Other contaminants analyzed should be compared to MTCA cleanup levels to ensure that the imported soil is in fact clean.

11.6 Remediation

Cleanup may consist of one or more model remedies, depending on soil arsenic and lead levels. The Model Toxics Control Act prefers permanent remedies like excavation and mixing. Other considerations include property-specific costs, planned land use, the permanence of the remedy, and institutional controls.

Table 11.5 summarizes some key considerations in selecting a remedy. Table 11.6 gives soil arsenic and lead levels at which remedies may be used. The following sections describe the five model remedies.

Table 11.5 Summary of Model Remedy Options and Considerations

	Remedy	Action	Considerations
Permanent	**Excavate & Remove**	Excavate contaminated soils and properly dispose of them.	⇒ The top 6" of soil must have <20 ppm average arsenic after excavation. Take samples at depth to remove all contamination. ⇒ Performance monitoring required.
Permanent	**Mix**	Mix the top 6 or 12" of contaminated soils with imported or deeper, clean soil.	⇒ Not for soils >40 ppm average arsenic. ⇒ Performance monitoring required.
Non-Permanent	**Cap in Place**	Cover contaminated soils with a geotextile barrier and soil cap, or a hard cap.	⇒ Hard caps include asphalt or concrete. ⇒ Thicker cap is required when sampling results are high (see Table 11.6). ⇒ Institutional controls required. ⇒ Performance monitoring required. ⇒ Confirmational monitoring required.
Non-Permanent	**Consolidate and Cap**	Excavate and consolidate contaminated soils into an area of the property and place under a cap (above).	⇒ Thicker cap is required when sampling results are high (see Table 11.6). ⇒ Not for average arsenic >200 ppm or lead >1000 ppm ⇒ Performance monitoring required. ⇒ Confirmational monitoring required. ⇒ Institutional controls required.

Table 11.6 Model Remedies Applicability by Soil Arsenic Level

Characterization Sampling Results in parts per million (ppm)		Permanent		Non-Permanent	
Average	Maximum	**Excavate & Remove**	**Mix**	**Cap in Place**	**Consolidate and Cap**
Arsenic 20-40 Lead 250-500		Yes	Yes	Yes	Yes
Arsenic 40-100 Lead 250-500	<200 <1000	Yes	No*	Type 1 or 2	Type 1 or 2
Arsenic 100-200 Lead 500-1000		Yes	No*	Type 2 cap only	Type 2 cap only
Arsenic >200 Lead >1000		Yes	No*	Type 2 cap only	No*

*At the arsenic levels given, these cleanup methods are not model remedies and require a separate Feasibility Study.
** No remediation level has been set for this remedy. It can only be used in consultation with Ecology.

11.6.1 Excavation and Removal

Excavation and removal is a permanent remedy that can be used for any level of soil arsenic or lead. Compliance sampling is required (Section 11.5.2). Therefore, soil removal must be deep enough to reach soils meeting state cleanup levels—average arsenic at or below 20 ppm and average lead at or below 250 ppm.

Soil with Tacoma Smelter Plume contamination can usually be taken to a municipal waste landfill, but local governments may require a Waste Disposal Authorization and Toxicity Characteristic Leaching Procedure test (see Chapter 9 for more on waste disposal). Solid waste handling facilities require, at a minimum:

- A form describing the waste;
- Laboratory data;
- Chain of custody; and
- A Toxicity Characteristic Leaching Procedure test if sample results are over 100ppm for lead or arsenic.

Contaminated soils must go to a landfill and shall not be reused on another property.

11.6.2 Capping in Place

Capping in place leaves contaminated soils where they lay and uses soil, pavement, or other materials as a barrier to human and ecological contact. There are two types of caps—type 1 and type 2. A type 1 cap must be at least 12 inches in thickness. It will have at least six inches of soil over a geotextile layer, covered by enough landscape material or gravel to total 12 inches depth (see Figure 11.1). A type 1 cap can only be used where average soil arsenic is at or below 100 ppm (and maximum <200 ppm) and lead is at or below 500 ppm (and maximum <1000 ppm).

A type 2 cap can be used with any soil arsenic and lead levels, when capping in place. There are two ways to construct a type 2 cap (see Figure 11.1):

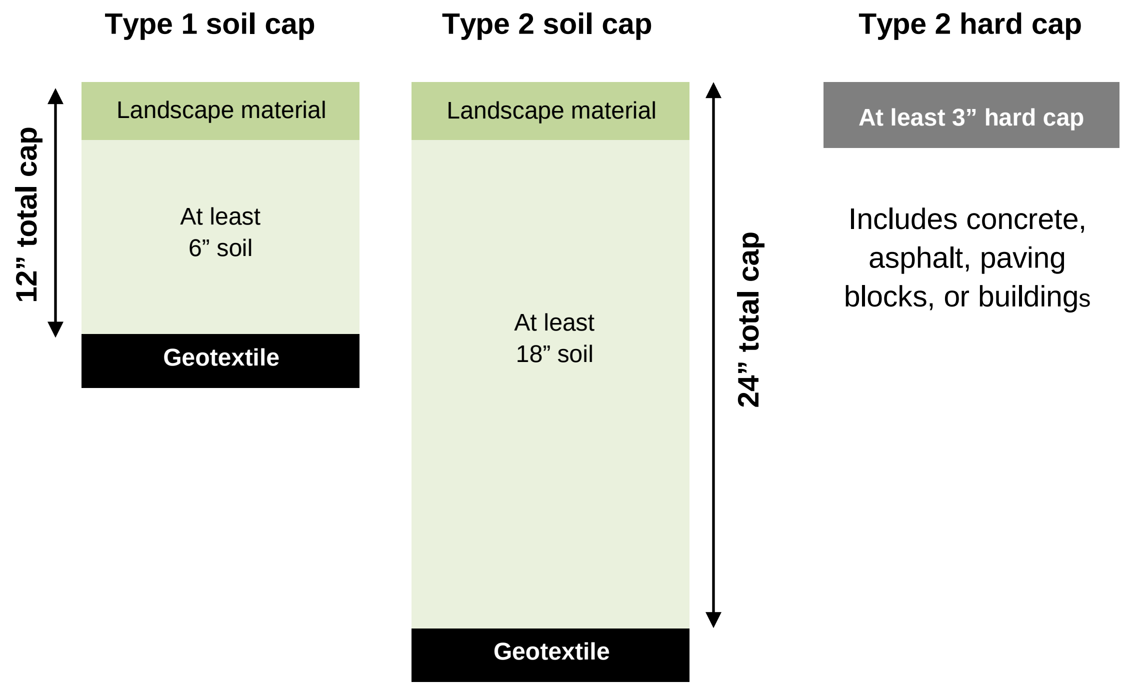
- **Soil cap** - At least 18 inches of soil over a geotextile layer, covered by enough landscape material to total 24 inches in depth; or
- **Hard cap** - Three inches of asphalt, concrete, paving, or other hard material.

Capping in place is non-permanent and requires institutional controls to maintain the remedy and warn future land owners. Institutional controls use an environmental covenant (Section 11.7).

Soil caps require sampling of the capping material to ensure it meets cleanup levels (see 11.5.4, imported soil sampling). Compliance monitoring (Section 11.4.2), such as regular inspection and maintenance, is required to ensure the long-term effectiveness of the cap.

Important: Ecology expects excavation and removal during residential development, rather than capping yards. Excavation and removal is permanent to the maximum extent practicable. The cost is not substantial and disproportionate to the cost of capping. Development presents a chance to remove all contaminated soil during grading.

Figure 11.1 Type 1 and 2 Caps



11.6.3 Consolidation and Capping

Consolidation and capping shall only be used where soils do not exceed 200 ppm average arsenic or 1,000 ppm lead. Ecology has concerns that consolidation of soils above these levels has the potential for groundwater impacts. Consolidating and capping soils above these limits requires a separate feasibility study.

Soils are excavated and consolidated in one or several areas of a property, then capped to prevent human and ecological contact. Excavated areas must meet Section 11.6.1 requirements, including compliance sampling. Consolidated soils may be placed under three types of caps (Figure 11.1):

- **Type 1 Cap** - At least six inches of soil over a geotextile layer, covered by enough landscape material or gravel to total 12 inches depth. For average arsenic <100 ppm (maximum <200 ppm) and average lead <500 ppm (maximum <1000 ppm).
- **Type 2 Soil Cap** - At least 18 inches of soil over a geotextile layer, covered by enough landscape material to total 24 inches in depth. For average arsenic <200 ppm and average lead <1000 ppm.
- **Type 2 Hard Cap** - Three inches of asphalt, concrete, paving, or other hard material. For average arsenic <200 ppm and average lead <1000 ppm.

Consolidation and capping is non-permanent and requires institutional controls to maintain the remedy and warn future land owners. Institutional controls are implemented using an environmental covenant (Section 11.7). If using a soil cap, sampling the capping material is required to ensure the soil cap meets cleanup levels (see 11.5.4, imported soil sampling).

Confirmational monitoring (Section 11.4.2), such as regular inspection and maintenance, is required to ensure the long-term effectiveness of the cap.

Important: Ecology expects excavation and removal of contaminated soil during residential development, rather than capping yards. Excavation and removal is permanent to the maximum extent practicable. The cost is not substantial and disproportionate to the cost of capping. Development presents a chance to remove all contaminated soil during grading.

11.6.4 Mixing

Mixing is only a model remedy where average soil arsenic does not exceed 40 ppm or 500 ppm for lead. This permanent remedy involves mixing with either clean imported soils, or clean soils underneath the contaminated surface soils. This reduces soil arsenic and lead below cleanup levels. Soil can be mixed in place, or piled in rows, mixed, and spread back out.

There are three main methods for mixing:

- **Mixing with deeper soils** - Soils may be mixed or tilled in place with deeper, cleaner soils. This method may require several passes of the mixing equipment and is more effective when there are few roots, rocks, or other objects in the soil.
- **Mixing with imported soils** - Soils may be mixed or tilled in place with imported, clean soils. Imported soil sampling (Section 11.5.4) should be used to ensure that imported soils are not contaminated.
- **Stockpile mixing** - Contaminated surface soils may be excavated, stockpiled, and mixed with clean imported or native soils. The mixed soils can then be spread out and reused on the property when they meet cleanup levels. Imported soil sampling (Section 11.5.4) should be used to ensure that imported soils are not contaminated.

Mixing requires performance monitoring—either compliance sampling (Section 11.5.2) for soils mixed in place, or stockpile sampling (Section 11.5.3) for soils mixed in piles. Sampling may need to be repeated throughout the mixing process, until cleanup levels are met. Compliance sampling of soils mixed in place should be done throughout the total mixed depth, as described in Section 11.5.2.

11.6 Environmental Covenants

Both capping remedies require an Environmental Covenant. The covenant, recorded with the property, notifies future owners that contamination remains on the property and specifies how to maintain the remedy. It must include detailed information about

- Location and nature of contamination, including maps and sampling results.
- Description and location of remediation completed, including the type and depth of cap.
- How lessees and future land owners will be notified.
- Restrictions on property use.
- Maintenance requirements.

The covenant should clearly state when and how lessees or future land owners will be notified about remaining contamination on the property. They should be informed of the location and levels of contamination, as provided with written materials about protecting and maintaining the remedy, and personal protective measures. The covenant must include restrictions on how the property can be used.

The covenant for a capping remedy restricts certain activities, particularly digging or otherwise disturbing the cap, to help protect the remedy. The covenant must also specify maintenance requirements such as:

- Maintaining sod or plant cover to prevent soil loss.
- Otherwise controlling erosion.
- Refilling soil, bark, wood chip, sand, rock, or gravel to maintain the required depth.
- Replacing geotextile barriers if they are observed to be disintegrating.
- Inspecting and repairing pavement.
- Maintaining signage, fencing, and other institutional controls.

Ecology can advise on language for the covenant. Properties in the Voluntary Cleanup Program receive technical assistance from Ecology.

11.7 Model Remedies Best Management Practices

Best management practices should be followed during both sampling and remediation. In accordance with state and local regulations (Chapter 9), best management practices should be used to protect human health and safety, air quality, and water quality. The Washington Department of Labor and Industries has regulations regarding working in contaminated soils, including arsenic and lead. These regulations apply to construction workers, as well as landscaping and maintenance employees. Protection monitoring (Section 11.4.2) should be used to confirm that human health and the environment are adequately protected during cleanup work.

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Glossary

Area-wide soil contamination - Low-to-moderate levels of contamination spread over large areas, from several hundred acres to many square miles.

Action level - The arsenic or lead level at which Ecology or EPA will do soil cleanup. Ecology and EPA's action levels for the Tacoma Smelter Plume are:

Agency	Area being cleaned up	Average* arsenic	Maximum arsenic	Average* lead	Maximum lead
Ecology	Child play areas	20 ppm	40 ppm	250 ppm	500 ppm
Ecology	Yards	100 ppm	200 ppm	500 ppm	1,000 ppm
EPA	Yards	230 ppm	--	500 ppm	--

*Arithmetic mean

Air deposition - Airborne pollution that falls to the ground in precipitation (rain or snow), in dust, or just because of gravity.

Arsenic - A metal found naturally in soil, and also as a result of pollution (like from the Asarco smelter). Scientists have linked long-term exposure to arsenic to heart disease, diabetes, and cancer of the bladder, lung, skin, kidney, liver, and prostate. For more on arsenic, please visit http://www.doh.wa.gov/ehp/oehas/pubs/arsenic.pdf.

Cleanup - "Cleanup" is a broad term that covers the whole cleanup process. This includes finding and studying contamination, looking at cleanup options, writing a cleanup plan, doing the cleanup, and checking to make sure the cleanup worked. For the interim action plan, cleanup refers to the actual digging, mixing, or capping. It also includes any "institutional controls" needed to prevent human exposure and protect the cleanup.

Cleanup action plan - A plan that explains how to clean up an entire contaminated site. It also explains how cleanup will meet state standards and other requirements. Unlike an interim action plan, which explains a partial cleanup, the cleanup action plan must cover the whole site. Draft cleanup action plans must go out for public comment.

Cleanup level - The level of a hazardous substance that Ecology believes will not harm human health or the environment. Any given substance will have cleanup levels for soil, water, air, and sediment. Tacoma Smelter Plume cleanup levels are just for arsenic and lead in soil. They are

- 20 parts per million (ppm) for arsenic.
- 250 ppm for lead.

Cleanup standard - A combination of the cleanup level and "point of compliance." For the Tacoma Smelter Plume, a cleanup must meet the arsenic and lead cleanup level as deep as contamination goes, to a max of 15 feet.

Commingled contamination - Contamination from two distinct sources that is mixed together. For example, one might have arsenic and lead from the Tacoma Smelter Plume, plus contamination from pesticides. They could both be mixed together in surface soils.

Community protection measures – EPA's plan to reduce exposure to contaminated soils in the Ruston/North Tacoma Study Area. These measures are only for areas with arsenic between 20 and 230 ppm. They include public outreach, a soil disposal program, protecting caps, and a database showing which yards they have cleaned up. EPA's website: http://yosemite.epa.gov/R10/cleanup.nsf/sites/ASARCO.

Confirmed and Suspected Contaminated Sites List - Ecology's list of sites that need cleanup. To find a cleanup site, visit: https://fortress.wa.gov/ecy/gsp/SiteSearchPage.aspx.

Decision units – Areas of a property sampled or cleaned up separately because they may have different patterns of soil contamination. For example, a recently developed area may have less arsenic and lead than a forested area. Sampling them separately may help narrow down the area that needs cleanup.

Deed restrictions – Legal limits on the use of a property. These limits stay with the deed and pass on to future owners of the property. An environmental covenant is one example.

Ecological receptors – The plants and animals that contaminants could harm.

Environmental covenant - A type of deed restriction (see above) specific to cleanup. It can limit or prevent activities that might damage the cleanup or lead to human exposure.

Excess cancer risk - The number of cases of cancer above the background cancer rate for a population.

Feasibility study - A study that weighs different options for cleaning up a site.

Footprint study – Study that examines how far contamination goes and how high the levels are. Tacoma Smelter Plume footprint studies focused on less-disturbed forest soils, looking mainly for arsenic and lead.

Hazardous Sites List - Ecology's list of ranked sites. Ecology ranks sites using the Washington Ranking Method (below).

High zone – The area of the Tacoma Smelter Plume that could have average arsenic levels above 100 ppm. See Appendix A.4 for a map of the high zone and more background.

Institutional controls – Measures that limit or prevent activities that could damage a cleanup or result in human exposure. Examples include deed restrictions (see above), which restrict land uses. They can also include site access restrictions like fencing, signs, and community education.

Interim action - Partial cleanup that only addresses part of the contamination on a site.

Interim action plan - A plan for cleaning up part of a site. Final cleanup requires a cleanup action plan (see above).

Lead – A toxic metal. In children, lead can cause behavioral problems, permanent learning difficulties, and reduced growth. In adults, it can increase blood pressure, affect memory, and contribute to other health problems. For more on lead, please visit: http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=93&tid=22.

MTCA Method A cleanup level - The Model Toxics Control Act regulation gives a table of cleanup levels for 25-30 of the most common hazardous substances in soil and groundwater. The cleanup levels are protective of human health when cleanups are straightforward or only involve a few substances.

Model remedy – Cleanup options designed for a certain site or type of contamination. Generally, users do not have to do a feasibility study because the model remedy includes one.

Model Toxics Control Act (MTCA) - A 1988 State of Washington law (Chapter 70.105D) that governs cleanups. It lays out a process for finding, investigating, and cleaning up contamination. MTCA encourages public involvement in cleanup decisions.

Moderate zone - The area of the Tacoma Smelter Plume that could have average arsenic levels between 20 and 100 ppm. See Appendix A.4 for a map of the moderate and high zones and more background.

No Further Action Determination (including property and site NFA) – A letter Ecology provides to a landowner when no more cleanup is needed at a site. The site must be completely cleaned up or have institutional controls.

Point of compliance – The depth at which soils (or other media) must meet state cleanup levels. For the Tacoma Smelter Plume, a cleanup must meet the arsenic and lead cleanup level as deep as contamination goes, to a max of 15 feet. Even during construction projects, humans usually aren't exposed to soils deeper than 15 feet.

Parts per million – A measure of concentration. One part per million is a half a drop of water in a bathtub.

Remediation - Cleanup.

Remediation level - The contamination level at or below which Ecology allows a certain cleanup method to be used. For example, the Tacoma Smelter Plume Model Remedies only allow soil mixing at or below 40 ppm average arsenic.

ROD (Record of Decision) - EPA's format for a cleanup action plan.

Science Advisory Board - A board that advises Ecology on cleanup policy. See http://www.ecy.wa.gov/programs/tcp/SAB/SAB_hp.html.

Smelter - A facility that heats ores to very high temperatures to extract metals.

Soil Safety Program - Ecology's program that offers free soil sampling and cleanup for play areas at schools, licensed childcares, parks, camps, and multi-family public housing.

Superfund Program - EPA's program for cleaning up contaminated sites. It funds EPA-led cleanup and allows EPA to compel responsible parties to do or pay for cleanup. See http://www.epa.gov/superfund/.

Voluntary Cleanup Program - Ecology fee-based program offering technical assistance and review of cleanups. Sites can enter the program voluntarily and receive a No Further Action letter (see above) if cleanup meets Ecology standards. See http://www.ecy.wa.gov/programs/tcp/vcp/Vcpmain.htm.

Washington Ranking Method (WARM) - The ranking takes into account health and environmental risk from contamination at the site. Ecology ranks sites from 1-5, with a score of 1 being the highest level of risk.

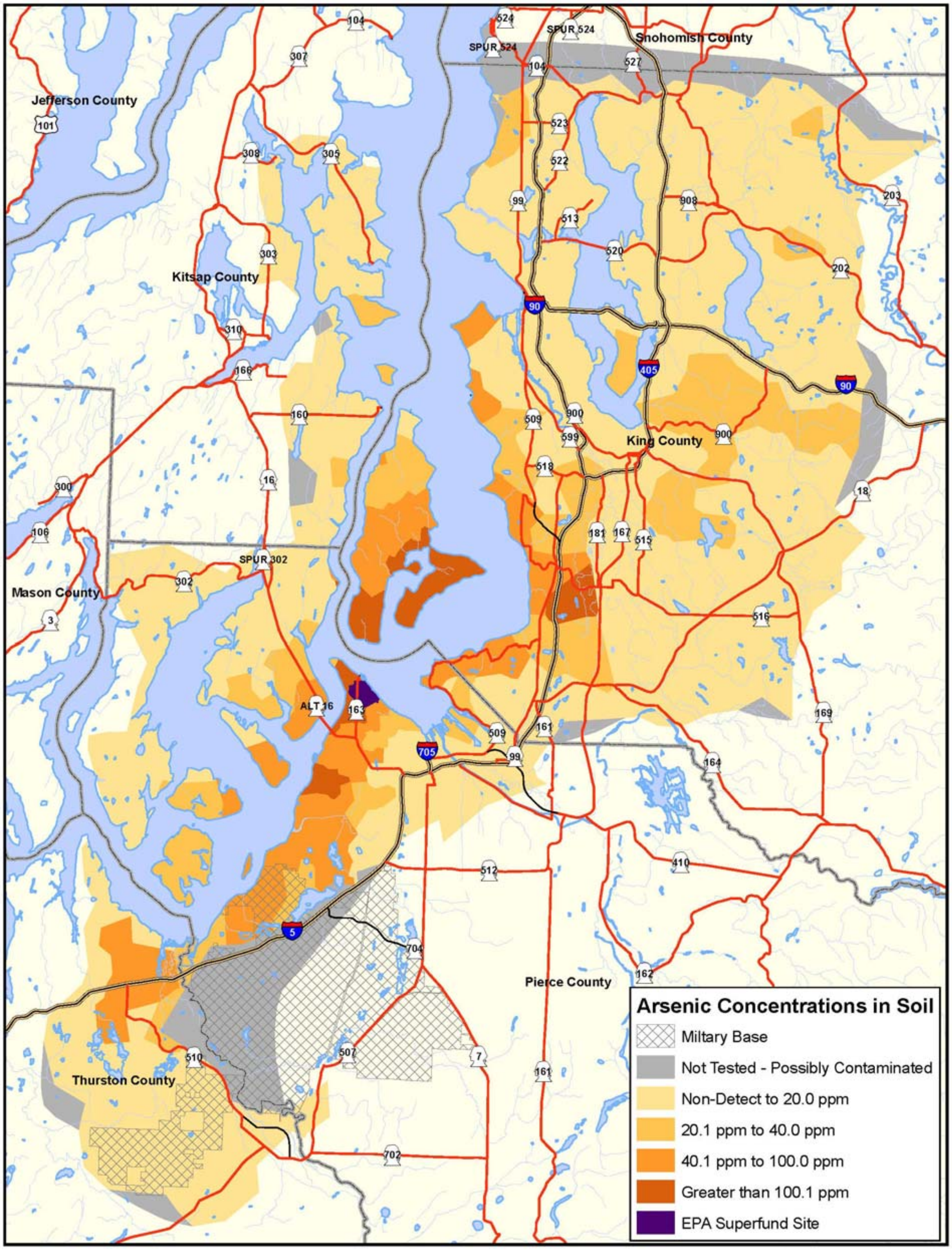
Yard Sampling and Cleanup Program - Proposed Ecology program offering free soil sampling and cleanup for residential yards. Ecology only plans to offer it for yards in the high zone (Appendix A.4). See Chapter 6 for more on the program.

Acronyms

ARAR	Applicable or Relevant and Appropriate Requirements
CSCSL	Confirmed and Suspected Contaminated Sites List
DEL	Department of Early Learning
EPA	U.S. Environmental Protection Agency
MTCA	Model Toxics Cleanup Act
NEBA	Net Environmental Benefit Analysis
NFA	No Further Action determination
OSPI	Office of the Superintendent of Public Instruction
PHSKC	Public Health—Seattle & King County
RCW	Revised Code of Washington
ROD	Record of Decision
SBOH	State Board of Health
SEPA	State Environmental Policy Act
TCLP	Toxicity Characteristic Leaching Procedure
TPCHD	Tacoma Pierce County Health Department
OU	Operable Unit
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation

Appendix A
Tacoma Smelter Plume Maps

A.1 Tacoma Smelter Plume Zones of Estimated Contamination



This map shows estimated concentrations of arsenic in the top six inches of soil. It is based on a relatively small number of soil samples, given the large area that is affected. Property-specific sampling is needed to determine the actual amount of arsenic on a given property.

How Ecology Created the Tacoma Smelter Plume Map

In the early 2000s, Ecology sampled mostly undisturbed surface soils to map the footprint of arsenic contamination. The 2005 Extended Footprint Study report evaluated the arsenic data and mapped the results. The map shows many different areas with varying arsenic levels called "Thiessen polygons."

The Thiessen polygon method uses math to group sampling points with similar arsenic levels. Each area on the map shows a high estimate of the arsenic level at a depth of 0-6 inches. It is **not** an average of the sampling results.

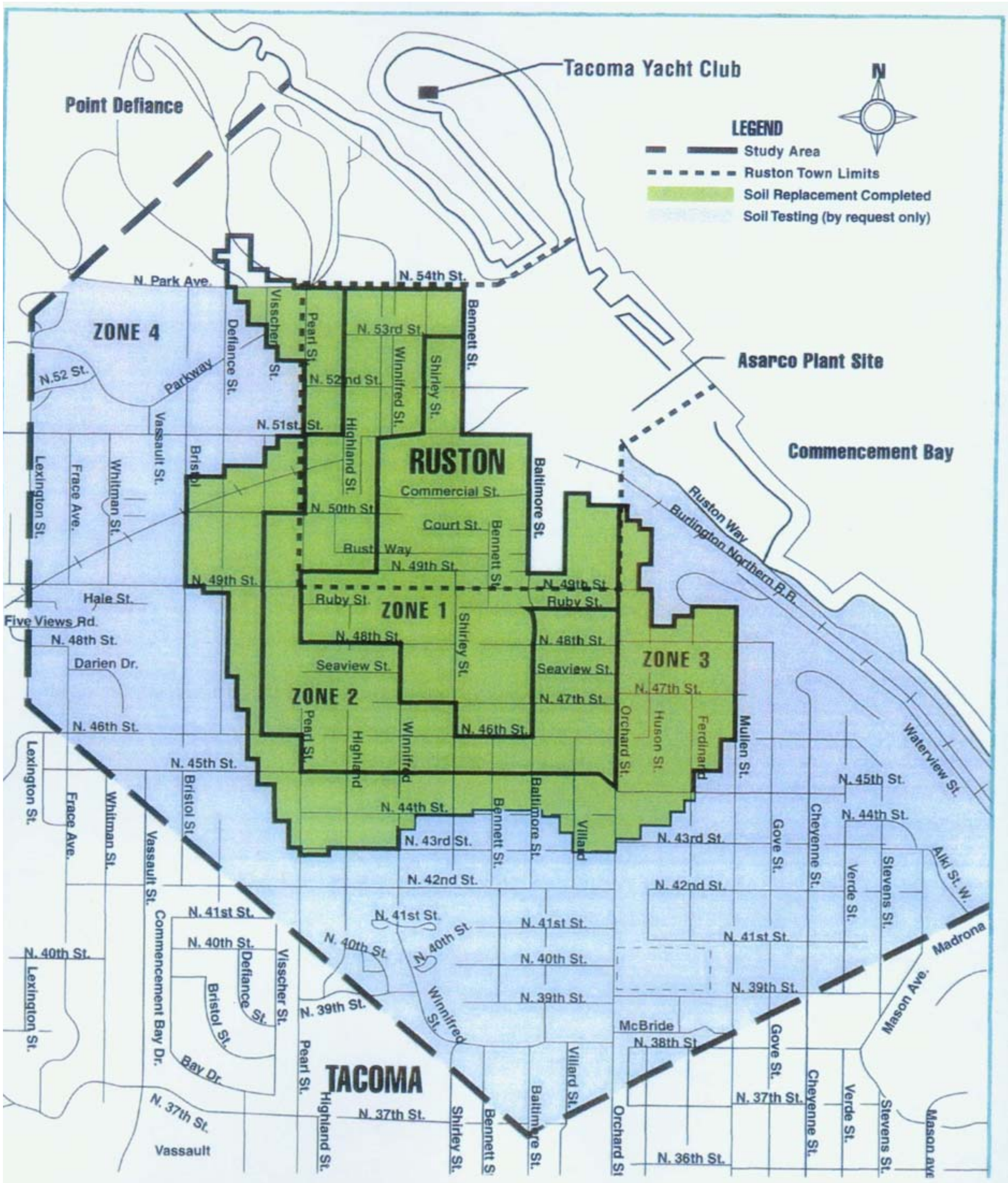
Thiessen Polygon Method - Technical Details

Ecology created a statistical distribution for each polygon location by combining the ten nearest arsenic levels within one mile of a starting point. Ecology made distributions from all 0-2 inch depth samples and the combination of the 0-2 and 2-6 inch depth samples. The 0-2 inch depth distributions represent surface levels. The combined 0-2 and 2-6 inch depth distributions represent total levels within the top 6 inches of the soil.

Distributions have 1 to 10 values, depending on the number of sample points within one mile of the first location. Ecology calculated a median and 90th percentile value from each the distribution. Depending on the map, Ecology assigned either the median or 90th percentile to an area around the first point. In some cases, there were no other samples within a mile. Here, Ecology estimated the median and 90th percentile from the one value.

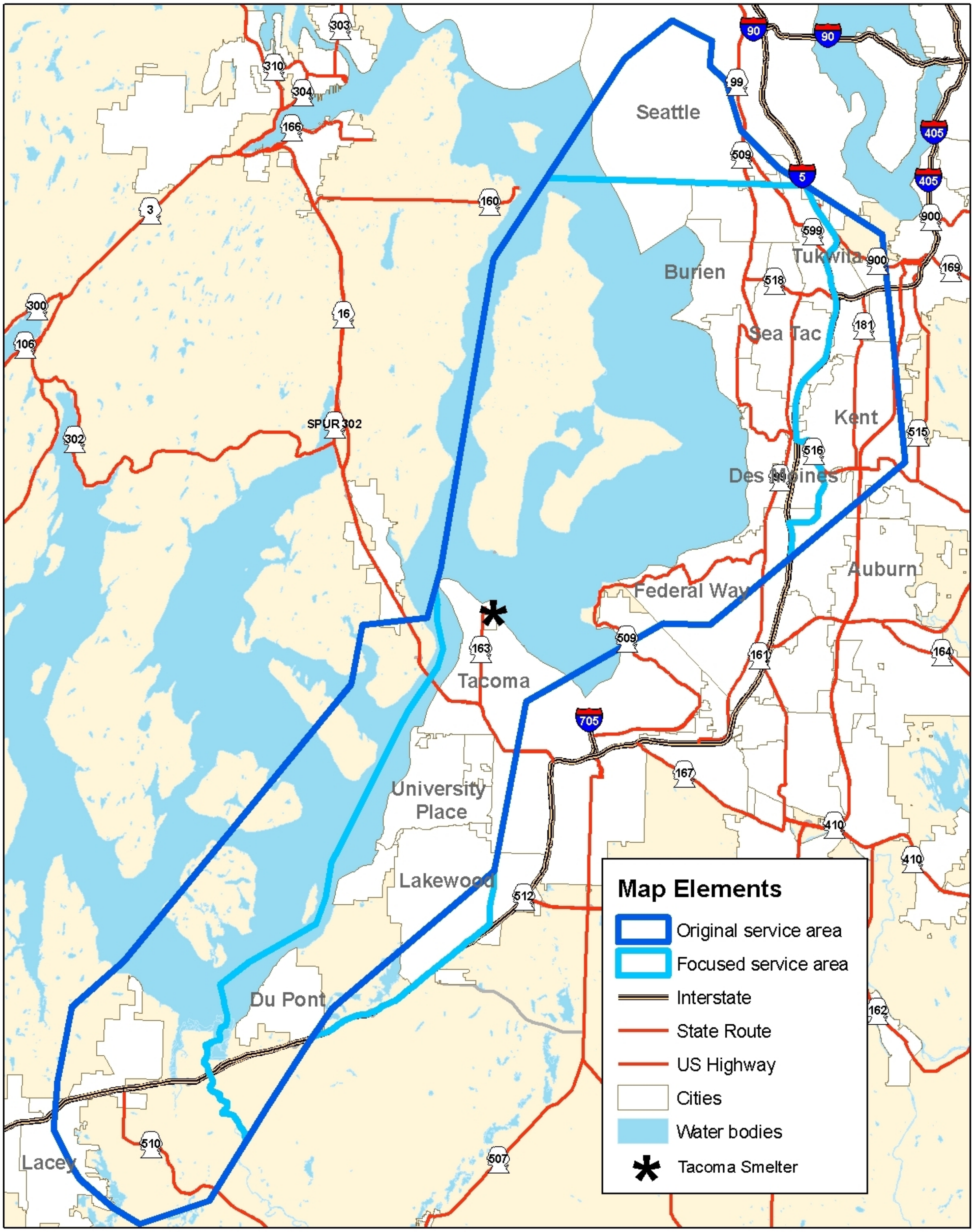
Ecology mainly uses the map of arsenic levels in soil, 0-6 inches and 90^{th} percentile. This is a conservative representation of the Tacoma Smelter Plume footprint.

A.2 Superfund site Operable Unit 4: Ruston/North Tacoma Study Area



The Ruston/North Tacoma Study Area is around 950 acres, surrounding the former smelter. Arsenic concentrations in surface soils range from 2 to 3,000 ppm. For more background, see Section 2.2 of the Tacoma Smelter Plume Interim Action Plan.

A.3 Soil Safety Program Service Area



The original Soil Safety Program service area (darker blue) was around 315 sq miles and extended north to West Seattle and south to Thurston County. Ecology set the boundary based on limited data to estimate where maximum arsenic levels were likely to be over 100 parts per million (ppm).

After three years of sampling schools and childcares, Ecology mapped the data and re-evaluated the service area. It is now smaller in order to better focus the program on play areas with a higher likelihood of having Tacoma Smelter Plume contamination. The lighter blue line shows the new boundary of the Soil Safety Program Service Area which covers about 253 square miles.

Ecology removed Thurston County from the focused service area, since no childcares or schools have had elevations of arsenic or lead.

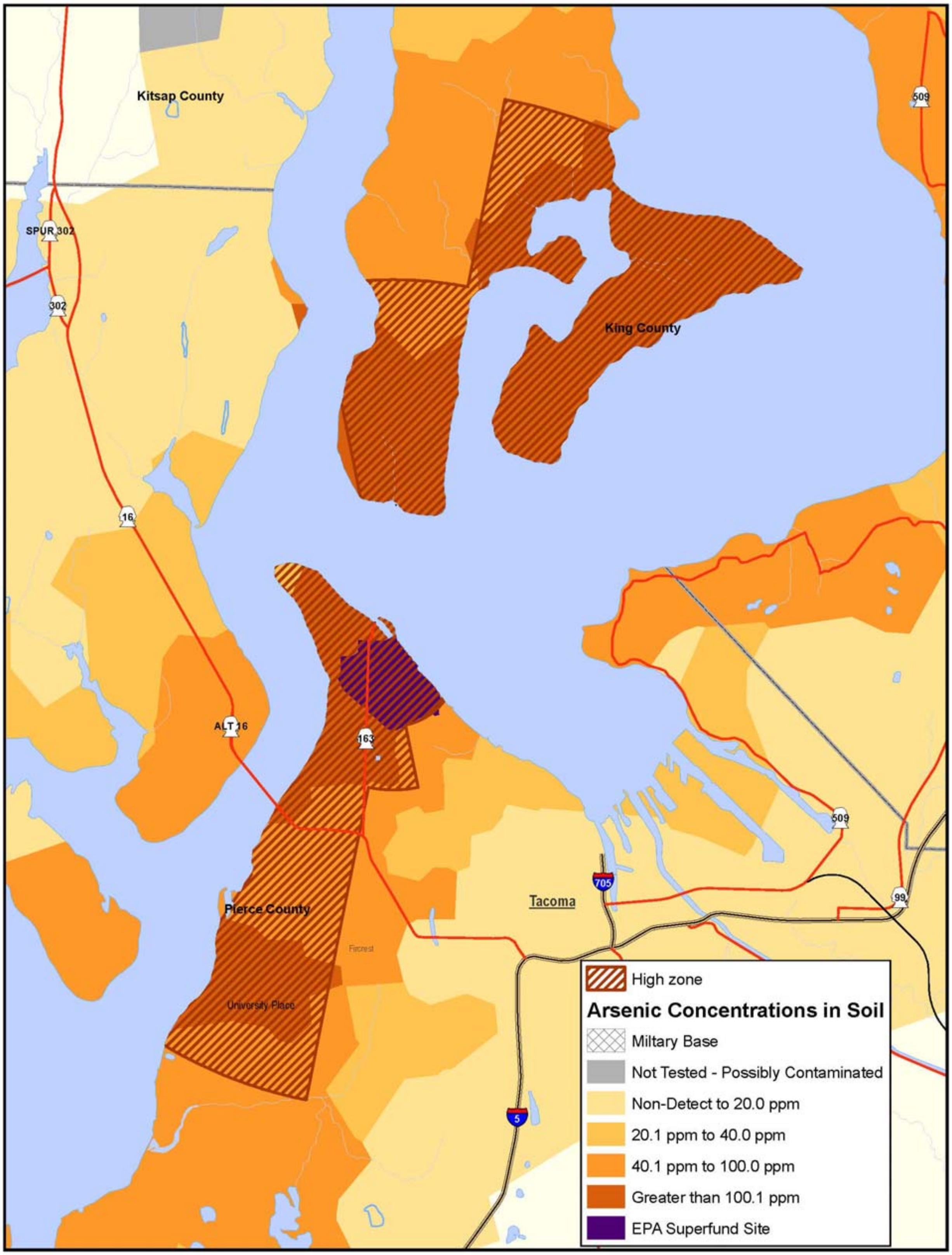
Pierce County has the greatest number of impacted schools and childcares. As a result, Ecology did sample outside of the service area, to the south and east around Lakewood. More childcares in that area had results above criteria, so the service area has been expanded in this one section. Ecology did not see any arsenic or lead above state cleanup levels on Anderson Island or Fox Island. Ecology also removed these areas from the focused service area. The Pierce County mainland border is now the service area boundary to the west.

King County's service area boundary is also smaller to the north and east. The few childcares with elevations in these areas had either:

- Lead only contamination, likely not from the Tacoma Smelter Plume; or
- Low levels of arsenic with an average below 20 parts per million (ppm) or a maximum below 40 ppm.

On a case-by-case basis, Ecology may still sample play areas outside of the new boundary and inside of the old boundary.

A.4.1 Tacoma Smelter Plume High Zone Map



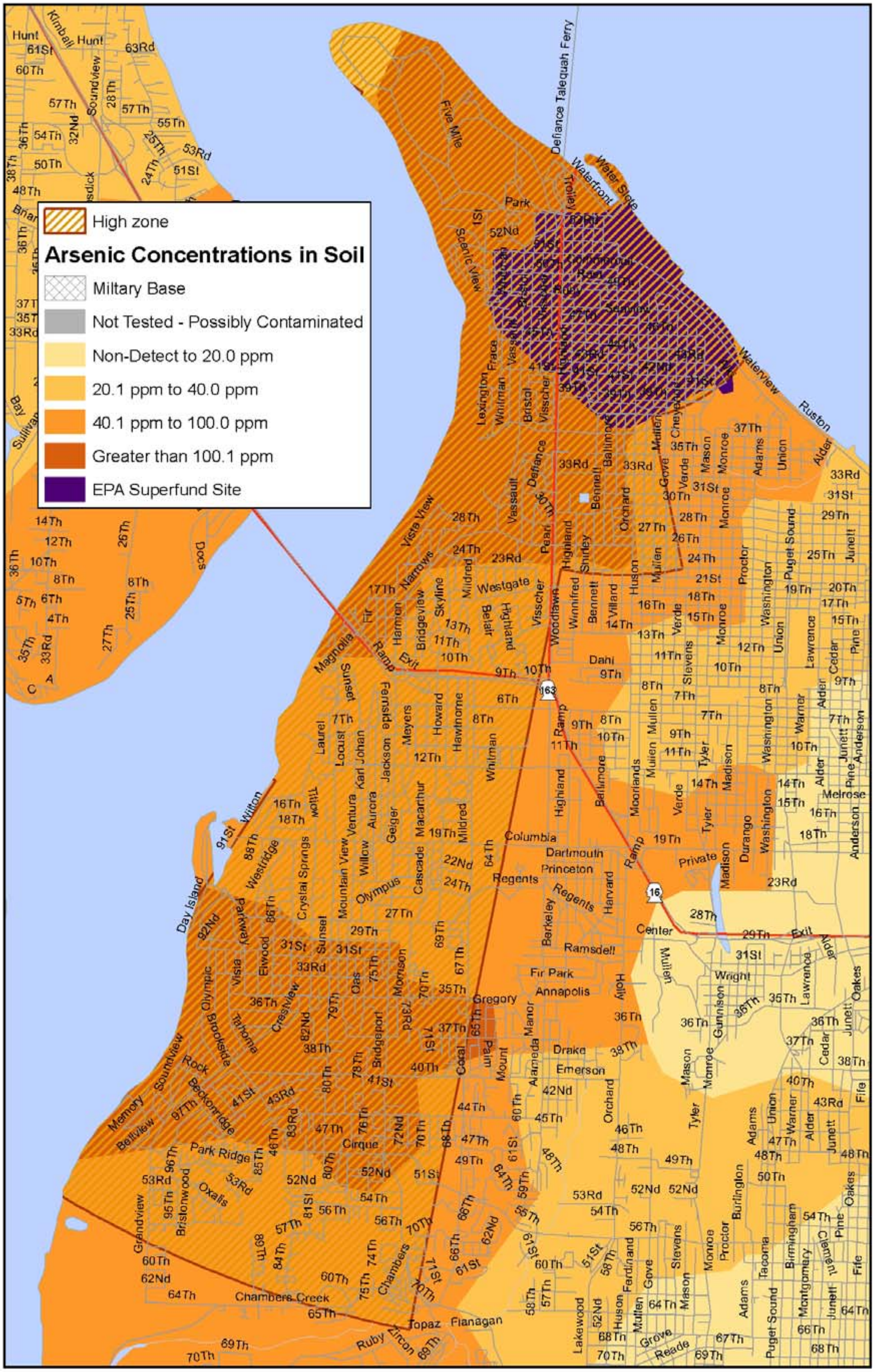
This map shows the areas Ecology estimates are more likely to have high arsenic contamination—over 100 parts per million (ppm)— in the soil. The high zones are where Ecology proposes focusing a yard sampling and cleanup program. These areas are based on sampling results from early plume studies and more recent sampling done under the Soil Safety and local home soil testing programs. The sampling included properties with both disturbed and undisturbed soils.

Some areas of the high zone have a limited number of samples and so are less reliable. However, they are in a predominant downwind direction from the former smelter or they are on the boundary of areas with known higher contamination.

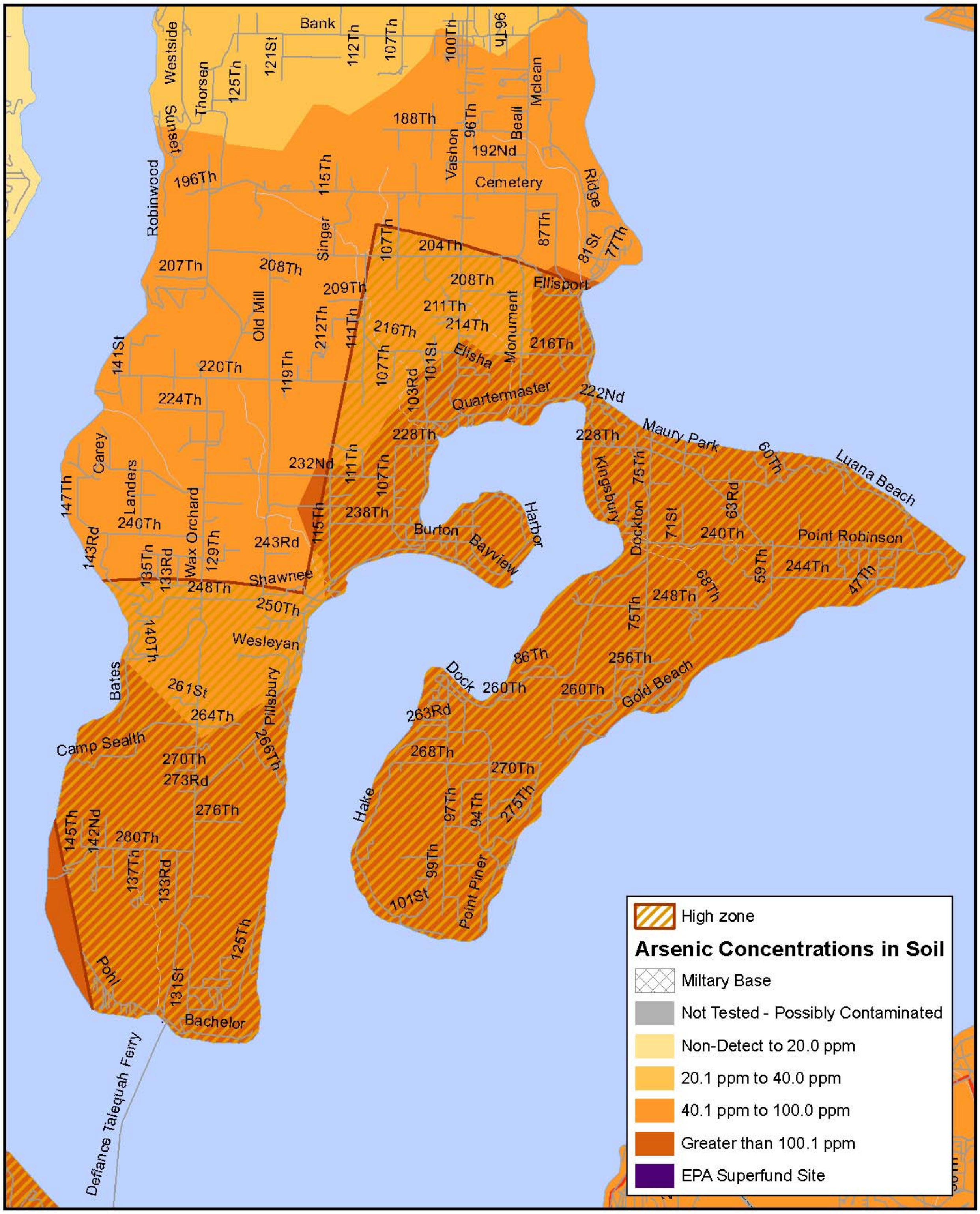
Ecology is currently refining the mapping methods. This will provide better estimates of the probability and level of confidence of finding high contamination certain areas, such as census tracts or block groups. In addition to distance and direction from the former smelter, the revised methods will take into account topography (shape of the land surface) and age of housing. **Therefore, Ecology may delete some areas in the map from the estimated high zone and add other areas.** Some areas may need more sampling to decide if they should remain in the high zone.

The revised maps will factor into the yard sampling and cleanup program design. The design will include the sequence in which Ecology will do soil sampling. Ecology will also use the information to prioritize outreach and education and to help with technical assistance to local land use planning and permitting agencies.

A.4.2 Tacoma Smelter Plume High Zone - Pierce County



A.4.3 Tacoma Smelter Plume High Zone – Vashon-Maury Island



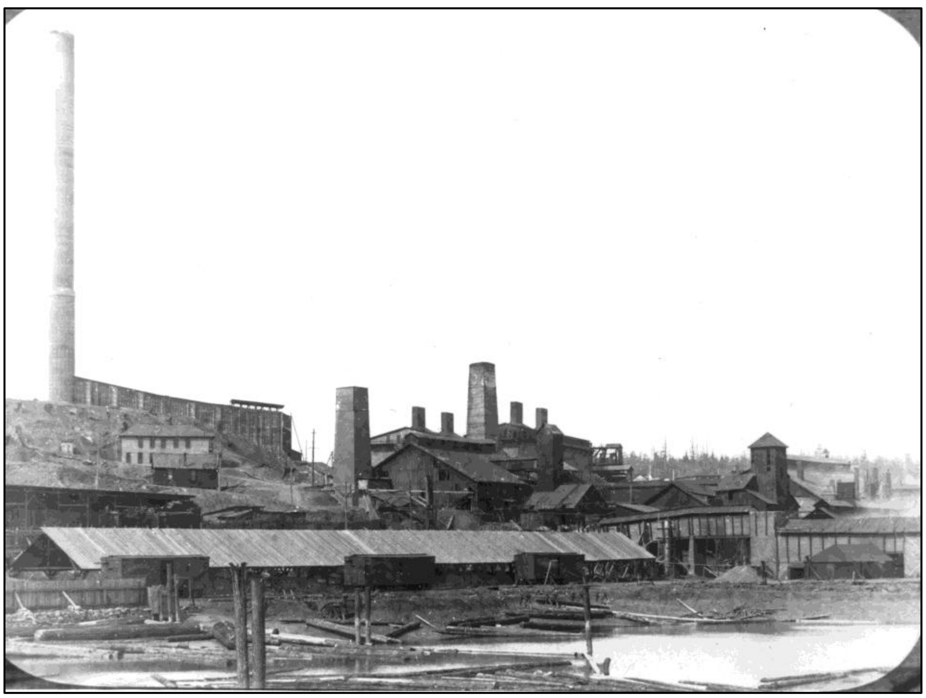
Appendix B
Tacoma Smelter Plume Model Remedies Guidance

Tacoma Smelter Plume Model Remedies Guidance

Sampling and cleanup of arsenic and lead contaminated soils

For:

Formal cleanup sites
Voluntary Cleanup Program
Properties under development

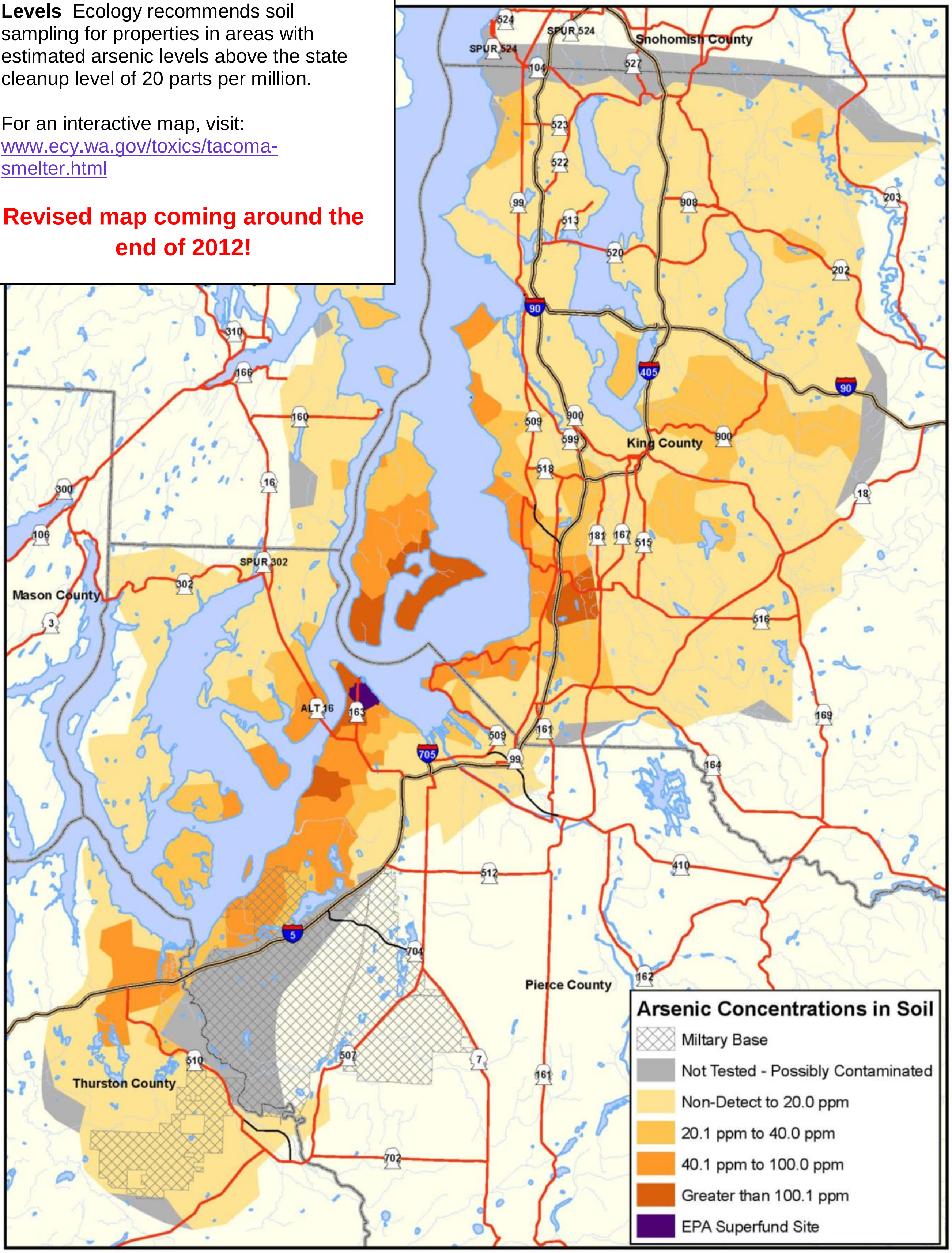


June 2012
Toxics Cleanup Program
Washington State Department of Ecology
Lacey, WA
Publication Number 12-09-086-A

Tacoma Smelter Plume Soil Arsenic Levels Ecology recommends soil sampling for properties in areas with estimated arsenic levels above the state cleanup level of 20 parts per million.

For an interactive map, visit: www.ecy.wa.gov/toxics/tacoma-smelter.html

Revised map coming around the end of 2012!



Before you get started…

On the map, is your property in an area where soil arsenic is 20 ppm or higher? Do you only suspect arsenic and lead, and not other contaminants? Use this manual for sampling and cleaning up Tacoma Smelter Plume contamination. You can meet state cleanup requirements without having to do your own feasibility study.

Sampling and cleanup steps

1. Take **characterization samples** to determine if your soil is contaminated.
2. Pick **cleanup remedies** that fit with your development plans:
    a. Excavation and removal
    b. Mixing
    c. Capping in place
    d. Consolidation and capping
3. Take **compliance samples** to make sure excavation or mixing worked.
4. Inform future property owners of remaining contamination under a cap or in a natural area through an **environmental covenant**.
5. Make sure that any caps are **protected and maintained**.
6. **Educate** residents and property users about remaining contamination.

I need a No Further Action determination from Ecology

If a local government permit office or lender requires Ecology's written approval of your cleanup, you must enter the Voluntary Cleanup Program (VCP). Also, a future buyer might want to see Ecology's written approval of your cleanup. The VCP provides technical assistance and a written opinion. **Getting written approvals via the VCP is free for projects with only Tacoma Smelter Plume contamination.**

This guidance covers a set of Ecology-approved cleanup remedies that already have a feasibility study. Work with your VCP site manager to use this guidance and ensure you are meeting all cleanup requirements. Visit http://www.ecy.wa.gov/programs/tcp/vcp/Vcpmain.htm

For more information, please call 360-407-6300 and ask for Ecology's Tacoma Smelter Plume Technical Assistance Coordinator.

Document Your Work!

Keep a copy of the forms you fill out to pass on to future property owners so they know that cleanup was done and how to maintain any non-permanent remedies. Future property owners may want this level of detail for when they sell the property.

As awareness about the Tacoma Smelter Plume grows, more buyers will be asking about soil contamination.

Disclaimer

Cleanups using these model remedies will meet state requirements under the Model Toxics Control Act (Chapter 70.105D) and its regulation (Chapter 173-340 WAC). However, you must enter the Voluntary Cleanup Program to get Ecology approval in the form of a No Further Action determination.

Cleanups are not exempt from local, state, and federal permitting requirements.

You may have flexibility in which cleanup methods you use. Please note that you may have to seek out other sources of information to complete your cleanup.

In this guidance, “average” refers to the arithmetic mean of sampling results. The model remedies do not use a geometric mean.

This guidance is for Tacoma Smelter Plume arsenic and lead contamination only. If your property has other contaminants besides lead and arsenic, like petroleum or industrial chemicals, contact Ecology. If you are in King or Kitsap counties call 425-649-7000. If you are in Pierce or Thurston counties call 360-407-6300.

Contents

Introduction

The former Asarco copper smelter in Tacoma caused widespread soil contamination in parts of King, Pierce, Kitsap, and Thurston counties. This 1,000 square mile area is known as the Tacoma Smelter Plume.

Arsenic and lead contamination pose a long-term human health risk, especially for children. Property owners and developers can help protect future owners and users by sampling and cleaning up affected properties.

Goals of this guidance:

- To streamline cleanups under the Voluntary Cleanup Program.
- To provide simple sampling guidance for any property in the plume.
- To encourage independent cleanup during property development.

Health Effects of Arsenic and Lead

Arsenic and lead are toxic metals. Exposure can increase the risk of certain health problems. Regular exposure can increase the risk of accidental ingestion of soil, or dust inhalation. Although the metals are not easily absorbed through the skin, Ecology is concerned about people that are regularly exposed to soil, such as children, construction workers, landscapers, and gardeners.

Scientists have linked long-term exposure to arsenic to a variety of health problems, including heart disease, diabetes, and cancer of the bladder, lung, skin, kidney, liver and prostate. Lead can cause behavioral problems, permanent learning difficulties, and reduced physical growth.

Whether someone is impacted depends on the amount of arsenic or lead taken into their body over time. People exposed to contaminated soil on a regular basis may be affected.

Children and workers are at highest risk

Young children are vulnerable because they play on the ground and put their hands in their mouths. The small amount of arsenic or lead that they may swallow is more harmful because they are still growing. Children can come in contact with arsenic or lead while playing outside and inside. Soil and dust can easily be tracked into homes from outside.

Construction workers, gardeners, and landscapers can also be exposed to contaminated soil at a work site. Exposure can happen by accidental ingestion of soil or inhalation of dust. Employers are responsible for meeting health and safety requirements at work sites to limit worker exposure. Employers should contact Department of Labor and Industries for more information.

Why sample?
The map in the front of this booklet is based on a small number of arsenic samples for the large size of the site. There is high variability in soil arsenic levels from property to property. Actual levels of arsenic and lead can only be found by soil sampling.

Once you know the contaminated areas, you can take actions to reduce contact with this soil and manage potential exposure on your property.

> **State Cleanup Level for Arsenic and Lead***
>
> 20 parts per million (ppm) arsenic
>
> 250 ppm lead
>
> *Unrestricted land use (all land uses, including residential)

Model Remedies
Model Remedies are cleanup options that Ecology has pre-approved for Tacoma Smelter Plume contamination. Ecology did a feasibility study* to show that these cleanup remedies were appropriate under certain conditions. This means you can meet state cleanup requirements by following this guidance, without having to do your own feasibility study.

Cleanups are not exempt from local, state, and federal permitting requirements.

**The feasibility study is Appendix C of the Tacoma Smelter Plume Interim Action Plan, available on Ecology's website* www.ecy.wa.gov/toxics/tacoma-smelter.html.

> **Forms vs. Worksheets**
>
> **Forms** for tracking your sampling and cleanup work are in the back of this booklet. **At a minimum**, fill out these forms for your records and to give to future property owners or others that need documentation of cleanup.
>
> There are **worksheets** at the end of some of the chapters. These are designed to help you estimate the cost of cleanup and do not need to be kept.

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Chapter One: Characterization Soil Sampling

Characterization
- Decision units
- Number of samples
- Where to sample
- Sample depths
- Sampling equipment
- Soil sampling steps
- Lab analysis
- Results
- Next steps
- Cleanup

Purpose: Characterization sampling shows whether a property or portion of it is clean or contaminated.

Thorough sampling helps plan for cleanup

Soil arsenic and lead levels can vary across a property. Sampling is the only reliable way to find out whether it poses a health concern. Once you know where the contamination is, you can take actions to reduce contact and manage potential exposure.

Planning for sampling

Think about land use history. Undisturbed areas like forests are more likely to have elevated arsenic or lead. **Forest duff** can contain arsenic and lead and should be sampled before disposal or reuse.

Then, think about proposed future uses. There is a greater risk to human health if the area will be used by children or by people regularly in contact with soil.

Track this information on a map of your property. Form 1 will help you document your planning.

Decision units

Identify decision units before starting sampling. This may save time and money when it comes to cleanup. Figure 1 shows two different properties, one that has decision units based on past use, and one based on future use.

Arsenic or lead may be *below* cleanup levels in a recently graded part of the property, and *above* cleanup levels in a formerly forested part. It is more cost effective to treat these as separate decision units, since you would only clean up the area that was above state cleanup levels.

Future use can also define decision units. While Ecology encourages excavating and removing soils from home sites, you could cap soils at a community center. It would be easier to maintain a cap at a community building. At a private home, a cap would limit future homeowners' ability to install an irrigation system, build a pool, or plant trees.

Decision Unit

Area of a property expected to have a different pattern of soil contamination than other areas. Some properties will only have one decision unit. Factors include current and past land uses and development history.

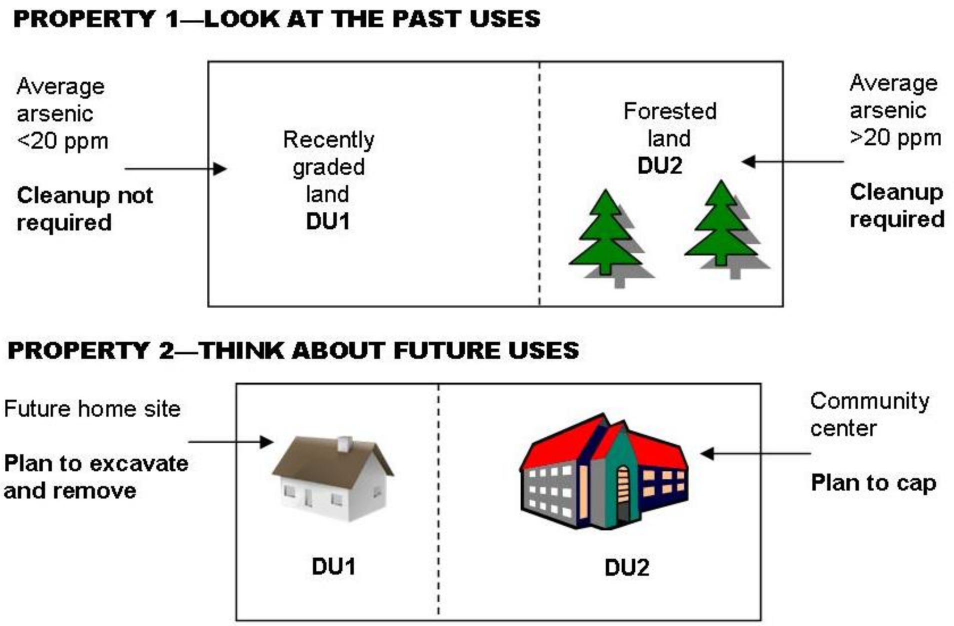


Figure 1. Dividing properties into decision units based on past or future uses

Soil: Number of samples per decision unit

Use Table 1 to find the number of sample locations you need, which depends on:

1. **Land use** – What is the **intended** use? Development or open space?
2. **Location** – Is the property in an area where arsenic has been found in soils from 20 -100 ppm or over 100 ppm (see map on inside cover)?
3. **Size** – How big is the decision unit?

For example, an undeveloped piece of property (open land or forest) will be developed into a residential plat. A land owner would need to take the number of samples needed for a residential property, not a forested or open land property.

If you also have forest duff: Number of extra samples

Mark each decision unit with significant forest duff. Plan to take **one composite sample** from each decision unit with forest duff. The composite sample will have at least six subsamples mixed together.

> **What is forest duff?** Moderately decomposed leaves, needles, and other plant material that has gathered on the soil surface.
>
> **Why sample?** Duff can have high levels of arsenic and lead. Test before mulching, reusing, or disposing of it!

Table 1. Minimum number of sample locations per decision unit

Sampling area	Residential, parks, commercial Samples needed		Forest and open land Samples needed	
Acres	**Arsenic >100 ppm**	**Arsenic 20-100 ppm**	**Arsenic >100 ppm**	**Arsenic 20-100 ppm**
0.25*	10	8	8	8
1	20	16	16	12
5	40	32	30	24
10	60	48	40	32
20	80	64	50	40
100	120	90	70	60
>100	120 + 1 per 5 acres	90 + 1 per 5 acres	70 + 1 per 10 acres	60 + 1 per 10 acres

*0.25 acres ~11,000 square feet

Soil: Where to sample
With Form 1, attach a diagram showing the property dimensions and decision units. For multiple decision units, attach a separate diagram for each, with dimensions and the location of any structures. No sampling is needed under structures or paving that will remain after development. These areas should be marked on the diagram.

For each decision unit diagram, prepare a sampling grid (Figure 2):

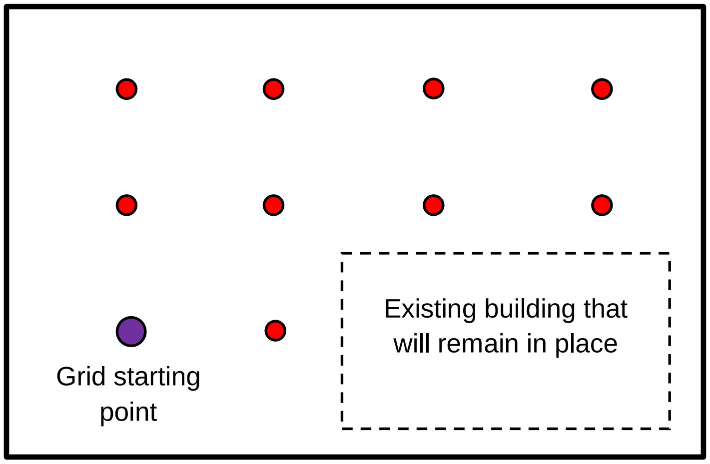
Step 1: Enclose the entire decision unit inside a rectangle. It is fine to have small margins around the edges.

Step 2: Mark a point towards one corner of this rectangle as a starting point.

Step 3: Start with this point and begin laying out sample points in an evenly-spaced grid (Figure 2). Use the number of locations from Table 1. Grid points should cover as much area as possible. Adjust the grid or add locations to make it fit.

All samples are discrete, which means the soils for one sample come from a single sampling location.

If you also have forest duff: Where to take extra samples
Each decision unit only needs one composite sample. Each composite needs at least six subsamples. Pick at least six evenly-spaced locations throughout the decision unit to take subsamples from. You **do not** need to take them from the soil sample locations.



Decision Unit Information

Use = Residential
Size < 0.25 acres (<11,000 ft^2)
Map area = arsenic >100 ppm

Samples needed = 10

Figure 2. How to lay out a sampling grid on a decision unit

Sample depths

- **At every sample location:** Take characterization samples from the top 0-6 inches of soil, after clearing away grass, leaves, gravel, or debris on the surface (Figure 3); and
- **At every fourth sample location (25% of samples):** Also take a sample from the 6-12 inch depth.
- **If you also have forest duff:** Take each subsample from throughout the entire depth of the duff layer.

Residential development example:
For a one-acre decision unit in an area with >100 ppm arsenic and thick forest duff…

Take 20 samples from 0-6 inches
\+ 5 samples from 6-12 inches
\+ 1 forest duff composite sample
26 samples total

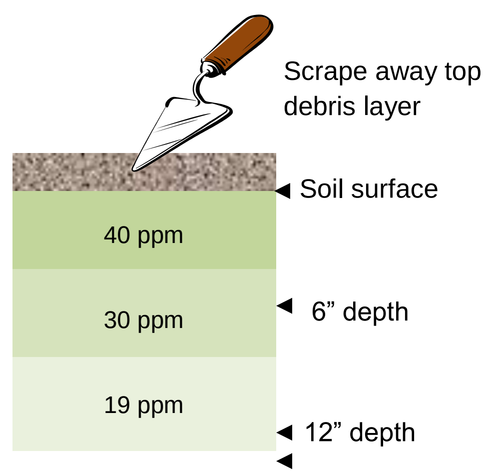


Figure 3. Example of a soil profile

Deeper soils

There may be areas where you know fill dirt, topsoil, or sod was added in the past. In every fourth sample location, also take a sample from the top 0-6 inches of the original land surface, if it is deeper than 12 inches.

Make sure you are taking enough samples

Thinking about a possible cleanup method now may help refine your sampling plan. More sampling will help to plan for excavation or mixing:

- **Excavation and removal:** You must show that the 0-6 inches under the final excavated surface meets state cleanup levels. Most projects excavate more than six inches, so at every fourth sampling location (25% of the samples), also sample from 6 -12 inches. This will help you ensure you are excavating deep enough.

- **Mixing in place with deeper soils:** Take samples from the depth you plan to mix to, at six inch intervals. At every fourth sample location, take a sample from the depth you plan to mix to. More samples than what is required for the 6-12 inch depth will give a better idea of whether the remedy will be effective.

Equipment needed:

- Stainless steel tools to dig holes and remove soil (trowel or small shovel).
- Stainless steel or glass bowl for mixing.
- Clean glass containers from the lab or zip-top plastic bags.
- Permanent marking pen to record sample locations on the jar or bag.
- Wash bucket, soap, scrub brush, and rinse water (distilled or deionized).
- Gloves and dust mask.
- Paper towels.
- Property diagrams with sampling grids.
- Map or aerial photo of decision unit.

Soil: Sampling steps

Take one sample from each depth range you need, at each sampling location marked on your decision unit diagrams. These should be collected as separate samples. Do not mix **soil** samples from different sampling locations or depth ranges.

1. Before taking any samples, contact an Ecology accredited lab (see “Help Desk”). The lab may have special instructions about labeling and delivering the samples.

2. Label each sampling location, in each decision unit, with a unique name or number. For better accuracy in recording your sample locations, use a Geographic Positioning System (GPS). Mark them on an aerial photo, if you can.

3. Using a permanent marker, label your glass jars or zip-top plastic bags with:
    - The unique identifier for the sampling location.
    - Your name.
    - The date the sample is being taken.
    - “Arsenic and lead”
4. Clear away grass, leaves, gravel or debris from the soil surface to ensure your sample is all soil. Dig a six-inch hole with the stainless steel trowel, shovel, or hand augur.
5. Using a clean trowel or spoon for each depth, scrape soil from the sides of the hole and put it in the mixing bowl. Avoid or discard pebbles, rocks, leaves, roots, and stems. Collect soil evenly from throughout the depth of the hole.
6. Mix soil thoroughly in the bowl. Fill up the jar or plastic bag with the mixed soil and seal it securely. Discard any extra back into the hole. Do not composite (mix) samples from different locations.
7. Between each sample, scrub the sampling tool and mixing bowl clean in the wash bucket, rinse, and pour the dirty water down a sanitary sewer or in a place where it can soak into the ground. Don’t pour it down the storm drain.
8. For 6-12 inch samples, dig another six inches deeper at the same location. This is a separate sample, so repeat steps 4-6, but only scrape the side of the hole where it is 6-12 inches deep.

Healthy Sampling Steps

Limit dust by dampening soil before sampling, or wear a dust mask.

Wear gloves. Wash hands, arms, and face after sampling.

Wash work clothing separately from other laundry.

Forest duff: Sampling steps

1. For each subsample, dig a hole through the whole duff layer and scrape duff all the way down the side of the hole. Use a clean trowel or spoon.
2. Wash the trowel or spoon between subsamples.
3. Mix all of the subsamples together in a stainless steel mixing bowl.
4. Take one sample from the bowl and place it in a jar or plastic bag. Make sure the jar or bag is labeled with the decision unit and type of sample (duff).
5. Follow the lab analysis guidelines.
6. Wash your bowl and sampling tools before taking another composite sample. Pour the dirty water down a sanitary sewer or in a place where it can soak into the ground. Don't pour it down the storm drain.

How deep should I sample the duff? It can be hard to tell where the duff ends and soil begins. Sample down to the point where the duff can be easily brushed away from the soil. If you have to scrape to get any deeper, you are likely in the soil.

Lab analysis

See the Help Desk section of this guidance for how to select a lab. The lab must use EPA methods 6010, 6020, or 6200 (for arsenic and lead). They may also use method 7060 for arsenic, or 7421 for lead.

Keep samples in a cool, dry place until they are analyzed. Bring the samples to the lab or follow its instructions for shipping. Include a copy of the sample inventory sheet (Form 2) and the custody form provided by the lab. Keep copies for yourself.

The lab report should include a list or separate pages of results for each sampling location. It should have results for quality control samples done at the lab. This is standard practice for all metals analysis. You will also see a chain of custody form—this is used to keep track of the samples. Keep everything you receive from the lab.

Soil: Understanding your characterization results

Use the sample results to plan your next steps. If arsenic or lead levels are "elevated" for any decision unit on the property, it needs cleanup. Elevated means:

- Average arsenic >20 parts per million (ppm) or average lead >250 ppm; **or**
- Maximum (any one sample) arsenic >40 ppm or maximum lead >500 ppm.

Use Form 2 to calculate average and maximum arsenic and lead for each decision unit, at each depth. Mark which decision units exceed state cleanup levels.

"Elevated" arsenic and lead levels

- Average* arsenic >20 parts per million (ppm)
- Max arsenic >40 ppm

- Average* lead >250 ppm
- Max lead >500 ppm

**Arithmetic average*

Forest duff: Understanding your results

If any of your composite samples are over 20 ppm arsenic or 250 ppm lead, the duff will pose a risk if reused or composted. You must dispose of the duff at an appropriate disposal facility. For information about waste disposal within the Tacoma Smelter Plume:

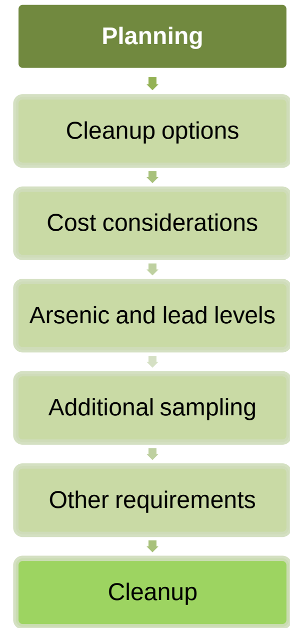
Tacoma-Pierce County Health Department
http://www.tpchd.org/environment/waste-management/

King County Landfills
http://your.kingcounty.gov/solidwaste/facilities/wasteclearance.asp

What to do next

If none of your decision units are "elevated," stop here. If one or more decision units are elevated, you must select one or more cleanup options from Chapter 2. Ecology also recommends:

- Doing cleanup as part of your development project.
- Taking healthy actions like hand-washing and taking shoes off at the door (see the Help Desk section).
- Notifying tenants or property users of healthy actions and why to use them.



Chapter Two: Planning for Cleanup

Cleanup options

Table 2 summarizes the four Tacoma Smelter Plume Model Remedies. Some cleanup options are only model remedies when arsenic and lead are at or below a certain level (Table 3).

Excavation and mixing are the two permanent remedies, whereas capping needs ongoing maintenance and property restrictions.

Cost: The location, accessibility, and features of the property can make certain options less expensive. Many cleanup activities can be incorporated into existing plans, which is more cost-effective.

Table 2. Model Remedy options

	Model Remedy	Action	Considerations
Permanent	**Excavate & Remove (Ch. 3)**	Excavate contaminated soils and properly dispose of them.	⇒ The top 6” of soil must have <20 ppm average arsenic and <250 ppm average lead after excavation. Take samples at depth to make sure you remove all contamination. ⇒ Performance monitoring required.
Permanent	**Mix (Ch. 4)**	Mix the top 6-12” of contaminated soils with imported soils or deeper, clean soil.	⇒ Not for soils >40 ppm average arsenic. ⇒ Performance monitoring required.
Non-Permanent	**Cap in Place (Ch. 5)**	Cover contaminated soils with a geotextile barrier and soil cap, or a hard cap.	⇒ Hard caps include asphalt or concrete. ⇒ Thicker soil cap required for higher levels. ⇒ Institutional controls required. ⇒ Performance monitoring required. ⇒ Confirmational monitoring required.
Non-Permanent	**Consolidate and Cap (Ch. 6)**	Excavate and consolidate contaminated soils into an area of the property and place under a cap (above).	⇒ Thicker cap required for higher levels. ⇒ Not for average arsenic >200 ppm or lead >1000 ppm ⇒ Performance monitoring required. ⇒ Confirmational monitoring required. ⇒ Institutional controls required.

Natural Areas
In 2013, Ecology hopes to have further guidance for natural areas. In some cases, there is more value in preserving a natural area, than in destroying habitat just to clean up the soil.

Currently, projects must do a separate disproportionate cost analysis to get Ecology approval to leave contamination in place. For more information, please call 360-407-6300 and ask for Ecology's Tacoma Smelter Plume Technical Assistance Coordinator.

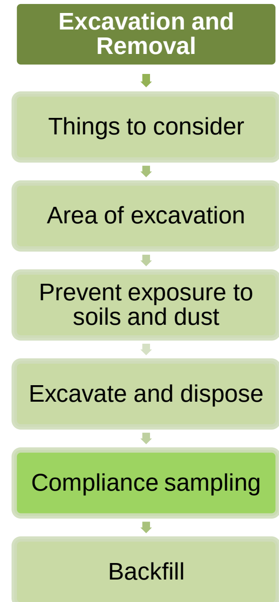
Table 3. Model remedies by arsenic and lead soil level

Characterization sampling results in parts per million (ppm)		Permanent		Non-Permanent	
Average	**Maximum**	**Excavate & remove**	**Mix**	**Cap in place**	**Consolidate and cap**
Arsenic 20-40 Lead 250-500		Yes	Yes	Yes	Yes
Arsenic 40-100 Lead 250-500	<200 <1000	Yes	No	Type 1 or 2*	Type 1 or 2*
Arsenic 100-200 Lead 500-1000		Yes	No	Type 2 cap only	Type 2 cap only
Arsenic >200 Lead >1000		Yes	No	Type 2 cap only	No

*Type 1 and 2 caps are described in Chapter 5.

Additional sampling
Excavation and removal and mixing require compliance sampling (Chapter 7) to show the cleanup is complete. When importing soils, Ecology recommends requesting sample results from the soil provider or doing imported soil sampling yourself (Chapter 9). Soil disposal may also require stockpile sampling.

Follow other government requirements for your project
This guidance only covers Model Toxics Control Act requirements. It does not cover other federal, state, and local rules and regulations that may apply to your project. For example, your local planning department will not allow you to destroy a wetland in order to clean up soil contamination.



Chapter Three: Excavation and Removal

Purpose: To permanently clean up any level of arsenic or lead contamination on your property by digging out soils, properly disposing of them at a landfill, and backfilling with clean soils.

Things to Consider

Arsenic and lead levels: Use excavation at any level of contamination.	
Pros: • Permanent. • Only permanent remedy for average arsenic >40 ppm, lead >500 ppm. • Works for all levels of arsenic or lead soil contamination.	**Cons:** • May require a waste disposal authorization for landfill disposal. • Can be expensive to transport and dispose of soils and import new soil. • Requires sampling for disposal and for importing new soils.
Costs: There are costs with removal, proper landfill disposal, and bringing in clean fill. However, there are no long term costs for maintenance and monitoring because the remedy is permanent. Estimate costs using the worksheet at the end of the chapter.	

Excavation and Disposal Process (see Form 3)

1. Determine your area of excavation. You should only excavate areas that you do not plan to clean up using other methods. Make sure that you have sufficiently narrowed down your decision units. You can use more sampling to eliminate areas that already meet state cleanup levels for arsenic and lead.

2. Prevent contaminated soils and dust from leaving the site. Control dust on the worksite during dry months by watering down the soil. If you are storing soil until it can be disposed of, make sure it is covered to prevent runoff. Install proper erosion control devices to prevent contaminated soil from leaving the project area.

You will need to apply for coverage under the construction stormwater general permit (http://www.ecy.wa.gov/programs/wq/stormwater/construction/) if your property is over one acre. There may be additional local stormwater control requirements.

If possible, trucks should avoid driving through contaminated soils. Trucks removing soil should be tightly covered, their wheels should be rinsed to prevent contaminated soil from leaving the worksite, and quarry spall should be used at entrance.

3. Plan to protect workers. The Washington Department of Labor and Industries regulates health and safety at worksites. For guidance on arsenic in soils, visit: http://www.lni.wa.gov/WISHA/Rules/arsenic/HTML/ht2Arsenic.htm.

4. Excavate and test soils before disposal. For any property or decision unit with arsenic or lead above state cleanup levels, all soil, sod, and duff must be disposed of at a permitted landfill.

Use stockpile sampling (Chapter 8) to determine your arsenic and lead levels. This information or a toxicity characteristic leaching procedure (TCLP) may be required for a Waste Disposal Authorization, or to dispose of soils in a private landfill. You may also be able to use characterization sampling results.

For information about waste disposal within the Tacoma Smelter Plume:

Tacoma-Pierce County Health Department
http://www.tpchd.org/environment/waste-management/

King County Landfills
http://your.kingcounty.gov/solidwaste/facilities/wasteclearance.asp

5. Take compliance samples after excavation is complete. Soils from 0-6" below the excavated surface should have average arsenic at or below 20 ppm and average lead at or below 250 ppm. If not, excavate further. Chapter 7 describes how to take compliance samples.

6. Backfill the excavated areas with clean soil, if needed. Before you purchase soil, check with the supplier to ensure it has below 20 ppm arsenic and below 250 ppm lead. Some questions to ask your supplier include:

- Where does this soil come from?
- Is it blended with compost or additives? If so, where do they come from?
- Has it been tested for chemical contamination?
- Will the soil support sod, vegetation, etc.?

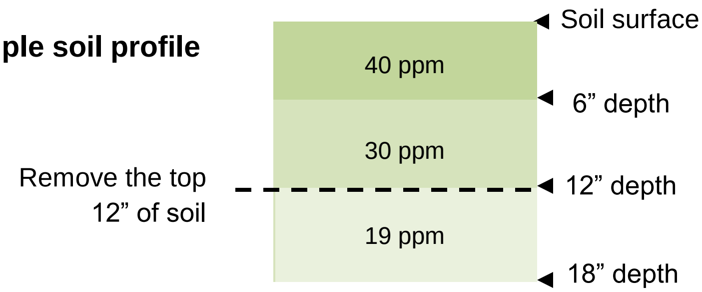
If you are unsure of whether these soils meet state cleanup levels, do imported soils sampling (Chapter 9) or ask the supplier to sample. If you are planning to use onsite soils to backfill, do stockpile sampling to make sure they won't re-contaminate the excavated area.

Worksheet: Planning for excavation and removal

1. Calculate soil removal depth by decision unit

Remove enough soils to reach soils meeting state cleanup levels below the contaminated surface soils (Figure 4).

Figure 4. Example soil profile for arsenic



2. Calculate the volume of soil to be removed in cubic yards (yds^3), by decision unit (DU).

DU1 area _____________ sq ft **x** removal depth ______ ft**/**27 **=** _________ yds^3

DU2 area _____________ sq ft **x** removal depth ______ ft**/**27 **=** _________ yds^3

DU3 area _____________ sq ft **x** removal depth ______ ft**/**27 **=** _________ yds^3

DU4 area _____________ sq ft **x** removal depth ______ ft**/**27 **=** _________ yds^3

3. Calculate soil transport cost by volume.

________ yds^3 (from step 1) x 1.5 tons/yds^3 x $_______ /ton = $_____________

4. Select a municipal or private permitted landfill and call for waste disposal authorization fee information.

Landfill name: ____

Phone: (____) ______________________ Fee: $_____________

5. Ask the permitted landfill or your local health department what type of sampling is required for soil disposal.

It may require stockpile sampling (Chapter 8) or toxicity characteristic leaching procedure (TCLP) testing. This test determines if soil is safe for landfill disposal. Ask your lab if they can do TCLP, which typically costs $75-100.

Sampling or TCLP: $ _______________

6. Calculate the soil disposal cost by volume.

__________tons of soil x $_________ /ton= $________________

7. Calculate the fill cost by volume.

Use the excavated soil volume from step 1 as your backfill volume. To ensure you are not re-contaminating the property, check the soil quality with your supplier. Ask if they have any data on metals in their soils. If not, ask if they can sample for you (see Chapter 9).

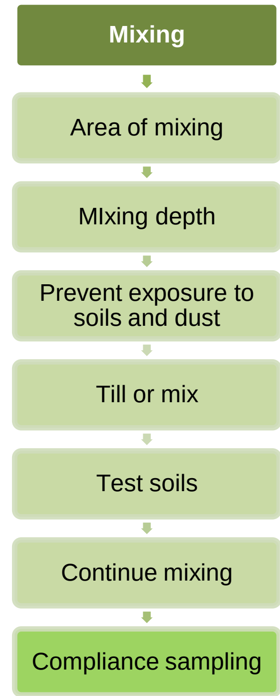
_______________ yds^3 fill x $__________ /cubic yd = $_________________

8. Other costs: Estimate the labor and equipment costs of soil removal and backfilling. Also think about the cost of compliance sampling (Chapter 7) and possible imported soil sampling (Chapter 9).

$______________________

9. Total the costs

3	Soil transport	$ ______________
4	Disposal fee	+ $ ______________
5	TCLP	+ $ ______________
6	Soil disposal	+ $ ______________
7	Backfill	+ $ ______________
8	Other costs	+ $ ______________
		= $ ______________



Chapter Four: Mixing

Purpose: To permanently clean up soils with average arsenic of 40 ppm or less (or average lead of 500 ppm or less) through dilution.

Mix contaminated soils with clean imported soils or clean soils underneath the contaminated surface soils. Soil can be mixed in place, or piled into rows, mixed, and spread back out. Mixing is only for areas with average arsenic below 40 ppm and average lead below 500 ppm. It is impractical to dilute higher levels of arsenic or lead. The effectiveness of mixing depends on how deep you mix, how deep contamination goes, and the efficiency of mixing equipment.

Things to Consider:

<table>
<tr><td colspan="2">Arsenic and lead levels: Use mixing <u>only</u> when <40 ppm arsenic and <500 ppm lead (average).</td></tr>
<tr><td>Pros:
• Permanent.
• Does not require excavation or off-site disposal.</td><td>Cons:
• Low remediation levels.
• Only practical for contamination not deeper than 12”.
• Higher sampling costs.
• Extra sampling may cause delays.</td></tr>
<tr><td colspan="2">Costs: Mixing can be labor-intensive. However, there are no long term costs because the remedy is permanent. You also do not have the cost of soil disposal. Estimate costs using the worksheet at the end of the chapter.</td></tr>
</table>

Characterization sampling helps to plan for mixing

Review your characterization sample results (Form 2) to make sure:

1. Average arsenic is below 40 ppm and average lead is below 500 ppm.
2. Contamination is not deeper than 12 inches.
3. Arsenic and lead levels in deeper soils (12-18” and 18-24”) have low enough arsenic and lead levels to dilute surface soils.

Use the worksheet in this chapter to calculate your mixing depth.

Mixing Process (see Form 4)
Ecology has tested mixing methods on large areas of arsenic and lead contaminated soils in central Washington. However, there is no detailed guidance on how to use mixing as a cleanup method. There is some guesswork in knowing how much to mix soils, but compliance sampling (Chapter 7) will show if the cleanup level is met.

1. Determine your mixing area. Only mix decision units with average arsenic at or below 40 ppm (or lead at or below 500 ppm).

2. Calculate your mixing depth. Use the worksheet at the end of this chapter to determine how deep to mix, or how much clean soil to import.

3. Prevent contaminated soils and dust from leaving the site. Control dust on the worksite during dry months by watering down the soil. If you are storing soil until it can be mixed, make sure it is covered to prevent runoff. Install erosion control devices to keep dirty water from leaving the site. You will need to apply for coverage under the construction stormwater general permit if your property is over one acre (http://www.ecy.wa.gov/programs/wq/stormwater/construction/). There may be additional local stormwater control requirements.

4. Plan to protect workers. The Washington Department of Labor and Industries regulates health and safety at worksites. For guidance on arsenic in soils, visit: http://www.lni.wa.gov/WISHA/Rules/arsenic/HTML/ht2Arsenic.htm.

5. Begin tilling or mixing. Using the calculated depth from the worksheet, add the appropriate depth of soil or mix to that depth. There are three ways to mix:

A. Till soils **in place** using several passes of the equipment, blending contaminated surface soils with cleaner, deeper soils. This may be difficult when rocks or roots are present in the soil.

B. **Import clean soils** and till them into contaminated soils (see Chapter 9).

C. Dig up contaminated surface soils and stockpile them. Either import clean soils or dig up cleaner, deeper soils. Next, mix these soils **on the land surface**. Use stockpile sampling (Chapter 8) to tell if soils are clean enough before spreading them back over the site.

6. Test your soils. Once an area is well mixed, take soil samples. Analyze each sample for arsenic and lead using an XRF device (see box) or send it to a lab. Lab analysis may take weeks, but samples can be rushed in

XRF

An X-ray fluorescence spectroscopy (XRF) device gives instant arsenic readings in the field.

Very few consultants have these devices, which require special training to use. They can be rented from companies that sell them. You will need to compare the rental cost to the cost of lab analysis.

about 24 hours.

7. Continue mixing. If arsenic or lead is still above state cleanup levels, continue mixing.

8. Take compliance samples after mixing is complete (Chapter 7). Take samples every six inches, from the soil surface, down to the deepest point you mixed (Figure 5). Send them to a lab.

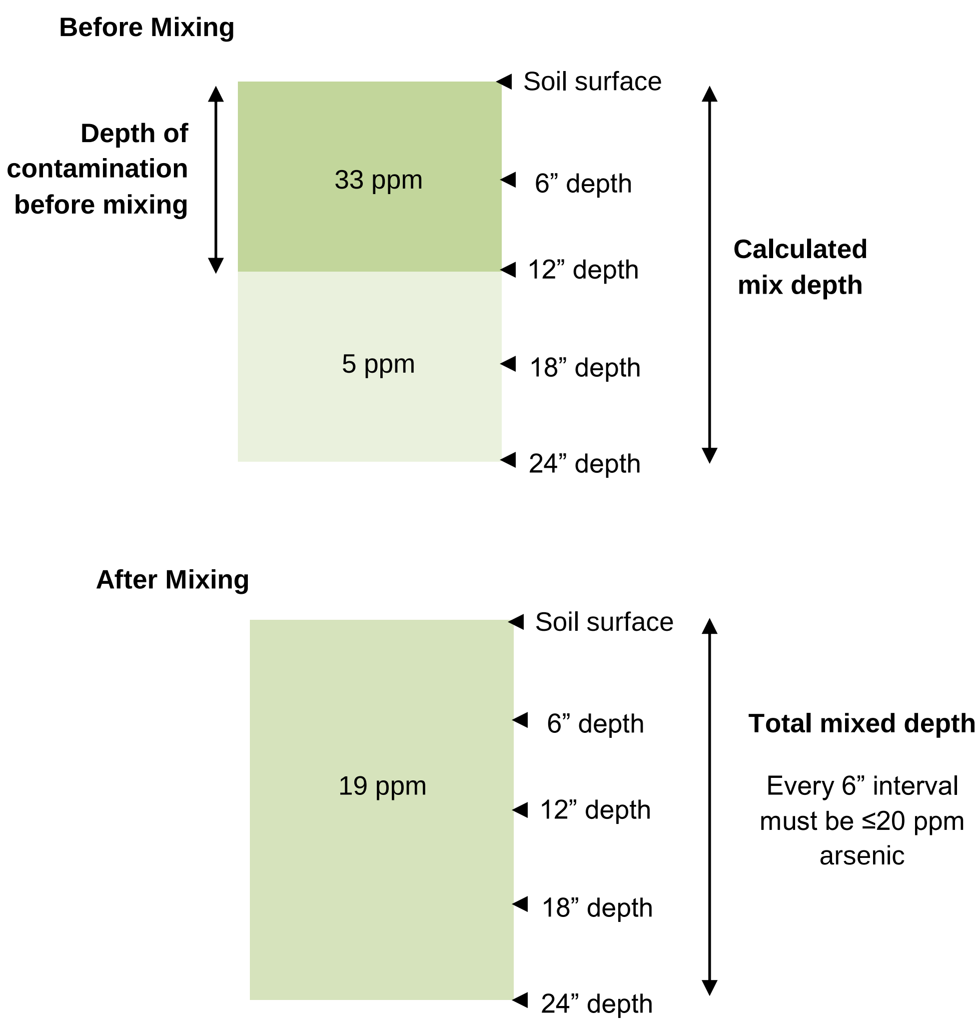


Figure 5. Soil profile before and after mixing

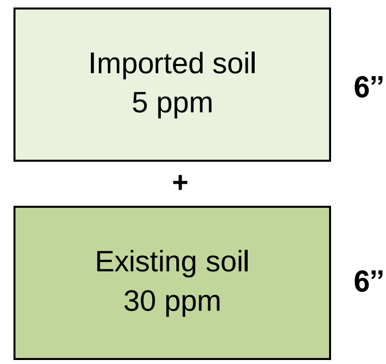
Worksheet: Planning for mixing

1. Mixing depth examples

For lead, use the same mixing depth calculations, with 250 ppm as the cleanup level.

A. Importing soil to mix in

This example assumes some level of background arsenic in local soils. Don't bring contaminated soils onto the property—ask the supplier for soil test results or stockpile sample imported soils. To calculate whether a certain depth of imported soils will dilute the contaminated soils:



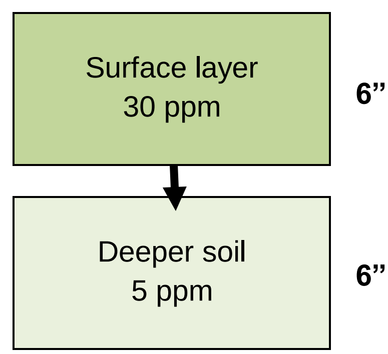
<u>Imported soil arsenic x depth + existing soil arsenic x depth</u>
Imported depth + existing depth

(5 ppm x 6” + 30 ppm x 6”)/(6”+6”) = 210 ppm”/12” = **17.5 ppm**

→ <u>17.5 ppm meets the cleanup level of 20 ppm for arsenic.</u>

B. Mixing with deeper soils (undisturbed areas)

Undisturbed soils tend to have contamination mainly in the top 6” of soil. To calculate how deep to mix:



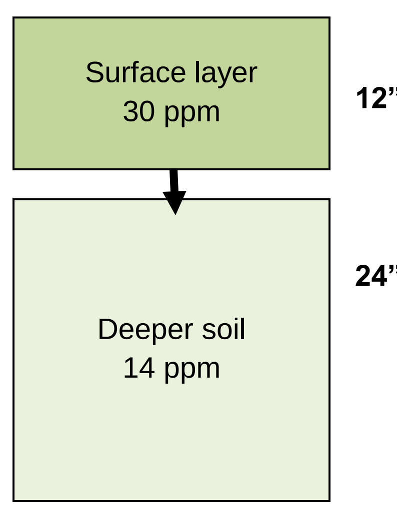
<u>Surface soil arsenic x depth + Deeper soil arsenic x depth</u>
Surface depth + deeper depth

(30 ppm x 6” + 5 ppm x 6”)/(6”+6”) = 210 ppm”/12” = **17.5 ppm**

→ <u>17.5 ppm meets the cleanup level of 20 ppm</u>.

C. Mixing with deeper soils (disturbed areas)

Areas that have been graded, sloped, or otherwise disturbed may have higher levels in deeper soils. Characterization samples may be needed at 12-18” or deeper. This example uses characterization samples down to 36”. To calculate how deep to mix:



<u>Surface soil arsenic x depth + Deeper soil arsenic x depth</u>
Surface depth + deeper depth

(30 ppm x 12” + 14 ppm x 24”)/(12”+24”) = 696 ppm”/36” = **19.3 ppm**

→ <u>19.3 ppm meets the cleanup level of 20 ppm</u>.

2. Imported soil volume

______ ft mix depth **x** ___________ ft^2 decision unit /27 = ____________ yd^3 soil

3. Imported soil cost

Fill cost by volume. Check the soil quality with your supplier (chapter 9).

_____________ cubic yds of soil x $_________ /cubic yd = $________________

4. Equipment

a. Describe soil type and mixing depth when asking about rental costs for mixing equipment.

$__________________

b. An X-ray fluorescence spectroscopy (XRF) gun provides instant arsenic and lead readings in the field. A few consultants may have these devices and the expertise to operate them. Otherwise, take samples to a lab.

$_________________

c. Labor—Mixing cannot be done with a single pass from a tiller. Go over each section several times to ensure contamination is diluted. This process can be labor intensive. Account for the time it will take to sample soils along the way.

$___________________

5. Total estimated costs

3	Imported soil	$ ______________
4a	Mixing equipment	+ $ ______________
4b	XRF or lab samples	+ $ ______________
4c	Labor	+ $ ______________
		= $ ______________

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Capping in Place
- Things to consider
- Area of capping
- Cap type
- Prevent exposure to soils and dust
- Build the cap
- File a covenant

Chapter Five: Capping in Place

Purpose: To cover contaminated soil where it lies with a soil cap or hard cap. The cap prevents exposure to contaminated soils on the property.

A hard cap is a building, parking lot, pavement, or driveway. A soil cap is a certain depth of clean soil over a geotextile. Part of the soil cap can be landscaping material. Select a cap type (Figure 6) based on the arsenic and lead levels.

Important: Ecology expects excavation and removal of contaminated soil during residential development, rather than capping yards. Excavation and removal is permanent to the maximum extent practicable.

Development presents a chance to remove all contaminated soil during grading. It is also a good time to do mixing if arsenic levels are below 40 ppm and lead is below 500 ppm. Mixing can be less expensive because it does not require landfill disposal.

Things to Consider:

<table>
<tr><td colspan="2">Arsenic and lead levels:
Use Type 1 caps only when average <100 ppm arsenic and <500 ppm lead or maximum <200 ppm arsenic and <1000 ppm for lead.

Use Type 2 caps at any level of contamination.</td></tr>
<tr><td>Pros:
• Can be integrated into existing development plans.
• Does not require off-site disposal.
• Certain cap types can be used for any arsenic or lead level.</td><td>Cons:
• Not permanent; potential for exposure if the cap is removed.
• Soil caps add 1-2 feet of elevation.
• Long-term monitoring and maintenance needed.
• Requires environmental covenant.</td></tr>
<tr><td colspan="2">Costs: The up-front costs of capping in place can be lower, especially if integrated into existing development plans. However, there are long-term monitoring and maintenance costs. Estimate costs using the worksheet at the end of the chapter.</td></tr>
</table>

Soil caps: Cap soils must meet state cleanup levels for arsenic and lead. Otherwise, you will re-contaminate the property. Do imported soils sampling (Chapter 9) or ask the supplier to sample. Ask where the soil came from, if it has additives, and if it will support vegetation.

Landscaping materials: Up to 6 inches of the Type 1 or Type 2 soil cap can be materials other than soil. This includes wood chips, bark, mulch, sand, and gravel. Keep in mind that these materials can wear away quickly if they are in a play area or high traffic area. Gravel is better for pathways and trails. The landowner must maintain the cap.

Geotextiles: A geotextile indicates that soil beneath it may still be contaminated, and that maintenance is needed when it becomes exposed. Use a bright color to warn future property users. The fabric also minimizes capped soils from being brought to the surface by animals. Check with your supplier to make sure the geotextile is not bio-degradable, and thick and durable enough to last underground.

Hard caps: Hard caps are most cost-effective when they are part of the original development plan, like a building or driveway.

Remember to follow proper engineering practices and local, state, and federal regulations when installing both soft and hard caps.

Capping Process (see Form 5)

1. **Determine the capping area.** Use more sampling to narrow down the area.

2. **Pick a cap type.** Many developments can use a combination of hard caps—buildings and paved areas—and soil caps for landscaped areas.

3. **Prevent contaminated soils and dust from leaving the site.** Control dust on the worksite during dry months by watering down the soil. Be sure install proper erosion control devices to prevent dirty contaminated water from leaving the project area. You will need to apply for coverage under the construction stormwater general permit if your property is over one acre. (http://www.ecy.wa.gov/programs/wq/stormwater/construction/) There may be additional local stormwater control requirements.

4. **Plan to protect workers.** The Washington Department of Labor and Industries regulates health and safety at worksites. For guidance on arsenic in soils, visit: http://www.lni.wa.gov/WISHA/Rules/arsenic/HTML/ht2Arsenic.htm.

5. **Build the cap.** Use enough materials to create the necessary cap depth (Figure 6). Make sure it covers the contaminated area.

6. **File an environmental covenant.** This is a legal mechanism that warns future property owners that contamination remains on the property. It also restricts uses that would damage the cap and sets an inspection schedule and cap maintenance instructions. See Chapter 10 for more information.

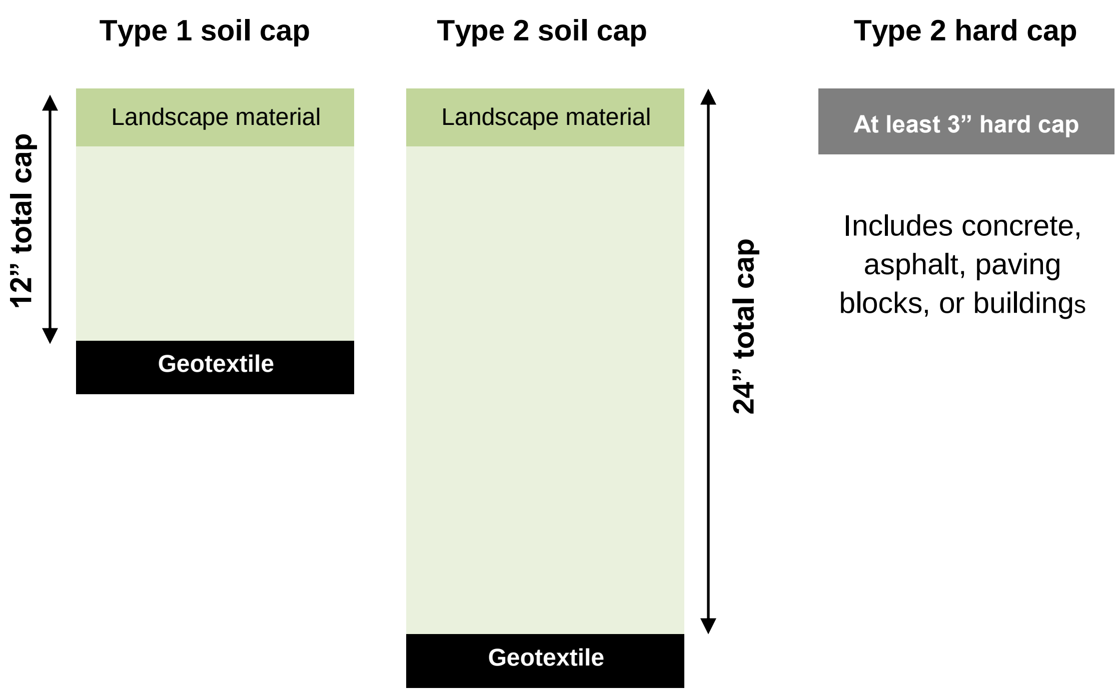

Figure 6. Cap types

Worksheet: Planning for capping in place

1. Hard cap - There should be no extra cost to your project if the building or pavement area was part of the original plan.

2. Soil cap - There should be little additional cost for areas where landscaping was part of the original development plan.

a. Calculate the volume of soil by decision unit (DU)

DU area ______________ft^2 **x** _____ft depth of cap **/** 27 = _____________ yd^3

b. Request a cost estimate for the new soil and delivery.

$ ______________/yd^3 **x** _______________yd^3 = $_________________

c. Calculate the cost of the geotextile

DU area _____________ ft^2 **/** 9 **x** $ _______/yd^2 material = $ _______________

d. Labor. Cost of Installing the cap $______________

3. Monitoring and maintenance

Inspect caps at least once every year. Factor in the cost of regular inspections and repairs. Maintenance may include replenishing soil or landscaping materials.

4. Total estimated costs

2b	Soil cap	$ _______________
2c	Geotextile	+ $ _______________
2d	Labor	+ $ _______________
3	Monitoring and maintenance	+ $ _______________
	=	$ _______________

- **Consolidation and Capping**
- Things to consider
- Area of capping
- Cap type
- Prevent exposure to soils and dust
- Excavate and dispose
- Compliance sampling
- Consolidate soils
- Build the cap
- File a covenant

Chapter Six: Consolidation and Capping

Purpose: To dig out contaminated soils, consolidate them in one place, and cover them with a soil cap or hard cap. The consolidation reduces the footprint of contamination on the property and the cap prevents exposure.

A hard cap is a building, parking lot, pavement, or driveway. A soil cap is a certain depth of clean soil over a geotextile. Part of the soil cap can be landscaping material. Figure 6 in Chapter 5 shows both cap types.

Important: Ecology expects excavation and removal of contaminated soil during residential development, rather than capping yards. Excavation and removal is permanent to the maximum extent practicable.

Development presents a chance to remove all contaminated soil during grading. It is also a good time to do mixing if arsenic levels are below 40 ppm and lead is below 500 ppm. Mixing can be less expensive because it does not require landfill disposal.

Things to consider:

Arsenic and lead levels: Use Type 1 caps only when average <100 ppm arsenic and <500 ppm lead. Use Type 2 caps only when average <200 ppm arsenic and <1000 ppm lead.	
Pros: • Can be integrated into existing development plans. • Does not require off-site disposal. • Confines contamination to a smaller footprint on the property. • Can be used for high arsenic and lead levels.	**Cons:** • Not permanent; potential for exposure if the cap is removed. • Soil caps add 1-2 feet of elevation. • Long-term monitoring and maintenance needed. • Requires environmental covenant. • Excavated soils may not be suitable as subgrade for paving or buildings.
Costs: The up-front costs of consolidation and capping can be lower, especially if integrated into existing development plans. There are long-term monitoring and maintenance costs. Estimate costs using the worksheet at the end of the chapter.	

Process for consolidation and capping (see Form 6)

1. **Determine the capping area.** Use additional sampling to narrow down the area that needs to be capped.

2. **Pick a cap type.** Many developments can use a combination of hard caps (buildings and paved areas) and soil caps (landscaped areas).

7. **Prevent contaminated soils and dust from leaving the site.** Control dust on the worksite during dry months by watering down the soil. Be sure install proper erosion control devices to prevent dirty contaminated water from leaving the project area.

   You will need to apply for coverage under the construction stormwater general permit if your property is over one acre (http://www.ecy.wa.gov/programs/wq/stormwater/construction/). There may be additional local stormwater control requirements.

3. **Plan to protect workers.** The Washington Department of Labor and Industries regulates health and safety at worksites. For guidance on arsenic in soils, visit: http://www.lni.wa.gov/WISHA/Rules/arsenic/HTML/ht2Arsenic.htm.

4. **Excavate contaminated soils from the entire decision unit.** Use the worksheet in this chapter to help determine your excavation depth.

5. **Take compliance samples after excavation is complete.** Soils from 0-6" below the excavated surface should have average arsenic at or below 20 ppm and average lead at or below 250 ppm. Chapter 7 describes how to take compliance samples.

6. **Consolidate the soils.** Carefully transport excavated soils to the area where they will be capped. These soils can contaminate other parts of the property if they escape during transport.

7. **Build the cap.** Use enough materials to create the needed cap depth (Figure 6 in Chapter 5). Make sure it covers the contaminated area. Sample any imported soils (Chapter 9) to make sure the cap material is not contaminated.

8. **File an environmental covenant.** This is a legal mechanism that warns future property owners that contamination remains on the property. It also restricts uses that would damage the cap and sets an inspection schedule and cap maintenance instructions. See Chapter 10 for more information.

Worksheet: Planning for consolidation and capping

1. Consolidation - Labor and equipment costs may vary depending on the volume of contaminated soil and how far it is being moved.

2. Hard cap - There should be no additional cost to your project if the building or pavement area was part of the original plan.

3. Soil cap - There should be little extra cost for areas where landscaping was part of the original development plan.

a. Calculate the volume of soil

Consolidated area __________ft^2 **x** ____ft depth of soil cap **/** 27 = ________ yd^3

b. Request a cost estimate for the soil

$ ______________/yd^3 **x** _______________yd^3 = $_________________

c. Calculate the cost of the geotextile

DU area _____________ ft^2 **/** 9 **x** $ ________/yd^2 material = $ _______________

d. Labor. Cost of Installing the cap $______________

4. Monitoring and maintenance

Inspect caps at least once every year. Factor in the cost of regular inspections and repairs. Maintenance may include replenishing soil or landscaping materials.

5. Total estimated costs

1	Consolidation	$ _______________
3b	Soil cap	+ $ _______________
3c	Geotextile	+ $ _______________
3d	Labor	+ $ _______________
4	Monitoring and maintenance	+ $ _______________
		= $ _______________

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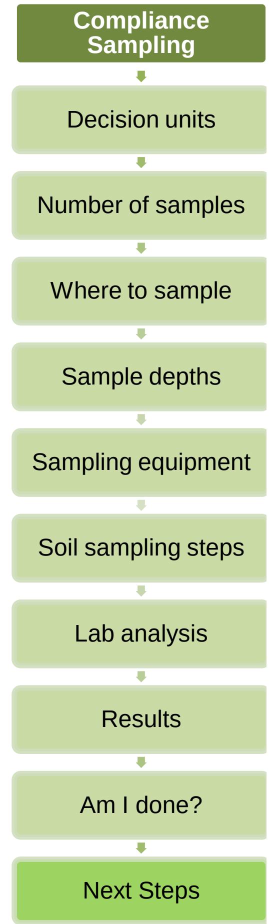


Chapter Seven: Compliance Sampling

Purpose: Sampling to determine if excavation or mixing worked. Samples must meet state cleanup levels for arsenic and lead.

When to do compliance sampling

- Excavation and removal – After excavation and before backfilling.
- Mixing – After mixing is complete.
- Consolidation and capping – After excavation and before backfilling.

Sampling area

Use Form 7 to record the sampling area, sample numbers, and locations. You may treat contiguous decision units with the same cleanup remedy all as one unit for compliance sampling (Figure 7).

However, you may want compliance sample results for different parts of the property. For example, if you plan to sell certain parcels, purchasers may wish to see compliance results for their specific parcel. In this case, determine the sampling area, and number and location of samples for each of the areas. Attach a separate diagram for each.

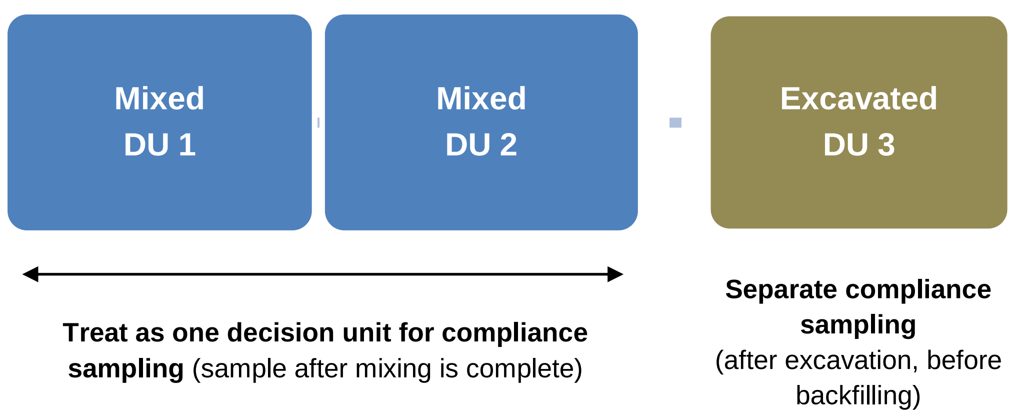


Figure 7. Combining decision units for compliance sampling

Table 4. Minimum number of compliance sample locations per decision unit

Sampling area size (acres)	Samples needed Mapped arsenic >100 ppm	Samples needed Mapped arsenic <100 ppm
0.25*	10	8
1	20	16
5	40	32
10	60	48
20	80	64
100	120	90
>100	120 + 1 per 5 acres	90 + 1 per 10 acres

*0.25 acres ~11,000 square feet

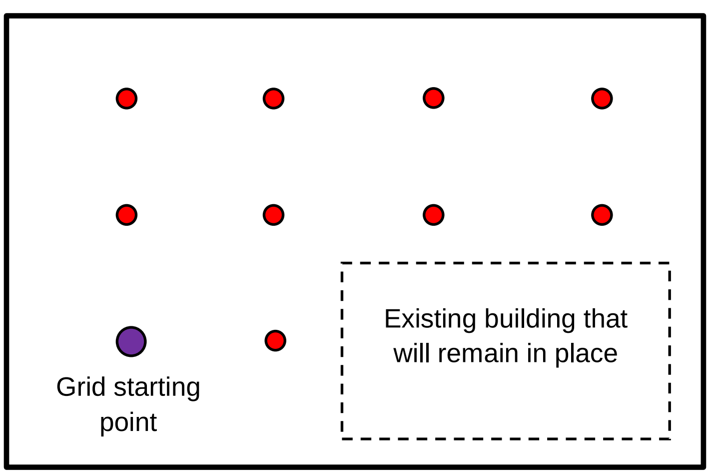
Number of Samples and Sampling Grid
Use Table 4 to find the number of sample locations. It depends on the acreage and if the property is in a map zone where arsenic is over 100 ppm (see inside cover).

Next, attach a diagram showing cleaned up areas of the property, and the location of buildings or paved areas, which are not included in compliance sampling. For each decision unit diagram, prepare a sampling grid (Figure 8):

Step 1: Enclose the entire decision unit inside a rectangle.

Step 2: Mark a location towards one corner of this rectangle as a starting point.

Step 3: Lay out sample locations in an evenly-spaced grid (Figure 8). Use the number of sample locations from Table 4. Grid points should cover as much of the decision unit area as possible.



Decision Unit Information

Use = Residential
Size < 0.25 acres (<11,000 ft^2)
Map area = arsenic >100 ppm

Samples needed = 10

Figure 8. How to lay out a sampling grid on a decision unit

Sample Depth

1. **Excavated soils:** Take compliance samples from the top six inches of the soil surface after an area has been excavated (but not filled back in). Do this for every sampling location.

2. **Mixed Soils:** For areas where soils have been mixed, at every sample location, take samples from the entire depth profile, at six inch intervals. For example, if you mixed to a depth of 24 inches, you need to sample four depths—0-6, 6-12, 12-18, and 18-24 inches below the finished surface at each sampling location.

Sampling process

Compliance sampling is similar to characterization sampling (Chapter 1). Begin by preparing the same type of equipment:

- Stainless steel tools to dig holes and remove soil (trowel or small shovel).
- Stainless steel or glass bowl for mixing.
- Clean glass containers from the lab or zip-top plastic bags.
- Permanent marking pen to record sample locations on the jar or bag.
- Wash bucket, soap, scrub brush, and rinse water (distilled or deionized).
- Gloves and dust mask.
- Paper towels.
- Property diagrams with sampling grids.
- Map or aerial photo of the decision unit.

As in Chapter 1, take samples from each location marked on the decision unit diagrams. These should be collected as separate samples. Do not composite (mix) samples from different locations.

1. Before taking any samples, contact Ecology accredited lab. To find out more information see the "Help Desk" section of this guidance. The lab may have special instructions about labeling and delivering the samples to their labs.

2. On your diagram, label each sampling location with a unique name or number.

3. With permanent marker, label the jars or zip-top bags with the sampling location identifier from the diagram. Mark your name, the date the sample is being taken, and "arsenic and lead".

4. Dig a six or twelve inch hole with the trowel or hand augur. Using a separate, clean trowel or spoon for each depth, scrape soil evenly from the sides of the hole and place it in the stainless steel mixing bowl.

5. Mix soil thoroughly in the bowl. Fill up the jar or plastic bag with the mixed soil and seal it securely. Discard any extra soil back into the hole.

6. Scrub the trowel or shovel clean in the wash bucket and pour the dirty water down a sanitary sewer or in a place where it can soak into the ground. Don't pour it down the storm drain.

7. List all of the soil samples in the sample inventory on Form 7.

See the Help Desk section for how to select a lab. The lab must use methods 6010, 6020, 6200, or 7060 for arsenic and methods 6010, 6020, 6200, or 7421 for lead. Keep samples in a cool, dry place until they are analyzed. Bring the samples into the lab in person or follow the lab's instructions for shipping. Be sure to include a copy of the sample inventory sheet and the lab custody form provided by the lab with the samples. Keep copies for yourself.

Understanding compliance results

Evaluate the compliance sample results to confirm that each decision unit meets state cleanup levels. If arsenic or lead levels are elevated (box to the right) for any decision unit, you will have to take further action to clean up the soils:

- **Excavate** at least six inches deeper and do compliance sampling again.
- **Mix** in more clean soil, or mix deeper.

"Elevated" arsenic and lead levels

- Average arsenic <20 parts per million (ppm)
- Max arsenic <40 ppm
- Average lead <250 ppm
- Max lead <500 ppm

When am I done?

Cleanup is complete when all excavated or mixed areas meet state cleanup levels for soil arsenic and lead. Make sure that you have a complete packet for Ecology, future property owners, and your own records. This packet should include:

- Characterization sampling lab report and chain of custody
- Forms 1 and 2 (characterization sampling)
- Form 7 (compliance sampling)
- Compliance sampling lab report and chain of custody
- One completed form for each cleanup method used, covering all decision units needing cleanup.
- Maps documenting characterization and compliance sample locations and cleanup work.
- For capping, consolidation and capping, or institutional controls, a copy of the environmental covenant filed at the County Auditor for the property.

Next Steps

Keep a copy of the forms you filled out to pass on to future property owners so they know that cleanup was done and how to maintain any non-permanent remedies. Future property owners may want this level of detail for when they eventually sell their property. As awareness about the Tacoma Smelter Plume grows, more buyers will be asking about soil contamination.

Stockpile Sampling
When to use it
Number of composites
Number of subsamples
Stockpile segments
Soil sampling steps
Lab analysis
Results

Chapter Eight: Stockpile Sampling

Purpose: To determine if a stockpile of soil meets state cleanup levels for arsenic and lead.

When to do stockpile sampling

- When sampling soils after excavation and before transporting offsite. It may be required for a Waste Disposal Authorization (see note below right).
- Ensure soils mixed in stockpiles are clean enough to reuse onsite or dispose of.

Stockpile sampling is different than characterization sampling. You will be taking your samples from a pile of soil that you excavated and plan to dispose of or reuse onsite as clean. The samples are called "composite" samples, meaning you are taking many subsamples and mixing them together for analysis. Use Form 8 to track your sampling.

Planning for Sampling

Prepare the same type of equipment used in Chapter 2.

- Stainless steel tools for digging sampling holes and removing soil.
- Stainless steel mixing bowl and spoon for compositing.
- Clean glass containers from the analytical lab or Ziploc ™ plastic bags.
- Permanent marking pen to record sample locations on the jar or bag.
- Wash bucket, soap, scrub brush, and rinse water (distilled or deionized).
- Gloves and dust mask.

> **Note on disposing soils:**
> Check with the local health department's waste management staff about specific guidance for sampling and interpreting results.
>
> They may be able to use results from characterization samples instead of re-sampling stockpiles.

Number of samples: Take composite samples from each stockpile. Table 5 shows how many samples are needed for a certain size stockpile. The number also depends on arsenic levels. Each composite should contain six subsamples that get mixed together into a single sample (Figure 9).

Table 5. Number of composite samples per stockpile

Stockpile volume (cubic yds)	# of composites (DU arsenic >100 ppm)	# of composites (DU arsenic <100 ppm)
<500	2	2
500-999	4	4
1,000 – 4,999	8	6
5,000 – 9,999	14	10
10,000 – 19,999	20	14
≥20,000	20 + 1 per 4,000 cubic yds	14 + 1 per 5,000 cubic yds

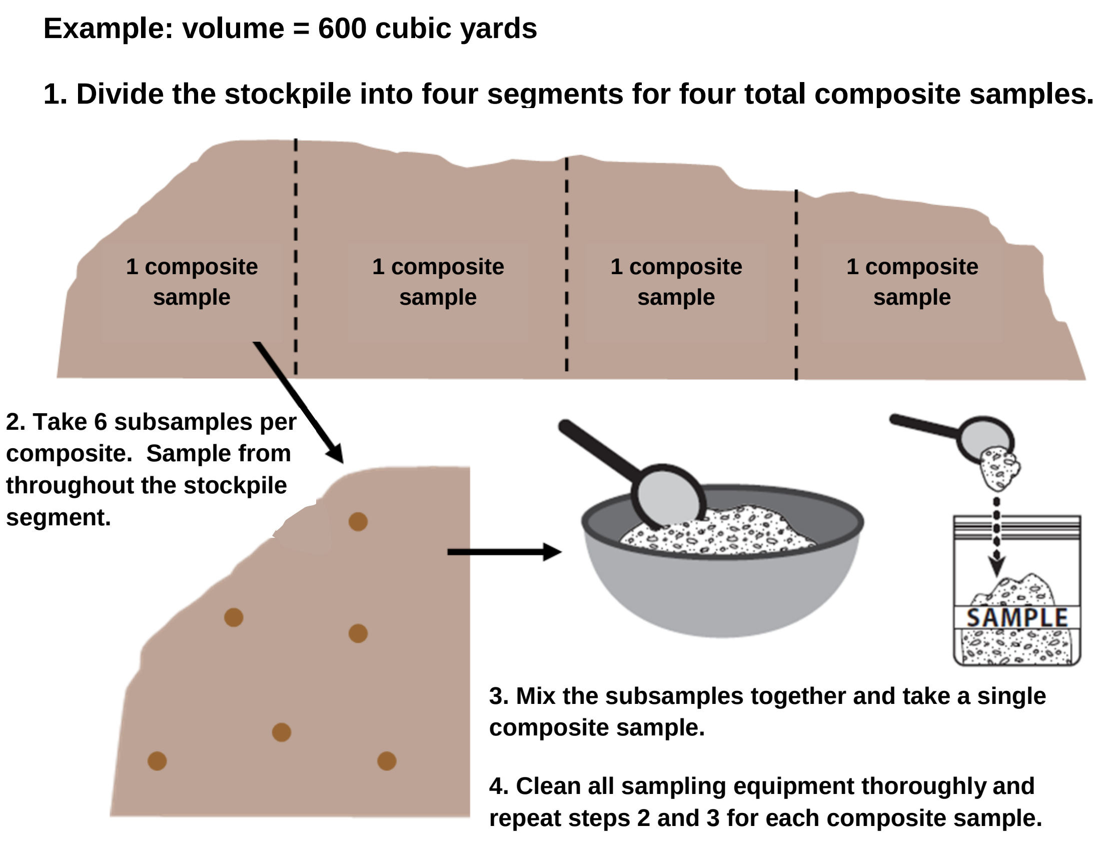


Figure 9. Stockpile sampling process

Sampling Process

1. Before taking any samples, contact an Ecology accredited lab. To find out more information see the "Help Desk" section of this guidance. The lab may have special instructions about labeling and delivering the samples to their labs.

2. Check the number of composites needed and divide your stockpile into that many sections. Plan to take one composite per segment, so they are well distributed throughout the stockpile (Figure 9).

3. Using the permanent marker, label the glass jars or Ziploc™ bags with:
    - The stockpile identifier.
    - Composite number (you will take multiple composites per stockpile).
    - Your name.
    - The date the sample is being taken.
    - "Arsenic and lead"

For each composite sample, for each stockpile segment:

4. Divide your six subsamples evenly among surface samples, mid-depth samples, and deep samples. Make sure these samples are taken from several different parts of the pile. Clean the trowel in the wash bucket and change the dirty water between samples.

5. Place all subsamples for a single composite into the stainless steel bowl. All subsamples should be the same size. Mix thoroughly with the stainless steel spoon. Scoop a jarful or bagful as your composite sample.

6. Repeat the sampling process until all composites are taken.

7. Between individual composite samples, scrub the bowl and spoon clean in the wash bucket, rinse, and pour the dirty water down a sanitary sewer or in a place where it can soak into the ground. Make sure to not pour dirty water down the storm drain.

8. List all of the composite soil samples in the sample inventory on Form 8.

Keep samples in a cool, dry place until they are analyzed. Bring the samples into the lab in person or follow the lab's instructions for shipping. Be sure to include a copy of the sample inventory sheet and the lab custody form provided by the lab with the samples. Keep copies for yourself.

Understanding your results

If any composite result is over 20 ppm for arsenic or 250 ppm for lead, that segment must be properly disposed of. If reused on the property, the soil will need to be capped to meet model remedies requirements. If arsenic is at or below 40 ppm, contaminated stockpiles may be mixed with clean soils and retested to ensure that arsenic is at or below 20 ppm.

Disposal: If you plan to dispose of these soils, check with your local health department's solid waste division about their requirements. A waste disposal authorization form may be needed.

Tacoma-Pierce County Health Department
http://www.tpchd.org/environment/waste-management/

King County Landfills
http://your.kingcounty.gov/solidwaste/facilities/wasteclearance.asp

Reusing soils on site as "clean" soils: If none of your stockpiles exceeds state standards, you may reuse the soils in other locations on the property.

Transporting stockpiled soils offsite for use on another property is not a model remedy and not advised, even if sampling shows they meet state cleanup levels.

Chapter Nine: Imported Soils Sampling

Purpose: To determine if imported soil meets state cleanup levels for arsenic and lead.

When to do imported soils sampling

- When backfilling an excavation.
- When mixing with existing soils to dilute contamination.
- When creating a soil cap.
- Bringing imported fill for construction projects, gardening, or landscaping projects.

Before you purchase soil, check with the supplier to ensure it has below 20 ppm arsenic and below 250 ppm lead. Some questions to ask your supplier include:

- Where does this soil come from?
- Is it blended with compost or additives? If so, where do they come from?
- Has it been tested for chemical contamination?
- Will the soil support sod, vegetation, etc.?

If you are unsure of whether these soils meet state cleanup levels, do imported soils sampling or ask the supplier to sample.

The samples are called “composite” samples, meaning you are taking many subsamples and mixing them together for analysis. Use Form 10 to track your sampling.

Number of composite samples: Take three composite samples from each stockpile of the imported soil source. Each composite should have three subsamples.

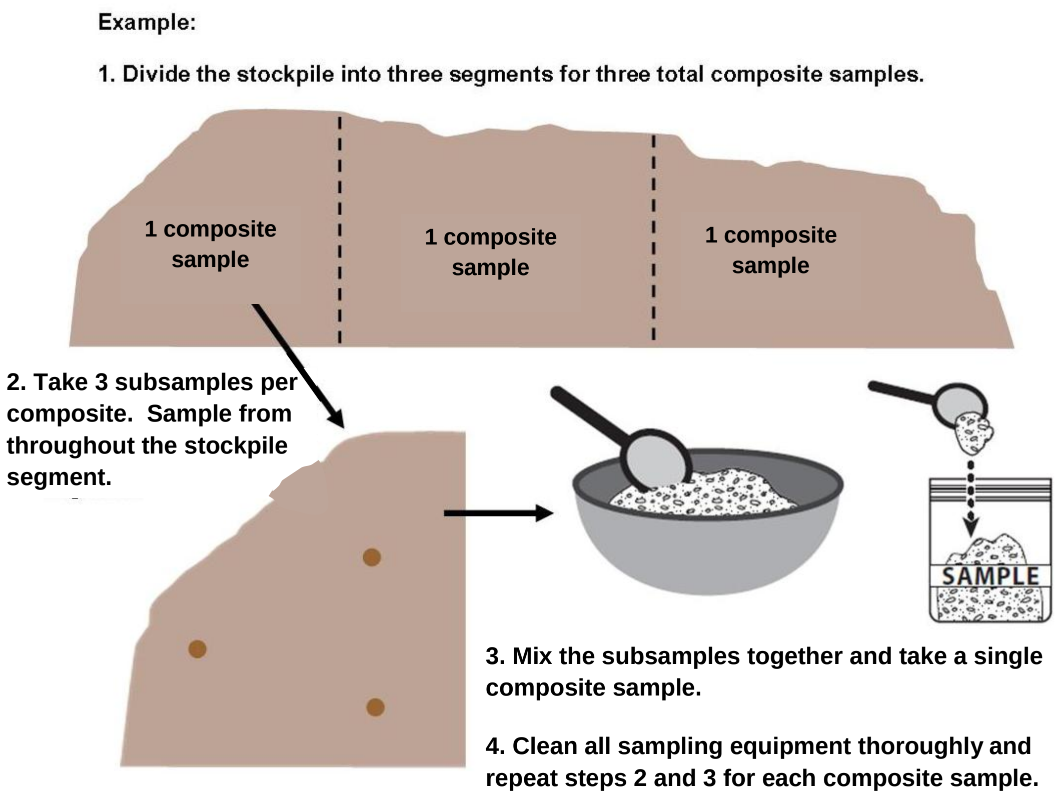


Figure 10. Imported soil sampling process (similar to stockpile sampling)

Sampling Process

Use the same sampling process as in Chapter 8.

Understanding your results

On the inventory sheet, fill in each sample result. If any of the composite samples are over 20 ppm arsenic or 250 ppm lead, the soil should not be used on the property.

Chapter Ten: Environmental Covenants and Institutional Controls

Purpose of institutional controls: To restrict access to areas with remaining contamination, to protect the remedy and protect human health.

Purpose of environmental covenants: To inform future property owners of contamination left on the property and how to maintain the remedy.

Institutional controls include:

- **Site access restrictions**, which prevent or discourage people from coming into a contaminated area. Common access restrictions are fencing, warning signs, or a combination of both.
- **Land use restrictions**, which are legal measures such as environmental covenants. They warn future land owners of contamination. They also prevent activities or land uses that could make the cleanup less effective, such as removing or digging through a cap.

  Environmental covenants or clauses in sales contracts can ensure ongoing monitoring and maintenance even when land ownership changes.

Land use restrictions can discourage direct contact, but unlike site access restrictions, they do not provide a physical barrier to contact.

When to file an environmental covenant
Capping in place and consolidation and capping model remedies both require environmental covenants.

Environmental covenants are recorded with the county and remain with the land until all contamination is cleaned up. They warn future property owners that contamination remains, and explain how to maintain the cap or access restrictions such as fencing, educational materials.

What to include in an environmental covenant

Prepare the environmental covenant using Ecology's template, found at the bottom of: http://www.ecy.wa.gov/programs/tcp/vcp/vcp2008/vcpRequirements.html.

At a minimum, it should include:

- Location of remaining contamination, including maps.
- Nature of remaining contamination, including sampling results.
- How and when lessees, users, and future property owners will be notified.
- Cap locations and dimensions.
- Cap depth and materials used.
- Inspection schedule and cap maintenance.

Options for restricting access to capped areas

Access restrictions can help limit wear and tear on a cap through physical barriers or education. Physical barriers are fencing or plantings that discourage foot traffic or use of the area. If the development will have residents or regular users, they should receive educational materials about the remaining contamination. Posting signs can also help protect a capped area.

For more about educational materials, visit: http://www.ecy.wa.gov/programs/tcp/sites_brochure/tacoma_smelter/ts_hp.htm.

Help Desk

Selecting an analytical lab
Ecology maintains a list of labs accredited by the state to do soil analysis (http://www.ecy.wa.gov/apps/eap/acclabs/labquery.asp). The lab must use methods 6010, 6020, 6200, or 7060 for arsenic and methods 6010, 6020, 6200, or 7421 for lead. The above website lists what methods each lab uses.

Labs can also be found in the Yellow Pages under “Laboratories-Analytical”. You do not have to use a local lab, since many labs can work with you through the mail. Most labs should be able to provide results within three to four weeks. Costs vary.

When you talk to the lab, find out the following information:

- Can they screen the soil sample to 2 millimeters?
- Can they report the results on a dry weight basis?
- Will they provide a quality review of the data and a summary of the quality control results?
- How long will it take to get results?
- How much it will cost? (Typically $30-60 per sample.)

Hiring and working with a consultant
Ecology has a guide for finding and hiring a consultant:
http://www.ecy.wa.gov/biblio/ftcp92116.html

You may want to start the search by asking other companies in your industry, environmental professional organizations, and banks for recommendations. Follow up with your own research. Environmental consultants are also listed in the Yellow Pages. Ask questions and get at least three different proposals and cost estimates.

Questions you may want to ask include:

- What is your firm’s experience with soil sampling and related cleanup work? Request a list of completed projects and references.
- What work might be subcontracted? Request the names of their

subcontractors and check their experience.
- What is your firm's experience with regulatory requirements?
- Which staff members will be assigned to my project? Ask for resumes, roles, and project manager.
- Is your field staff trained in safety procedures required by the Washington Industrial Safety and Health Act (WISHA)?
- Do your firm and subcontractors have environmental liability insurance?
- How will you plan to be cost-effective?

Ask each firm to prepare a proposal for the sampling work. The proposal should include a detailed approach and cost estimate by specific task. It may be difficult to provide specific estimates for future work because it will depend on the characterization sampling results.

Special situations: rights of way, utility trenches, swales, small construction
For all projects, check if federal, state, or local land use permits are needed.

Rights of Way – Some developments may include roadways that will eventually be owned and maintained by local government, a homeowner association, etc. If contaminated soils are consolidated under a roadway cap, the future owner must sign the covenant.

Utility Trenches - Utility trenches are excavations. Typically, contamination will not extend any deeper than the trench bottom. For deeper contamination, Ecology recommends further excavation and backfilling with clean soils to bring the trench to the correct depth. <u>Do not use contaminated soils to fill in the trench once utility lines are placed.</u> It will pose a risk to anyone working on the utility line in the future.

Storm Water Swales - Areas planned for storm water swales should have a permanent cleanup remedy—excavation or mixing. Contamination left in the swale could be carried into groundwater or run off.

Small Structure Construction (cell towers, pump stations, sheds) - It may not be practical to go through the full sampling and cleanup process when building small structures with minor soil disturbance. For example, a portion of a completely paved area is opened up to place a concrete pad or shed. At a minimum:

- Properly dispose of any soils coming from the property—stockpile sampling (Chapter 8) will be needed for a Waste Disposal Authorization.
- Follow Department of Labor & Industries worker safety regulations.
- Ensure that the final construction covers any bare soil.

Other Situations - For situations not covered by this guidance, call 360-407-6300 and ask for Ecology's Tacoma Smelter Plume Technical Assistance Coordinator.

Healthy actions to reduce exposure to contaminated soils
Anyone living in the Tacoma Smelter Plume, or working or playing in soils should follow a few simple actions:

- Wash hands after working or playing outside, and before eating.
- Take off shoes at the door or use a doormat.
- Damp dust, damp mop, and vacuum with a HEPA filter regularly.
- Wear gloves when working in soil.
- Wash fruits and vegetables well.
- Keep pets clean.

For a full list of healthy actions, visit:www.ecy.wa.gov/toxics/tacoma-smelter.html

Form 1 Characterization Sampling

Reminder: Keep a copy of the filled out forms to pass on to future property owners.

Part 1: Determine Your Decision Units

1. Total property size: _________ acres

2. In an area of arsenic >100 ppm (see map on inside cover): yes no

3. Check all that apply and identify decision units in any of these cases:

- ☐ Property is larger than 0.25 acres.
- ☐ Property currently or historically had a mix of forested and developed land.
- ☐ More than one type of land use is planned for the development.
- ☐ Parts of the property will be play areas, gardens, or other high use areas.
- ☐ Property has different geographic features, such as hills or slopes.
- ☐ Areas have forest duff that needs separate sampling.

4. On the next page, list the decision units on your property and their size in Table 1. Use Table 2 to determine the number of samples needed for each decision unit.

Part 2: Sample Depth

5. Fill in Table 1 on the following page with the sample depths.

- **At every location:** Take samples from the top 0-6 inches of soil, after clearing away grass, leaves, gravel, or debris on the surface (Figure 3).
- **At every fourth location (25% of the samples):** Also take a sample from the 6-12 inch depth.
- **Areas where fill dirt or topsoil was added in the past:** At every fourth location, take a sample from the top 0-6 inches of the original land surface, if it is deeper than 12 inches.
- **If using mixing as a remedy:** At every fourth sample location, take a sample from the depth you plan to mix to.
- **For forest duff:** Take six subsamples throughout the decision unit and combine into one sample.

Part 3: Overlay a sampling grid for each decision unit

6. Attach a diagram showing property dimensions and locations of decision units.

7. Attach a separate diagram for each decision unit, including dimensions, existing structures, and which structures will remain after development.

Table 1. Characterization sampling plan

Decision unit description (past use, planned use)	**Acres/ft^2**	**# of samples**	**Sample depth/duff layer**
1.			
2.			
3.			
4.			

Table 2. Number of sample locations per decision unit by planned use and estimated arsenic level.

Sampling area	**Residential, parks, commercial** (# samples needed)		**Forest and open land** (# samples needed)	
Acres	**Arsenic >100 ppm**	**Arsenic <100 ppm**	**Arsenic >100 ppm**	**Arsenic 20-100 ppm**
0.25*	10	8	8	8
1	20	16	16	12
5	40	32	30	24
10	60	48	40	32
20	80	64	50	40
100	120	90	70	60
>100	120 +1 per 5 acres	90 + 1 per 5 acres	70 + 1 per 5 acres	60 + 1 per 5 acres

*0.25 acres ~11,000 square feet

Form 2 Characterization Sampling Results

Reminder: Keep a copy of the filled out forms to pass on to future property owners.

Filling in the sample inventory

List the samples by decision unit in the inventory on the back of this page. Enter the depth of each sample. When sampling multiple depths at a single location, mark each depth as a separate sample number.

Optional: If you have duff, remember to sample and analyze that separately from the soil.

Next, fill in the date and time. Note any unusual observations (high soil disturbance, heavy rain, etc.) in the "Comments" column.

Complete the rest of the columns when you get the sampling results.

Determining if arsenic or lead is elevated

1. Calculate average arsenic and lead levels for each decision unit and enter them on the inventory sheet. For each decision unit where average arsenic exceeds 20 ppm, or average lead exceeds 250 ppm, circle the average.*
2. Circle every value where maximum arsenic exceeds 40 ppm and where maximum lead exceeds 500 ppm.
3. Attach a copy of your lab results and chain of custody.
4. For decision unit with a circled value (maximum or average), note in the "Comment" column that cleanup is needed for that entire decision unit. Turn to Chapter 2 to review options for cleaning up those decision units.

   If no decision units have elevated arsenic or lead, no cleanup is necessary. Because no cleanup is being done, you do not need to take any compliance samples. The characterization samples demonstrate that your soils meet state standards. Treat these results as "compliance" sampling results and read Chapter 7 for next steps.

* Milligrams per kilogram is equivalent to ppm.

Characterization Sampling Inventory Sheet

Property address: Phone: Sampled by:						Testing Parameters (ppm)			
DU	Sample no.	Soil Depth /Duff	Date	Time	Notes	Arsenic	Avg. arsenic	Lead	Avg lead

Form 3 Excavation and Removal

Reminder: Keep a copy of the filled out forms to pass on to future property owners.

1. Decision units being excavated **Depth**

Decision units being excavated	Depth
____	__________
____	__________
____	__________

2. Prevent soils from escaping the site and plan for worker safety

- ☐ Water source for dust control.
- ☐ Install erosion control devices.
- ☐ Cover trucks carrying contaminated soil.
- ☐ Rinsing area for truck wheels and quarry spall at the entrance.
- ☐ Follow Department of Labor & Industries worker safety regulations.

3. Soil disposal

Name of landfill facility: ____

Contact name and phone: ____

- ☐ Attached a copy of the Waste Disposal Authorization form

4. Source of new soils:

- ☐ Off-site soils - Supplier: ______________________________________

  Supplier phone: ______________________________
- ☐ On-site soils

5. Stockpile sampling or imported soil sampling:

- ☐ Completed stockpile sampling for onsite soils and filled out Form 8.
- ☐ Completed imported soil sampling and filled out Form 9 or soils certified to be clean by the supplier.

6. Compliance Sampling:

- ☐ Filled out Form 7.
- ☐ Attached a map showing areas excavated and the depth of excavation.

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☐

Form 4 Mixing

Reminder: Keep a copy of the filled out forms to pass on to future property owners.

Decision unit	Area	Mixing depth

2. Prevent soils from escaping the site and plan for worker safety

- ☐ Have dust and erosion practices installed.
- ☐ Follow Department of Labor & Industries worker safety regulations.

3. Equipment used

Type of mixing equipment: ____

- ☐ XRF device
- ☐ Lab testing

4. Mixing method (check all that apply)

- ☐ Mixing in place
- ☐ Mixing with imported soils
- ☐ Mixing on land surface and reusing

5. Stockpile sampling

Use stockpile sampling before spreading or disposal

- ☐ Filled out Form 8

6. Compliance Sampling:

- ☐ Filled out Form 7 - required for all mixed soils left on the property

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Form 5 Capping in Place

Reminder: Keep a copy of the filled out forms to pass on to future property owners.

Decision unit	Type of cap	Cap depth	Geotextile used?

2. **Prevent soils from escaping the site and plan for worker safety**
   - ☐ Have dust and erosion practices installed.
   - ☐ Follow Department of Labor & Industries worker safety regulations.

3. **Source of soils:** ____

   Phone: ________________________

4. **Environmental Covenant**

   ☐ Filed a deed notice with: __________________________________ County

   Recording number: ___________________________________

5. **Attachments**

   - ☐ Attached a map showing areas capped and any additional details about the cap a future property owner would need to know.
   - ☐ Attached a maintenance and monitoring plan.
   - ☐ Attached a copy of the environmental covenant.

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Form 6 Consolidation and Capping

Reminder: Keep a copy of the filled out forms to pass on to future property owners.

1. Excavation and consolidation

Decision unit	Excavation depth

- ☐ Did compliance sampling after excavation and filled out Form 7.

2. Prevent soils from escaping the site and plan for worker safety

- ☐ Have dust and erosion practices installed.
- ☐ Follow Department of Labor & Industries worker safety regulations.

3. Cap description (type and depth)

- ☐ Geotextile barrier used
- ☐ Attached a map showing both excavated and consolidated capped areas. Include details about the cap a future property owner would need to know.

4. Source of soils: ____

Phone: _______________________

5. Environmental Covenant

- ☐ Filed a deed notice with: _________________________________ County

  Recording number: __________________________________

6. Attachments

- ☐ Attached a map showing areas capped and any additional details about the cap a future property owner would need to know.
- ☐ Attached a maintenance and monitoring plan.
- ☐ Attached a copy of the environmental covenant.

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Form 7 Compliance Sampling

Reminder: Keep a copy of the filled out forms to pass on to future property owners.

1. Total acreage for each area excavated: ____________________acres

or mixed: ____________________acres

Include only areas where soil is accessible for sampling (not paved or built over).

2. Calculate the number of samples needed using the Table 1: __________

Table 1: Compliance samples by acre

Sampling area	**Samples needed**	
Acres	**Arsenic >100 ppm**	**Arsenic <100 ppm**
0.25*	10	8
1	20	16
5	40	32
10	60	48
20	80	64
100	120	90
>100	120 +1 per 5 acres	90 + 1 per 5 acres

* 0.25 acres ~ 11,000 square feet

3. Sample depth

Excavated areas = 0-6"

Mixed areas = total mixing depth profile: ______________

samples per sampling location : ___________ (one per 12" depth)

4. Attachments

☐ Attached a property diagram with compliance sampling grid overlaid (see Chapter 7). Show which areas were cleaned up and the locations of paved or built areas.

Filling in the sample inventory

List the samples by decision unit in the inventory on the next page. Enter the depth of each sample. When sampling multiple depths at a single location, mark each depth as a separate sample number.

Next, fill in the date and time. Note any unusual observations (high soil disturbance, heavy rain, etc.) in the “Comments” column.

Complete the rest of the columns when you get the sampling results.

Determining if arsenic or lead is elevated

1. Calculate average arsenic and lead levels for the area sampled and enter them on the inventory sheet. For each decision unit where average arsenic exceeds 20 ppm, or average lead exceeds 250 ppm, circle the average.*
2. Circle every value where maximum arsenic exceeds 40 ppm and where maximum lead exceeds 500 ppm.
3. Attach a copy of the lab results and chain of custody.
4. For each sampled area with a circled value (maximum or average), note in the “Comment” column that more cleanup is needed for that area. Return to Chapter 2 to review options for cleaning up those decision units.

If no decision units have elevated arsenic or lead, read Chapter 7 for next steps.

Compliance Sampling Inventory Sheet

Property address:

Phone:

Sampled by:

						Testing Parameters (ppm)			
DU	Sample no.	Depth	Date	Time	Notes	Arsenic	Avg. arsenic	Lead	Avg lead

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Form 8 Stockpile Sampling

Reminder: Keep a copy of the filled out forms to pass on to future property owners.

Each composite should contain six subsamples mixed together. In Table 1, fill in the number of composite samples needed for each stockpile, based on its size (Table 2).

Table 1. Planning for stockpile sampling

Stockpile identifier	Stockpile volume	# of subsamples	# of composites
		6	
		6	
		6	
		6	

Table 2. Composites per stockpile

Stockpile volume (cubic yards)	# of composites (arsenic >100 ppm)*	# of composites (arsenic <100 ppm)*
<500	2	2
500-999	4	4
1,000-4,999	8	6
5,000-9,999	14	10
10,000-19,999	20	14
>20,000	+1 per 4,000 cubic yards	+1 per 5,000 cubic yards

*When removing soils from a property, refer to the map on the inside cover to find the estimated arsenic levels for the area the property is in.

Filling in the sample inventory

List the composite samples by stockpile in the inventory on the next page. Next, fill in the date and time. Note any unusual observations in the "Comments" column. Complete the rest of the columns when you get the sampling results.

Determining if arsenic or lead is elevated

1. Mark each composite over 20 ppm arsenic or 250 ppm lead. These segments cannot be reused on the property. See Chapter 8 for next steps.

2. Attach a copy of the lab results and chain of custody.

Stockpile Sampling Inventory Sheet

Property address: Phone: Sampled by:					Testing Parameters (ppm)	
Stockpile no.	Composite Sample no.	Date	Time	Notes	Arsenic	Lead

Form 9 Imported Soils Sampling

Reminder: Keep a copy of the filled out forms to pass on to future property owners.

Shorter projects: For projects less than six months long, collect one set of data from the imported soil source. This should include three composites, with six subsamples in each composite.

Longer projects: If the project goes for longer than six months, collect a new set of three composites, with six subsamples in each composite, every six months.

New soil source: If the source soil changes, then collect a new set of three composites, with six subsamples in each composite.

1. Once you have the results from your three composite samples, enter the arsenic and lead levels into the table below.

2. Attach a copy of the lab results and chain of custody.

Do not import soils from the supplier if any composite sample is over 20 ppm arsenic or 250 ppm lead.

Soil supplier name: Phone: Sampled by:				Testing Parameters (ppm)	
Sample no.	Date	Time	Notes	Arsenic	Lead
1					
2					
3					
1					
2					
3					

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Sampling and Cleanup Checklist

CHARACTERIZATION SAMPLING

Form 1: Planning for Sampling with sampling grid maps

- ☐ Appropriate number of samples per decision unit (0-6” depth)
- ☐ 25% of samples from 6-12”

Form 2: Sample Inventory and Whether Soils Are Elevated

- ☐ Maximum arsenic <40 ppm <u>and</u> average arsenic <20 ppm (stop here)
- ☐ Maximum arsenic >40 ppm <u>or</u> average arsenic >20 ppm (continue below)

CLEANUP & COMPLIANCE SAMPLING

1. Excavation and Removal
   - ☐ **Form 3** with cleanup map
   - ☐ **Form 7** with sampling grid map
   - ☐ **Form 8** stockpile sampling (if applicable)
   - ☐ **Form 9** imported soils (if applicable)

> Compliance sample depth should be at least 6”.

2. Mixing
   - ☐ **Form 4** with cleanup map
   - ☐ Compliance sampling grid map

> Take compliance samples every 6” throughout the mixing depth.

3. Capping in Place
   - ☐ **Form 5**
   - ☐ Environmental covenant*

4. Consolidation and Capping
   - ☐ **Form 6**
   - ☐ Environmental covenant*

> To be protective, cap depth should meet the guidelines in Chapter 5 or 6. Ensure future owners know to maintain the remedy by providing them with the sample results and cleanup information.

**The environmental covenant should describe remaining contamination and how to inspect and maintain the remedy.*

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Know what's below.
Call before you dig.

DEPARTMENT OF
ECOLOGY
State of Washington

Southwest Regional Office
P.O. Box 47775
Olympia, WA 98504-7775
Reception: (360) 407-6300

Appendix C
Tacoma Smelter Plume Model Remedies Feasibility Study

REPORT

FEASIBILITY STUDY FOR THE TACOMA SMELTER PLUME

Submitted To: Tacoma-Pierce County Health Department
3629 South D Street, MS 301
Tacoma, WA 98418-6813
and
Washington State Department of Ecology
300 Desmond Dr
Lacey, WA 98503

Submitted By: Golder Associates Inc.
18300 NE Union Hill Road, Suite 200
Redmond, WA 98052 USA

April 6, 2011 **Project No. 103-93117.300**

A world of capabilities delivered locally

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LIST OF ACRONYMS

ARARs	applicable or relevant and appropriate requirements
BMPs	best management practices
COCs	Contaminants of Concern
DCA	Disproportionate Cost Analysis
Ecology	Washington State Department of Ecology
EISC	Ecological Indicator Soil Concentrations
FS	Feasibility Study
Golder	Golder Associates Inc.
IAP	Interim Action Plan
MTCA	Model Toxics Control Act
MCL	maximum contaminant level
NEBA	Net Environmental Benefits Analysis
NFA	No Further Action
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PHSKC	Public Health Seattle & King County
PPM	Parts Per Million
PSAPCA	Puget Sound Air Pollution Control Agency
RAOs	Remedial Action Objectives
RI	Remedial Investigation
RCW	Revised Code of Washington
ROD	Record of Decision
SAB	Science Advisory Group
SEPA	State Environmental Policy Act
TCLP	Toxicity Characteristic Leaching Procedure
TEE	Terrestrial Ecological Evaluation
TPCHD	Tacoma-Pierce County Health Department
TSP	Tacoma Smelter Plume
USEPA	U.S. Environmental Protection Agency
VCP	Voluntary Cleanup Program
WAC	Washington Administrative Code
WLRD	Water and Land Resources Division (King County Department of Natural Resources and Parks)

1.0 INTRODUCTION

Golder Associates Inc. (Golder) has prepared this feasibility study (FS) for the Tacoma Smelter Plume on behalf of the Tacoma-Pierce County Health Department (TPCHD) and the Washington State Department of Ecology (Ecology). Air pollution from the former Asarco smelter in north Tacoma settled on surface soils over 1,000 square miles of the Puget Sound basin. This area is known as the Tacoma Smelter Plume (TSP). The TSP (Figure 1-1) includes portions of King, Pierce, Kitsap, and Thurston counties. Plume contamination consists of arsenic and lead in soils.

1.1 Background

Ecology has prepared a draft Interim Action Plan (IAP) to manage and address arsenic and lead soil contamination from aerial deposition from the TSP (Ecology 2010a). The TSP is a vast area of contamination that calls for a unique approach to managing cleanup. In developing the draft IAP, Ecology took a non-traditional approach by not conducting a typical remedial investigation (RI) and FS. Instead, Ecology and several local health departments conducted a series of studies to provide enough information to address immediate human health risks. These early actions alerted the public to the potential contamination and offered protective measures, especially for young children. Other non-traditional approaches included emphasizing voluntary action, outreach, and education. Ecology also developed the Soil Safety Program to address soil contamination at schools and child cares, described in Chapter 3 of the IAP (Ecology 2010a). The draft IAP describes four alternatives for the general interim action approach:

- Alternative A – No action
- Alternative B – Phased Prioritized Action
- Alternative C – Address all properties
- Alternative D – Limited Action

Ecology selected Alternative B (Phased Prioritized Action) as the preferred alternative because it provided the best protection to the most vulnerable populations, especially children, with the resources currently available.

Ecology will use model remedies, which provide a streamlined approach for addressing contamination within the TSP, to implement Alternative B and support voluntary action. The aerial deposition of arsenic and lead from the former smelter is similar across the TSP. Therefore the approach for remedial actions at each property is similar. Each property cleanup should follow the procedures in the model remedies for characterization sampling, remedy selection, cleanup, and confirmation sampling. The TSP Model Remedies Guidance provides best management practices for protecting workers, surface water, and air quality. Model remedy users do not need to conduct a feasibility study because Ecology evaluates remedial alternatives in this document.

1.2 Purpose and Objectives

Ecology is managing the TSP under the IAP, and intends to use the TSP Model Remedies to:

- Clean up residential properties in the most contaminated areas of the plume.
- Encourage property owners to clean up during development.
- Provide a streamlined approach for Voluntary Cleanup Program cleanups of TSP contamination.

The purpose of this FS is to evaluate a range of alternatives to remediate soils with TSP arsenic and lead exceeding cleanup levels. Ecology will develop these alternatives into a range of model remedies for future cleanup actions. As discussed later, some model remedies are applicable only to specific ranges of soil arsenic and lead concentrations, while others are applicable to all concentrations.

Model remedies are allowed under Washington Administrative Code (WAC): 173-340-390 for common categories of facilities, types of contamination, types of media, and geographic areas. The TSP Model Remedies can be used without an additional FS or disproportionate cost analysis usually required under WAC 173-340-350(8) and WAC 173-340360(3), respectively. However, these TSP Model Remedies apply only to TSP contamination. This FS does not cover other types of releases of hazardous substances, or arsenic and lead from a source other than the Tacoma Smelter. Property owners can use Ecology's Facility Site Atlas to determine whether they are within the plume boundary.

Map link at: http://www.ecy.wa.gov/programs/tcp/sites/tacoma_smelter/ts_hp.htm

1.3 Definition of Tacoma Smelter Plume and Relationship to the Asarco Tacoma Smelter Site

The TSP is part of the overall Asarco Tacoma Smelter Site, which also includes four operable units (OUs) within the Commencement Bay Nearshore/Tideflats Superfund Site—Asarco Tacoma Smelter (OU 02), Asarco Off-Property (OU 04), Asarco Sediments (OU 06), and Asarco Demolition (OU 07). The U.S. Environmental Protection Agency (USEPA) is managing the cleanup of the four operable units, while Ecology is overseeing the TSP.

1.4 Report Organization

This FS report is organized as follows:

- Section 1 Introduction – this section.
- Section 2 Site Characterization – provides a summary of the site location and description, history, physical setting, previous investigations, nature and extent of contamination, and the human health and ecological risk evaluation.
- Section 3 Remedial Action Objections – discusses remedial action objectives, including cleanup levels, and other applicable or relevant and appropriate requirements (ARARs) that must be met through the cleanup actions.
- Section 4 Identification and Screening of Remediation Technologies – gives the full range of potential remediation technologies and screens those retained for developing alternatives based on cost, effectiveness, or implementability.
- Section 5 Description of Remediation Alternatives – provides a description of the remediation alternatives that will be evaluated in Section 6.
- Section 6 Evaluation of Remediation Alternatives – provides an evaluation of the alternatives for meeting the criteria established in WAC 173-340-350 through 360.

2.0 SITE CHARACTERIZATION

2.1 Site Location and Description

Ecology estimates that the TSP covers more than 1,000 square miles of the most populated portions of the Puget Sound basin (Figure 2-1). Over two million people live within the plume area.

Figure 2-1 shows the area with the highest probability of exceeding 100 ppm arsenic. This section describes the studies Ecology has used to characterize the TSP.

Figure 2-1: Tacoma Smelter Plume

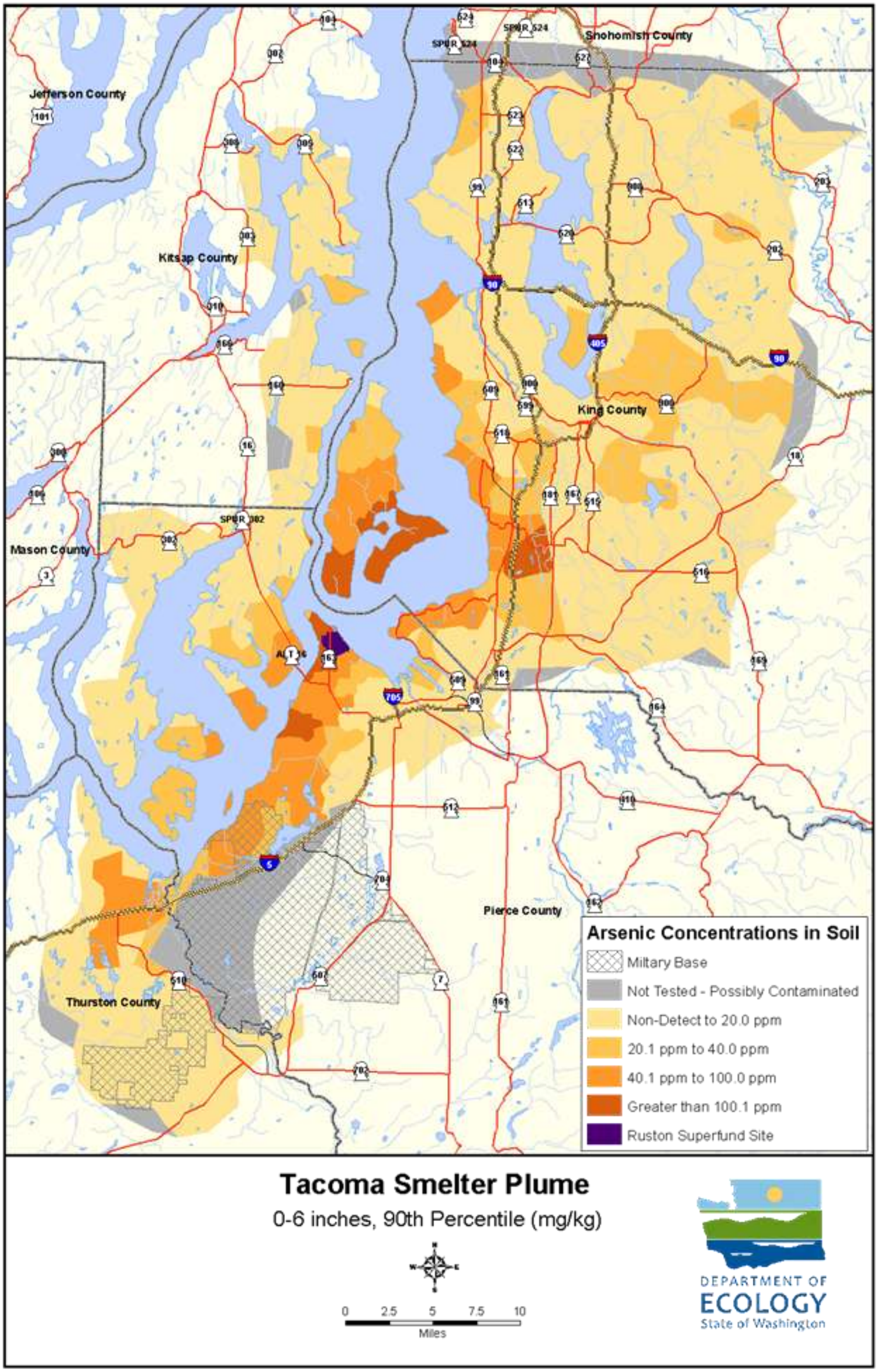
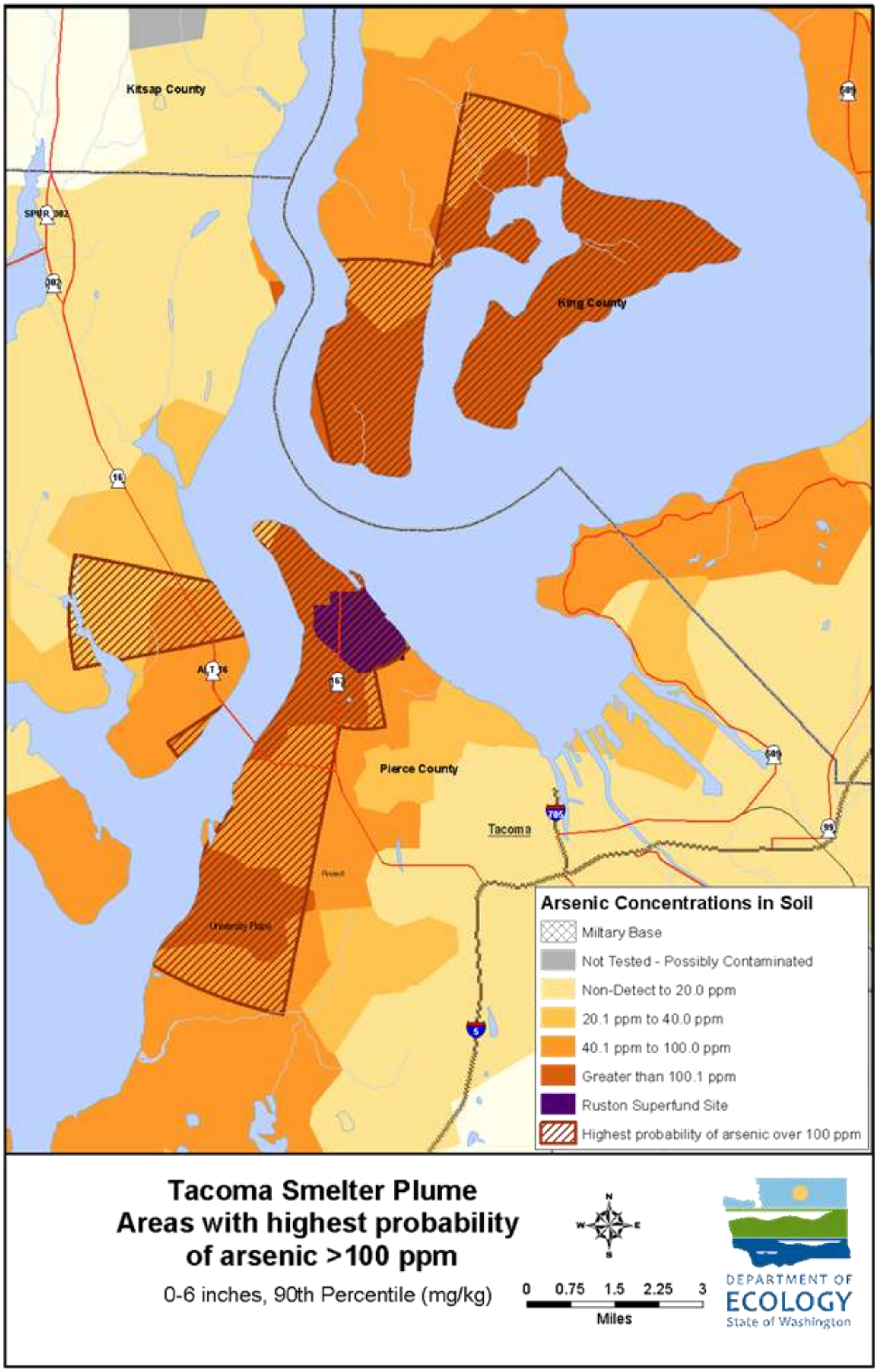


Figure 2-2: Tacoma Smelter Plume – Areas with Highest Probability of Arsenic >100 ppm



2.2 Site History and Setting

The Asarco smelter in Ruston began operations in 1890 as a lead smelter. Asarco purchased the smelter in 1905 and converted it to a copper smelter. After the 1912 closure of the Asarco Everett Smelter, arsenic recovery facilities were added to the Tacoma smelter.

The Tacoma smelter specialized in processing ores with high arsenic concentrations. It recovered arsenic trioxide and metallic arsenic as by-products of copper production. In recovering copper from ores and concentrates, the smelting process also produced slag. Slag is a hard, glassy material containing elevated concentrations of arsenic, lead, and other metals. Copper smelting operations ceased in 1985, and the arsenic production plant closed in 1986.

As part of the smelting process, emissions were released through a smokestack. Asarco replaced the original smokestack in 1917. At that time, the company claimed that the new smokestack was the largest in the world at 571 feet. The stack was imploded on-site in 1993.

The Asarco smelter was the main industrial facility in the area. It was located in the town of Ruston, within the city of Tacoma, Washington, approximately four miles northwest of downtown Tacoma (Figures 2-1 and 2-2). The smelter was situated on a peninsula extending into Commencement Bay. The peninsula includes the wooded Point Defiance Park and Zoo to the northwest of the smelter. Residential properties in Ruston are located immediately adjacent to the former smelter facility.

Ecology has identified estimated high and moderate concentration categories within the TSP (Table 2-1). These categories help to prioritize interim actions and identify the appropriate model remedy for a property.

Table 2-1: Map Contamination Level Categories (Averages)

Category	Arsenic Levels (ppm)	Map Color
High	>100	Dark Orange hatching
Moderate	20 to 100	Orange to dark orange

The high contamination area includes the southern tip of Kitsap peninsula (south of Gig Harbor to the west across the Narrows of Puget Sound), Fox Island, the northern and western portion of the city of Tacoma, University Place, and the southern portion of Vashon-Maury Island (to the north across Dalco Passage).

The moderate contamination area covers around 1,000 square miles and reaches areas more than 30 miles from the former smelter in Ruston. This region includes portions of King, Kitsap, Pierce, Snohomish, and Thurston Counties, including the greater Seattle metropolitan area. The approximate distribution of developed and undeveloped parcels estimated to be within high and moderate areas are shown in Table 2-2.

Table 2-2: Estimated Parcels by Land Use and Arsenic Level Category

	High	Moderate
Developed	12,000	624,270
Undeveloped	2,400	94,190
TOTAL PARCELS	14,400	718,460

Ecology used arsenic concentration data to estimate which areas of the plume were likely to have individual variation across properties

2.3 Summary of Investigations

In 1983, the USEPA listed the area around the Ruston Smelter on the National Priority List. In 1988, Ecology developed a Field Investigation Report for the site that was designed to characterize soil contamination patterns over an area expected to have about 100 ppm arsenic, which was identified as the Ruston/North Tacoma Study Area (Black & Veatch 1988). The USEPA focused their RI/FS in 1992 on this area, and in 1993 issued their Record of Decision (ROD) for the area (USEPA 1992 and 1993). The Ruston/North Tacoma Study Area is approximately 950 acres and comprises an arc with a radius of around one mile, surrounding the former smelter.

The USEPA ROD applies to those properties or areas located within the Ruston/North Tacoma Study Area, as well as three areas located directly to the south of the Study Area. The ROD acknowledges that there may be properties beyond the Study Area with soils exceeding the ROD action levels, and may require cleanup. The ROD states that EPA will evaluate the need for further sampling and appropriate cleanup outside of the Study Area separately from the current ROD action, and at a later date. In 2000, EPA and Ecology agreed that Ecology would be the lead agency for studying impacts beyond the Ruston Study Area.

As the cleanup began in the Ruston/North Tacoma Study Area, there was further interest in defining the broader impacts of the smelter on the region. Between 1999 and 2001, Ecology and the local health departments in King and Pierce counties began studying the extent of soil contamination from deposition of Tacoma smelter air emissions. These studies had large data sets and spatial coverage, and were phased in a series of investigations. In both counties, initial "footprint" sampling was followed by targeted sampling of child-use areas where young children’s exposures were of greatest concern. The studies included extensive sampling in undisturbed forest soils (PHSKC and Glass 2000; Glass 2002; Glass 2004) and at child use areas such as schools, parks, and childcare centers (PHSKC and Glass 2001; SAIC 2003; TPCHD 2004).

The primary contaminants of interest were arsenic and lead, but the investigations analyzed samples for other trace elements such as antimony, indium, bismuth, cadmium, and mercury. The trace element analyses supported the source evaluation (Glass 2003a and 2003b).

In 2003, Ecology expanded the footprint studies to include Kitsap and Thurston counties. Additional sampling was conducted in all four counties. A final Extended Footprint Study (PGG, 2005) filled data gaps and characterized the overall spatial distribution of arsenic and lead across the plume area.

Ecology conducted a study to evaluate the toxicity to plants and wildlife of arsenic and lead in the soils of the TSP footprint during the summer of 2010 (Ecology 2011). A summary of the study is provided in Section 2.5.2.2. Results have been used to aid in developing ecological soil cleanup levels as presented in Section 3.2.3.

2.4 Nature and Extent of Contamination

2.4.1 Soil

The footprint studies were designed to determine the upper bound of arsenic and lead soil contamination by sampling the least disturbed soils (for example, forests). Mapping the results portrays the highest levels likely to be found. Since the Model Toxics Control Act (MTCA) Method A cleanup level for arsenic (20 ppm) is considerably lower than for lead (250 ppm), arsenic tends to drive cleanup decisions. Therefore, the spatial extent of the TSP is defined by soil arsenic concentrations.

The TSP Boundary Map (Figure 2-1) shows the overall plume boundary and is based on footprint study results only. Ecology's Facility Site Atlas version of this map on Ecology's web site can be used to view more detail:

(http://apps.ecy.wa.gov/website/facsite/viewer.htm?sp_area=Tacoma%20Smelter%20Plume)

Contamination generally follows wind patterns and properties closer to the smelter tend to have higher contamination. Contamination is highly variable within small areas. Topography affects contamination; hilltops or ridges can be more contaminated. Undisturbed areas such as forests tend to have higher concentrations, and the contamination is typically found in the top six inches of soils. In disturbed areas, concentrations are generally lower, but contamination can be found deeper.

2.4.2 Groundwater

There has been no documented groundwater contamination associated with the TSP. King County Department of Natural Resources and Parks, Water and Land Resources Division (WLRD) has been monitoring groundwater for a variety of environmental indicators including arsenic at several locations on Vashon-Maury Island since 2001 (WLRD 2010) as part of a water resources study to better understand the water balance and overall water quality on the island. Some of the highest concentrations of arsenic have been detected in soils on Vashon-Maury Island. Concentrations of arsenic in groundwater have been low with no significant change throughout the period of monitoring. During 2009 WLRD sampling, arsenic groundwater concentrations throughout the Vashon-Maury Island study area ranged from 0.42 µg/L to 18.7 µg/L. Water samples from three of the wells exceeded the drinking water maximum contaminant limit (MCL) for arsenic of 10 µg/L (WLRD 2010). Samples exceeding the MCL were from deep wells and likely the result of naturally occurring arsenic and not as a result of impacts from the TSP.

2.4.3 Air

The original source of TSP soil contamination was deposition from airborne releases from the Tacoma smelter. Historical impacts from smelter releases to air were documented in numerous studies conducted by the Puget Sound Air Pollution Control Agency (PSAPCA) and others. These studies are summarized in the *Credible Evidence Report: The ASARCO Tacoma Smelter and Regional Soil Contamination in Puget Sound* (Glass 2003a). The historic releases were eliminated when the smelter ceased operations in 1986. Air borne contamination is not a current source. There are limited data on arsenic and lead associated with fugitive dust within the TSP. However, USEPA has collected air monitoring data during construction and remediation activities in the Tacoma Smelter/Ruston area that could generate fugitive dust containing these metals.

http://yosemite.epa.gov/r10/cleanup.nsf/9f3c21896330b4898825687b007a0f33/c73c106fd187e1b6882569150064ad86?opendocument#Air%20Monitoring%20Data

2.5 Risk Evaluation

A human health risk assessment has not been conducted for the TSP and is beyond the scope of this FS. This section provides a brief discussion of the potential primary pathways of human exposure within the TSP. Certain pathways pose risks that need to be addressed through cleanup actions. This helps to determine the remedial action objectives in Section 3.0 and to develop appropriate and effective model remedies for evaluation.

2.5.1 Pathways

The primary potential pathways of human exposure to TSP arsenic and lead are contact with or ingestion of contaminated environmental media including: 1) soil, 2) groundwater, and 3) air. These media are discussed further in the following sections.

2.5.1.1 Soil

Soil containing elevated concentrations of arsenic and lead is the primary environmental medium of concern. The pathways of exposure to soils containing these metals are dermal contact and incidental ingestion. As noted elsewhere, a large area of the TSP has arsenic and lead exceeding MTCA cleanup levels. The greatest risk is to children. Therefore, the model remedies focus on cleanup actions to reduce risk from contact with the contaminated soils.

2.5.1.2 Groundwater

As discussed in Section 2.4.2, there are no known groundwater impacts from TSP soil contamination. Landau (2006) evaluated the mobility of arsenic and lead in area-wide arsenic and lead contaminated soils and the potential to contaminate groundwater. They looked at geochemical processes as well as empirical data on the relationship of these metals in soil and groundwater in different settings. Their conclusions are as follows:

- Arsenic
  - Based on geochemistry, arsenic mobility in the acid soil of the Puget Sound region is expected to be quite limited.
  - Empirical data from TSP soil profiles indicate arsenic has low mobility. Concentrations of up to 586 mg/kg did not result in enrichment of arsenic below about 2 ft.
  - Groundwater data for wells on Vashon-Maury Island in King County do not indicate groundwater impacts from area-wide arsenic contamination.
- Lead
  - Based on geochemistry, lead mobility appears to be less than arsenic mobility.
  - Empirical data indicate lead enrichment to depths of about 18 inches. However, concentrations were lower relative to background than arsenic.
  - Groundwater data for wells on Vashon-Maury Island in King County do not indicate groundwater impacts from area-wide lead contamination.
  - The low mobility is consistent with literature data on distribution coefficients for lead.

The Science Advisory Board (SAB) evaluated the potential for area-wide arsenic and lead contamination to impact groundwater at their December 11, 2006 meeting (SAB 2006). As required by MTCA, Ecology established the SAB to provide advice on certain regulatory issues. Ecology and Eric Weber of Landau Associates gave presentations on the issue. The SAB concluded:

- Area-wide arsenic soil concentrations of 200 mg/kg are unlikely to pose a significant threat to groundwater. Site conditions that could result in this conclusion being violated include:
  - soils high in natural organic content (peat, wetlands),
  - presence of biodegradable organic compounds like petroleum,
  - very high pH and waste material (such as cement kiln dust),
  - addition of phosphate to the soil, and
  - contamination over substantial depth which would violate the finite source assumption in the transport model (and would also suggest a source other than airborne deposition from the former smelter).

- Area-wide lead soil concentrations of 1,000 mg/kg are unlikely to pose a significant threat to groundwater. Site conditions that could result in increased lead mobility include:
  - soils high in organic content (peat, wetlands),
  - presence of biodegradable organic compounds like petroleum, and
  - very low pH and waste material.

Therefore, groundwater is not normally considered a potential pathway for human exposure requiring development of remedial action objectives and model remedies. However, areas with a high water table may have groundwater coming in contact with contaminated soils. This could result in groundwater contamination.

2.5.1.3 Air

The pathway of potential concern for air is inhalation of airborne particulates containing arsenic and lead. There are no data to indicate that airborne arsenic and lead within the TSP are a concern under normal conditions. However, fugitive dust from construction and cleanup activities is a potential concern. Best management practices (BMPs) during construction activities, such as keeping soil damp to reduce fugitive dust, are effective at reducing or eliminating this pathway of exposure. USEPA has collected data during cleanup at the Tacoma Smelter (OU-1), where arsenic and lead concentrations are much higher than throughout most of the TSP. Their data indicate that BMPs are effective. Therefore, the model remedies do not directly address potential for airborne exposure. Instead, they provide information about worker and work site safety BMPs.

2.5.2 Receptors

2.5.2.1 Human

As discussed in Section 2.1, over two million people live within the boundary of the TSP and are potentially exposed to soils with elevated arsenic and lead. Actual exposure depends on property type, property uses, actual concentrations, time spent living, working, and playing in the affected area, and personal habits of the people exposed. The focus of the model remedies developed in this FS is to protect people from exposure to arsenic and lead in soils within the TSP area.

2.5.2.2 Ecological

In 2010 Ecology did a field study on the mobility and toxicity of lead and arsenic to terrestrial ecological receptors (plants, soil biota). Ecology collected uptake and toxicity data in 25 locations within the TSP (Sloan 2010 and 2011). The goal of the study was to help refine existing MTCA Ecological Indicator Soil Concentrations (EISCs; WAC 173-340-7493) for arsenic (As^{+3}, As^{+5}) and lead. The EISCs were developed for soil biota (based on invertebrates), plants and wildlife (birds, mammals).

The 25 soil, soil invertebrate and plant sampling locations (Sloan 2010 and 2011) represented a range of soil concentrations and Northwest soil types – Alderwood, Everett, Harstine, Kitsap and Spanaway. This enabled Ecology to evaluate the effect of soil type and concentration on soil receptor uptake and metal/metalloid toxicity. Plants associated with these soil types were sampled for metal/metalloid uptake and included salal (*Gaultheria shallon*), grass (*Poaceae sp*), English Ivy (*Hedera helix*), nettles (*Urtica dioica*), Sweet Cicely (*Osmorhiza berteroi*), Oregon Grape (*Mahonia sp.)*, blackberry (*Rubus sp.*) and evergreen huckleberry (*Vaccinium ovatum*). A representative soil invertebrate, the earthworm (*Lumbricus sp*.) was also sampled for metal/metalloid uptake and evaluated in a series of soil toxicity bioassays. Soil toxicity bioassays for plants used a common plant toxicity test species: lettuce (*Lactuca sp*).

Toxicity testing for TSP wildlife receptors (birds, mammals) was not within the scope of the study. However, the resulting soil uptake parameters for soil - plants - invertebrates are important for updating MTCA EISCs (Table 749-3) for all the surrogate MTCA terrestrial ecological receptors: plants, soil biota and wildlife (birds, mammals). See Section 3.2 for more detail. Accordingly soil cleanup levels were developed for soil biota, plants and wildlife (birds, mammals).

3.0 REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives are broad, administrative goals for a cleanup action that address the overall MTCA cleanup process, including:

- Implementing administrative principles for cleanup (WAC 173-340-130).
- Meeting requirements, procedures, and expectations for conducting a feasibility study and developing cleanup action alternatives (WAC 173-340-350 through 173-340-370).
- Developing cleanup levels (WAC 173-340-700 through 173-340-760).

In particular, Remedial Action Objectives must include the following threshold requirements from WAC 173-340-360:

- Protect human health and the environment
- Comply with cleanup levels
- Comply with applicable state and federal laws
- Provide for compliance monitoring

3.1 Remedial Action Objectives and Cleanup Levels for Final Actions

Use of the TSP Model Remedies constitutes a final cleanup for TSP contamination on a property or a site. Non-permanent remedies include institutional controls to ensure the long-term protection of human health and the environment. The key remedial action objectives for final soil cleanup at properties or sites within the TSP are:

- Reduce potential exposure of human and ecological receptors to soil containing arsenic above cleanup standards.
- Reduce potential exposure of human and ecological receptors to soil containing lead above cleanup standards.

3.1.1 Cleanup Level Development

Cleanup levels for the TSP meet the requirements of MTCA for both human health and ecological receptors (WAC 173-340-704 and -740). The focus for cleanup level development is on the two TSP chemicals of concern: arsenic and lead. Cleanup levels should be protective of human and ecological health over a range of current and reasonably anticipated future land uses within the TSP, including:

1. Residential (including licensed home childcares):
    - Standard quarter acre lot
    - 1 – 5 acre lots built out with small green belts

- 1 – 5 acre lots built out with single home and significant greenbelt or open space
- > 5 acre developments with clustered homes (5 to 20) with open space or green belt

2. Commercial / Industrial – Where open spaces are part of the design or required as mitigation
3. Parks and Camps:
   - Highly developed with sparse wild areas or open space
   - Nature trails through wild areas
4. Childcare centers, schools or other campuses – assumed to have open space and some green space
5. Utility easements (right of ways) – moderate to significant green spaces assumed.

MTCA Method A cleanup levels for arsenic (20 mg/kg) and lead (250 mg/kg) (WAC 173-340-900, Table 740-1) are protective of human health and are applicable to all of the land uses described above. The MTCA Method A cleanup level of 20 mg/kg for arsenic is based on a combination of considerations, including incidental soil ingestion (MTCA equation 740-2), protection of groundwater from arsenic leaching using the MTCA 3-phase model and natural background soil arsenic concentrations (WAC 173-340-900, Table 740-1). For lead, the MTCA Method A cleanup level of 250 mg/kg is based upon preventing adverse blood concentrations of lead associated with learning and behavioral deficits in children (WAC 173-340-900 Table 740-1).

As discussed in Section 2.5.2.2, Ecology studied arsenic and lead uptake from soils to co-located invertebrates (e.g., worms) and plants from throughout the TSP. Ecology also did laboratory studies of TSP soil toxicity to invertebrates (e.g., worms) and plants (Ecology 2011). These data, specific to ecological conditions within the TSP, were used to develop ecological cleanup levels for soil biota, plants and wildlife consistent with MTCA (WAC 173-340-7493(3)(b)(c)(e)). The resulting ecological cleanup levels (Ecology 2011) are 38 mg/kg for plants, 62 mg/kg for soil biota, and 339 mg/kg for wildlife protection (Appendix A). The ecological cleanup levels for lead are 67 mg/kg for plants, 200 mg/kg for soil biota, and 225 mg/kg for wildlife (Appendix A). See Appendix A for details of the methods and procedures used to develop these ecological soil cleanup levels. Appendix A also includes an evaluation of uncertainties considered in selecting the recommended cleanup levels.

3.1.2 Recommended Human and Ecological Cleanup Levels

Table 3.1 summarizes the cleanup levels protective of human and ecological health and the cleanup levels recommended for use in the TSP.

Table 3-1: Summary of Recommended Soil Cleanup Levels for the Tacoma Smelter Plume

Chemical / Receptor	Human Health mg/kg	Ecological[a] mg/kg	Final Cleanup Level mg/kg
Arsenic	20	38	20
Lead	250	67	250[b]

[a] The most protective cleanup level is shown (i.e., plants) of those developed for soil biota, plants, and wildlife (birds, mammals).
[b] Ecological value of 225 mg/kg for wildlife rounded to human health cleanup level for final recommended cleanup level.

As shown in Table 3-1, the recommended cleanup level for arsenic is based on the Method A level of 20 mg/kg. This is slightly more conservative than the ecological (plant) cleanup level. For lead, the Method A human health cleanup level is notably less protective of ecological receptors. The lowest cleanup level for lead shown in Table 3-1 is based on the protection of plants and vegetation. The level for protection of soil biota is 200 mg/kg. The environmental benefit of cleaning up soil to protect plant or soil invertebrate communities from lead was weighed against the destruction of plant and invertebrate habitat during a soil cleanup. This was done for a wide range of land uses.

Uncertainties in establishing safe levels for plant and soil biota communities arise from the range of exposures across the different habitat types within the TSP. This range of exposures and habitat types could not, for practical reasons, be fully represented in the lead/arsenic study. The most significant uncertainties are the plant root zone and soil biota burrowing depths (from inches to a foot or more) relative to the “worst case” soil depth horizon tested by Ecology (0 to 6 inches; Ecology 2011; Appendix A).

Ecology believes that a lead cleanup level of 250 mg/kg will still be protective of overall ecological health considering the uncertainty in soil exposure depth for these receptor groups. These exposure uncertainties and Ecology’s desire to avoid the unnecessary destruction of plant and wildlife habitat were considered in selecting the final soil cleanup level. In addition, attainment of the arsenic cleanup level will result in lead concentions much lower than 250 mg/kg. (See Appendix A for more detail.)

3.1.3 Points of Compliance

Under the Model Toxics Control Act (173-340-740(6)), the standard point of compliance for protection of human health from direct contact with soils is 15 feet below ground surface. The regulation states that this represents a reasonable estimate of the depth of soil that could be excavated and distributed at the soil surface as a result of site development activities. The standard point of compliance for protection of ecological receptors is 6 feet below ground surface.

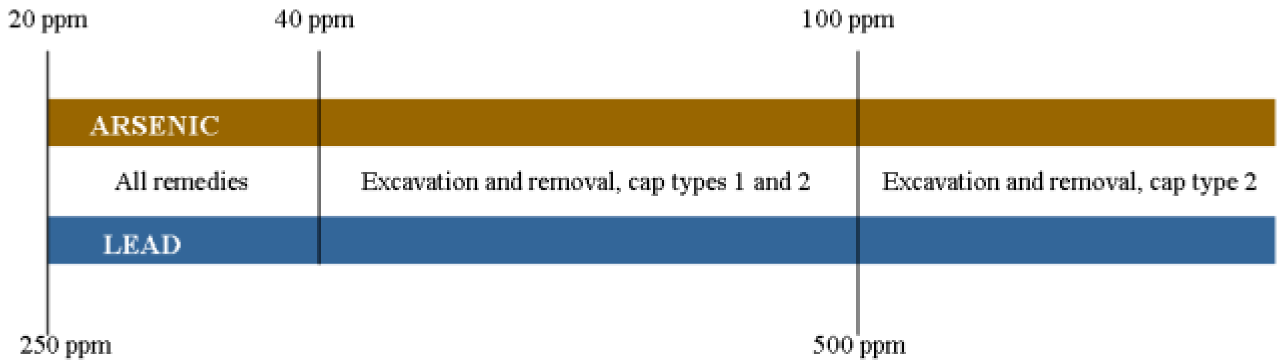
TSP contaminants typically reach a maximum of 24 inches below ground surface unless covered with fill, or mixed to deeper depths during site construction. Therefore, the standard point of compliance for Tacoma Smelter Plume contamination will typically be to the maximum depth of the contamination.

The Model Toxics Control Act regulation recognizes that some cleanup approaches include containment or isolation of hazardous substances, where the cleanup levels will not be met at the point of compliance. For the TSP, Ecology has determined that some sites will not meet the cleanup level at the standard point of compliance because the remedy involves capping.

3.2 Remediation Levels

Remediation levels were established to be protective of human health and the environment. The remediation levels for cover types were based in part on conclusions of the SAB, which indicated that As concentrations of up to 100 ppm and lead levels up to 500 ppm would not pose a threat to groundwater (SAB 2006). These remediation levels are the upper limits for the model remedies for capping, since the caps are not designed to limit infiltration of precipitation. Professional judgment was used in establishing remediation levels for the Type 1 vs Type 2 caps to be protective of human health, with a thicker cap required for the higher concentrations. The remediation level for soil mixing was based on a pilot study that determined that soil mixing is feasible where contamination is limited to shallow soils (Floyd and Snider 2001), while taking into account the upper limit of metals concentrations that could be reliably mixed to meet cleanup levels. The following remediation levels apply to the TSP Model Remedies:

- Arsenic - Above 100 ppm average arsenic (200 ppm maximum), only excavation and removal and certain types of caps (Type 2 Caps as described in Section 5.2.4) may be used.
- Arsenic - Between 40 and 100 ppm average arsenic Type 1 caps (as described in Section 5.2.4) may be used.
- Arsenic - Below 40 ppm average arsenic, all remedies are permissible.
- Lead – Above 500 ppm average lead (1000 ppm maximum), only excavation and removal and certain types of caps (Type 2 caps as described in Section 5.2.4) may be used.
- Lead – Below 500 ppm average lead Type 1 caps (as described in Section 5.2.4) may be used as well as soil mixing.



3.3 Applicable and Relevant and Appropriate Requirements

3.3.1 Overview

The MTCA regulation requires that all cleanup actions comply with applicable state and federal laws. It further states that the term 'applicable state and federal laws' shall include legally applicable requirements and those requirements that the department determines are "relevant and appropriate requirements" (WAC 173-340-710(1)). This section discusses the ARARs from state, federal, and local laws with regard to independent actions conducted in accordance with Model Remedies presented in this FS for the TSP. Local ordinances are not detailed in this chapter due to the large number of jurisdictions impacted by plume contamination.

This section lists potential ARARs and summarizes requirements considered when evaluating the Model Remedies in Section 6.0 of this FS. Section WAC 173-340-710(4) sets forth the criteria that Ecology evaluates when determining whether certain requirements are relevant and appropriate for a cleanup. If there are any conflicts between this summary and the language of the regulation itself, the language of the regulation shall govern. See the applicable statutes and regulations for more detail.

3.3.2 Applicable or Relevant and Appropriate Requirements or Exemptions

Several state laws apply to cleanup actions in the TSP, as do local government requirements (Section 3.5.4). Applicable or relevant and appropriate laws for Model Remedies developed in this FS:

- Revised Code of Washington (RCW) 43.21 C, State Environmental Policy Act.
- Executive Order 05-05, Archeological and Cultural Resources.
- Chapter 70.94 RCW, Washington Clean Air Act.
- Chapter 70.95 RCW, Solid Waste Management, Reduction, and Recycling.
- Chapter 70.105D RCW, Hazardous Waste Management.
- Chapter 90.48 RCW, Water Pollution Control.
- Chapter 90.58 RCW, Shoreline Management Act of 1971. (covered under local government regulations).

- Local government regulations for shoreline management, grading, and stormwater management.
- Chapter 296-848 WAC, Inorganic Arsenic Rule, Department of Labor and Industries.
- Chapter 296-155-176, Lead, Department of Labor and Industries.

3.3.3 State Regulations

3.3.3.1 RCW 43.21 C State Environmental Policy Act

Soil cleanup can trigger requirements under the State Environmental Policy Act (SEPA). Persons conducting cleanup should coordinate with the city or county with jurisdiction to determine what is required to comply with SEPA. Requirements related to a property cleanup can be coordinated with the overall project for larger developments which already have triggered a SEPA action.

3.3.3.2 Executive Order 05-05, Archaeological and Cultural Resources

SEPA and the Governor's Executive Order No. 05-05 require that state agencies and local governments consider impacts to cultural resources during their public environmental review process. Private property owners should check if their property contains a historic or prehistoric archeological resource or site (RCW 27.53), and comply with the Indian Graves and Records Act (RCW 27.44).

3.3.3.3 Air Emissions – RCW 70.94, Washington Clean Air Act

Best available control technologies consistent with the requirements of Chapter 70.94 RCW, Washington Clean Air Act, and the regulations that implement this statute shall be applied to releases of hazardous substances to the air resulting from cleanup actions at a site per WAC 173-340-710(7)(b). In the case of the Model Remedies presented in this FS, fugitive dust should be controlled by watering down soils during the cleanup process. Vehicle exhaust and greenhouse gas impacts can be reduced by minimizing truck trips and careful route planning. Excavators and other soil moving vehicles should not be idled unnecessarily.

3.3.3.4 Solid and Hazardous Waste Management – WAC 173-304, 173,350, and 173-340

Within the TSP, waste classification of soil depends on arsenic or lead concentration and leachability of the metals. Soil failing the Toxicity Characteristic Leaching Procedure (TCLP) test is federally-designated hazardous waste, and state dangerous waste under WAC 173-303-070(3). These types of soils are subject to the disposal and tracking requirements of the state and federal laws for dangerous and hazardous wastes. Ecology has tested soils for disposal as part of the Soil Safety Program, and they have not failed TCLP. Therefore, Ecology assumes that soils excavated and disposed of for TSP Model Remedies will not designate as dangerous or hazardous wastes.

Soils requiring disposal from TSP Model Remedies will be managed as 'problem wastes,' which are defined in the state Minimum Functional Standards for Solid Waste Handling (WAC 173-304-100) as "soils removed during cleanup of a remedial action site, or a dangerous waste site closure or other cleanup efforts and actions and which contain harmful substances but are not designated dangerous wastes." These wastes may be disposed of in any Subtitle D landfill (landfills authorized to accept non-hazardous waste).

Soils containing arsenic concentrations less than the cleanup level (20 mg/kg) are not regulated by the MTCA, the Dangerous Waste Regulations, or the Minimum Functional Standards for Solid Waste Handling. However, many local governments have their own, stricter solid waste laws, which require authorization for soil disposal. In some cases, they may not allow unrestricted disposal of soils below 20 ppm arsenic.

Private individuals conducting cleanups or generating contaminated soils or construction debris during property development in accordance with the Model Remedies in this FS must dispose of TSP waste soils at a Subtitle D landfill. Contaminated soils may not be disposed of at fill-dirt sites, construction debris landfills, or composting facilities.

3.3.3.5 Discharges to Waters of the State – RCW 90.48 and 90.54

Hazardous substances that are directly or indirectly released or proposed to be released to waters of the state shall be provided with all known, available, and reasonable methods of treatment consistent with the requirements of Chapters 90.48 RCW, Water Pollution Control Act, and 90.54 RCW, Water Resources Act, and the regulations that implement those statutes, WAC 173-340-710(6)(a).

Stormwater discharges associated with construction activities must comply with National Pollutant Discharge Elimination System (NPDES) requirements, as implemented through Ecology. Ecology requires coverage under the Construction Stormwater General Permit for clearing, grading, and excavating activities that disturb one or more acres and discharge stormwater to surface waters of the state. Smaller sites may also require coverage if they are part of a larger common plan of development that will ultimately disturb one acre or more. Operators of regulated construction sites are required to obtain coverage under the permit and meet permit requirements including the development of a stormwater pollution prevention plan and implementation of BMPs for sediment, erosion and pollution prevention control. Selected BMPs must be consistent with the most recent version of the Stormwater Management Manual for Western Washington (Ecology 2005). Ecology may add additional requirements including monitoring as the construction is taking place on a contaminated property.

3.3.3.6 Health and Safety – WAC 296-848, WAC 296-155-176 and OSHA requirements in 40 CFR 1910.120

Health and safety at the site is governed by statutes and regulations implemented by the Washington State Department of Labor & Industries. The Inorganic Arsenic Rule (Chapter 296-848 WAC) governs work at sites within the TSP, among other areas impacted by soil arsenic contamination. Chapter 296-155-176 WAC provides for worker protection for all construction work where an employee may be occupationally exposed to lead. In addition, requirements of the Occupational Safety and Health Administration (OSHA) in 40 CFR 1910.120, apply to remediation activities at listed sites containing hazardous substances.

A Health and Safety Plan should be prepared to ensure safety of workers engaged in implementing Model Remedies. Workers are required to be trained in accordance with the requirements of 40 CFR 1910.120 for Hazardous Waste Operations and Emergency Response. Safety measures include protective clothing and gloves for workers, as well as masks for dusty conditions, and hand-washing facilities. Workers should be educated about health hazards related to soil arsenic and lead and encourage to practice actions such as hand washing, and washing work clothes separately. Ecology can provide information to property owners doing independent cleanups about worker and work site safety guidelines.

3.3.4 Local Government Requirements

Local government requirements cover grading, controlling drainage at construction sites, and work in rights-of-way. The Model Remedies Guidance provides recommendations for complying with these requirements, including dust control, stormwater control, health and safety, and local disposal. Independent cleanups are not exempt and must have required permits from their local jurisdiction.

3.3.5 New Requirements

Ecology will consider new applicable state and federal laws as part of the periodic review under WAC 173-340-420.

4.0 IDENTIFICATION AND SCREENING OF REMEDIATION TECHNOLOGIES

This chapter identifies general response actions and remediation technologies potentially applicable to the TSP. The technologies are screened to obtain a set of remediation technologies feasible for use. These technologies are assembled into remediation alternatives in Chapter 5.

4.1 General Response Actions

General response actions are broad categories of remedial actions that can be combined to meet remedial actions at a site. The following general response actions are generally applicable to most sites, including the TSP:

- No action
- Institutional controls
- Monitored Natural Attenuation (MNA)
- Containment
- Removal
- Ex-Situ Treatment
- In-Situ Treatment
- Disposal

Except for "no action," each of these response actions represents a category of technologies. The applicable technologies will vary depending on the media and chemicals of concern.

4.2 Identification and Screening of Technologies

This section identifies and screens technologies that may be included as part of remediation alternatives. A comprehensive list of technologies to address the affected media and chemicals of concern has been considered that covers all of the applicable general response actions. This list is then screened to obtain the list of potentially feasible technologies used to develop remediation alternatives. The remediation technologies are screened using the following criteria:

- Effectiveness – The potential effectiveness of the technology to (1) address site-specific conditions, including applicability to the media and contaminants of concern (COCs) for this site, (2) meet remedial action objectives (RAOs), (3) minimize human health and environmental impacts during implementation, and (4) provide proven and reliable remediation under site conditions.
- Implementability – The technical and administrative feasibility of implementing a technology. Technical considerations cover site-specific factors that could prevent successful use of a technology. Administrative considerations include the ability to obtain permits and the availability of qualified contractors, equipment, and disposal services.

- Cost – The capital and operation and maintenance costs associated with the technology. Costs that are excessive compared to the overall effectiveness of the technology may be considered as one of several factors used to eliminate technologies. If two technologies provide similar effectiveness and implementability, the more costly technology may be eliminated. At the screening level, the cost evaluation is based on engineering judgment of relative costs.

The technologies and process options are screened against the criteria in the priority order listed above using the "fatal flaw" approach. This approach ranks the criteria in order of importance, as listed above. Once a technology is rejected based on effectiveness, it is not evaluated further (i.e., based on implementability or cost). Similarly, if a technology is effective, but not implementable, the technology is rejected and evaluation of cost is not undertaken. This approach streamlines the evaluation of technologies while meeting the overall objective of the screening process.

The potentially applicable technologies are presented in Table 4-1. The technology screening is also summarized in this table. Technologies retained through this screening process are then incorporated into remediation alternatives in Chapter 5.

Table 4-1: Identification and Screening of Remediation Technologies - Tacoma Smelter Plume

Technology	Description / Options	Effectiveness	Implementability	Relative Cost	Retained?	Basis for Screening
Site Access Restrictions	Prevention of access to affected area (thereby limiting contact with contaminated soil) by fencing and warning signs.	Moderate effectiveness in preventing routine access; low effectiveness at preventing trespass.	Easily implemented	Low	Yes	Feasible for low levels of contamination or in combination with other technologies.
Land Use Restrictions	Controls, such as deed restrictions, to limit or prevent activity that would lead to exposure or damage to the remedy (e.g., cap)	Can be effective in preventing routine access. Does not provide physical barrier to contact with contamination.	Easily implemented	Low	Yes	Feasible for low levels of contamination or in combination with other technologies.
Groundwater Use Restrictions	---	---	---	---	No	No groundwater contamination associated with TSP.
Monitored Natural Attenuation	Allow natural physical and biological processes to gradually remove site contamination.	Will not destroy or detoxify arsenic or lead in soil.	---	---	No	Not applicable to arsenic or lead.
Excavation	Standard excavating equipment such as backhoes, trenchers, and bulldozers.	High - removes contamination from area of concern for disposal in secure landfill.	Easily implemented in open areas; more difficult in areas with restricted access	Low unit cost for large area; unit cost can be high for small volumes or areas that are difficult to access (e.g., residential yards).	Yes	Use with consolidation or disposal.
Consolidation	Combining contaminated soil from different areas to cap or mix on-site	Moderate - does not remove contamination, but reduces area affected by contamination.	Easy to Moderate	Low	Yes	Use in combination with other technologies.
Capping	Soil cap	High - cap provides physical barrier to prevent contact with contamination and contaminant migration in surface water runoff	Moderate	Moderate	Yes	Feasible
	Wood/bark/sand cap		Easy to Moderate	Moderate	Yes	Feasible
	Rock/gravel cap		Easy to Moderate	Moderate	Yes	Feasible
	"Hard" cap (asphalt, concrete, other)		Moderate	Moderate	Yes	Feasible
	Low-permeability cap (e.g., RCRA cap)		Difficult (complex design requiring specialized contractors)	High	No	Not necessary to prevent direct contact
Groundwater Containment	Physical barriers to contain contaminated groundwater, or pumping (hydraulic containment)	---	---	---	No	No groundwater contamination associated with TSP
Soil Mixing	Reduce concentrations of contaminants by mixing with less contaminated soil.	Moderate - reduces concentrations but does not remove contamination.	Moderate difficulty	Low	Yes	Feasible
Chemical Stabilization	Addition of chemicals to limit leaching contaminants into groundwater	Not effective at reducing concentrations or preventing contact; leaching to groundwater is not a concern for arsenic and lead.	Difficult	High	No	Not effective at preventing contact with contamination.

Technology	Description / Options	Effectiveness	Implementability	Relative Cost	Retained?	Basis for Screening
Soil Washing	Process 1 - physical separation of more contaminated soil particles from less contaminated particles (size separation). Process 2 - chemical leaching to remove contaminants from soil.	Variable effectiveness depending on soil characteristics	Very difficult (complex process)	Very High	No	Effectiveness not guaranteed; low implementability; high cost
Phytoremediation	Use of plants that have ability to uptake and concentrate arsenic to reduce soil concentrations	Low effectiveness - not proven for arsenic or lead, and even if effective would take many years to reduce concentrations to cleanup levels.	Difficult - would require annual maintenance and removal and disposal of vegetative materials.	Moderate to High	No	Unproven. Pilot study with Chinese brake fern was unsuccessful.
Biodegradation (in-situ or ex-situ)	Use natural biological processes to degrade contaminants	Biological processes cannot destroy metals	---	---	No	Not applicable to arsenic or lead.
In-situ chemical oxidation (ISCO)	Inject chemical oxidants (e.g., Fenton's reagent) to degrade contaminants	Will not destroy or detoxify arsenic or lead in soil.	---	---	No	Not applicable to arsenic or lead.
In-situ thermal desorption	Heat soil in place to volatilize contaminants	Not effective on arsenic or lead	---	---	No	Not applicable to arsenic or lead.
On-Site Disposal	On-site landfill (encapsulates contamination)	Highly effective at preventing contact with contaminated soil.	Incompatible with other use of land; not practical for small volumes	High	No	Not appropriate for large number of small areas (instead use off-site disposal).
Off-Site Disposal	Permitted landfill (encapsulates contamination)	Highly effective at preventing contact with contaminated soil.	Easily implemented	Moderate to High	Yes	Feasible

4.3 Summary of Technology Screening

Based on the screening of remediation technologies presented in Table 4-1, the following technologies are retained for assembly into remediation alternatives:

- Institutional controls
  - Site access restrictions (e.g., fencing and warning signs)
  - Land use restrictions
- Excavation
- Consolidation
- Capping
- Soil mixing
- Off-site disposal.

5.0 DESCRIPTION OF REMEDIATION ALTERNATIVES

This section describes the Model Remedies. The remedies (alternatives) are combinations of technologies retained after screening (Section 4). The applicability of these remedies is discussed in Section 5.1. Components common to several of the remedies (alternatives) are provided in Section 5.2. The detailed descriptions of the remedies (alternatives) are provided in Section 5.3.

5.1 Applicability of the Model Remedies

The Model Remedies only apply to properties within the TSP with only contamination from the TSP source. Properties within the TSP with hazardous substances from another source will require cleanup meeting MTCA regulations. For these properties, the owners should consult Ecology's Toxics Cleanup Program. This includes sites performing cleanup under a Consent Decree, Agreed Order, or Enforcement Order.

5.2 Common Components of the Alternatives

This section provides descriptions of component technologies that are used in more than one alternative. Component technologies used in only one alternative are described with the alternative.

5.2.1 Institutional Controls

Institutional controls restrict access to contaminated areas in order to 1) prevent direct contact with contamination, and 2) prevent site activities inconsistent with continued remedy effectiveness.

5.2.1.1 Site Access Restrictions

Site access restrictions prevent or discourage people from coming into a contaminated area. The most common access restrictions are fencing and warning signs. Fencing can be used to prevent access by the general public. Warning signs can be used in addition to fencing, or in areas such as parks where public access is appropriate.

5.2.1.2 Land Use Restrictions

Land use restrictions are legal measures, such as environmental covenants, that 1) warn future property owners of site contamination, and 2) prohibit land use inconsistent with the remedy (such as removing or digging through a cap). Land use restrictions can discourage direct contact, but unlike site access restrictions do not provide a physical barrier to contact.

Environmental covenants or clauses in sales contracts can be used to ensure ongoing monitoring and maintenance even when property ownership changes.

5.2.2 Monitoring

Alternatives must meet MTCA compliance monitoring requirements (WAC 173-340-410). Compliance monitoring consists of:

- Protection monitoring
- Performance monitoring
- Confirmational monitoring

Ecology's Model Remedies Guidance document provides additional discussion of monitoring requirements.

Ecology has determined that the primary contaminants of concern (arsenic and lead) do not pose a groundwater risk at the soil concentrations that would remain on-site for these alternatives (see Section 2.4.2). Therefore, groundwater monitoring is not required for these model remedies.

5.2.2.1 Protection Monitoring

Protection monitoring is used to confirm that human health and the environment are adequately protected during implementation of an alternative. Each alternative must include protection monitoring appropriate for the remedial action. The details of this monitoring will be site-specific, and should be documented in writing.

5.2.2.2 Performance Monitoring

Performance monitoring is used to confirm that cleanup standards or other performance standards have been attained. Alternatives that involve soil removal (excavation and off-site disposal, or on-site consolidation) require soil sampling and analysis to show that the soil remaining after removal meets cleanup levels. Soil mixing requires soil sampling and analysis to show that the arsenic and lead concentrations in the mixed soil meets cleanup levels. Performance monitoring for capping alternatives includes:

- Sampling and analysis to show that soil contaminant concentrations are below remediation levels for the cap type.
- Inspection/monitoring to ensure that the cap materials meet the required specifications (geotechnical properties, lack of contamination, etc).
- Inspection/monitoring to confirm that cap installation meets design requirements (such as thickness and slopes).

5.2.2.3 Confirmational Monitoring

Confirmational monitoring checks the long-term effectiveness of the remedy after completion of cleanup. This is required for any remedy where contaminated material remains after remedial action. For caps, this includes periodic inspection. Confirmational monitoring is not required for soil mixing or excavation and off-site disposal because soil remaining on-site will meet cleanup levels.

5.3 Description of the Alternatives

Each of the Model Remedies can apply to all of a single site or property. However, for more complex sites, it will often be appropriate to divide the site into subareas ("decision units"), with different remedies used for the subareas.

5.3.1 Alternative 1 – Institutional Controls Only

This alternative only applies to undeveloped areas with limited potential for current or future human exposure that contain significant high-quality environmental habitat. This alternative could apply either to an entire property, or to portions of a larger property. Institutional controls could consist of one or more of the following:

- Warning signs
- Fencing
- Deed restrictions.

Although using only institutional controls leaves concentrations of arsenic and lead above cleanup levels, active cleanup disturbs habitat. For properties (or portions of properties) where the habitat damage outweighs the net benefit of active cleanup, this alternative could be suitable.

No remediation level has been established for this alternative. Therefore, this alternative cannot be used without consultation with Ecology. Ecology may require a disproportionate cost analysis per WAC 173-340-360(3)(e). Where preserving environmental habitat is a primary consideration, the disproportionate cost analysis may include a net environmental benefits analysis (NEBA). NEBA is a methodology for identifying and comparing net environmental benefits of management options. Net environmental benefits are the gains in environmental services or other ecological properties attained by remediation, minus the environmental damages caused by those actions (Efroymson et al 2003).

5.3.2 Alternative 2 – Excavation and Off-Site Disposal

In this alternative, all soil exceeding the cleanup level is excavated and hauled to a permitted landfill for off-site disposal. Excavated soil will normally be a non-hazardous waste. However, waste disposal regulations must be followed to determine the waste type and the landfill used must be permitted for the waste type. Dangerous waste regulations are found at WAC 173-303. Solid waste regulations are found at WAC 173-350. Unlike some of the other alternatives, this alternative may be used for any soil arsenic or lead concentrations.

Performance monitoring is required to demonstrate that residual soil meets cleanup levels. Because no soil remains on-site above cleanup levels, neither institutional controls nor monitoring and maintenance are required after this remedial action is complete.

5.3.3 Capping Alternatives (3a, 3b, 4a, 4b)

5.3.3.1 General

Caps prevent direct contact with contaminated soil by covering it. They also prevent off-site migration of the contaminated soil via soil erosion or airborne dispersion. A wide variety of caps are possible, with different cap materials, numbers of layers, and layer thicknesses.

This FS considers the following cap materials:

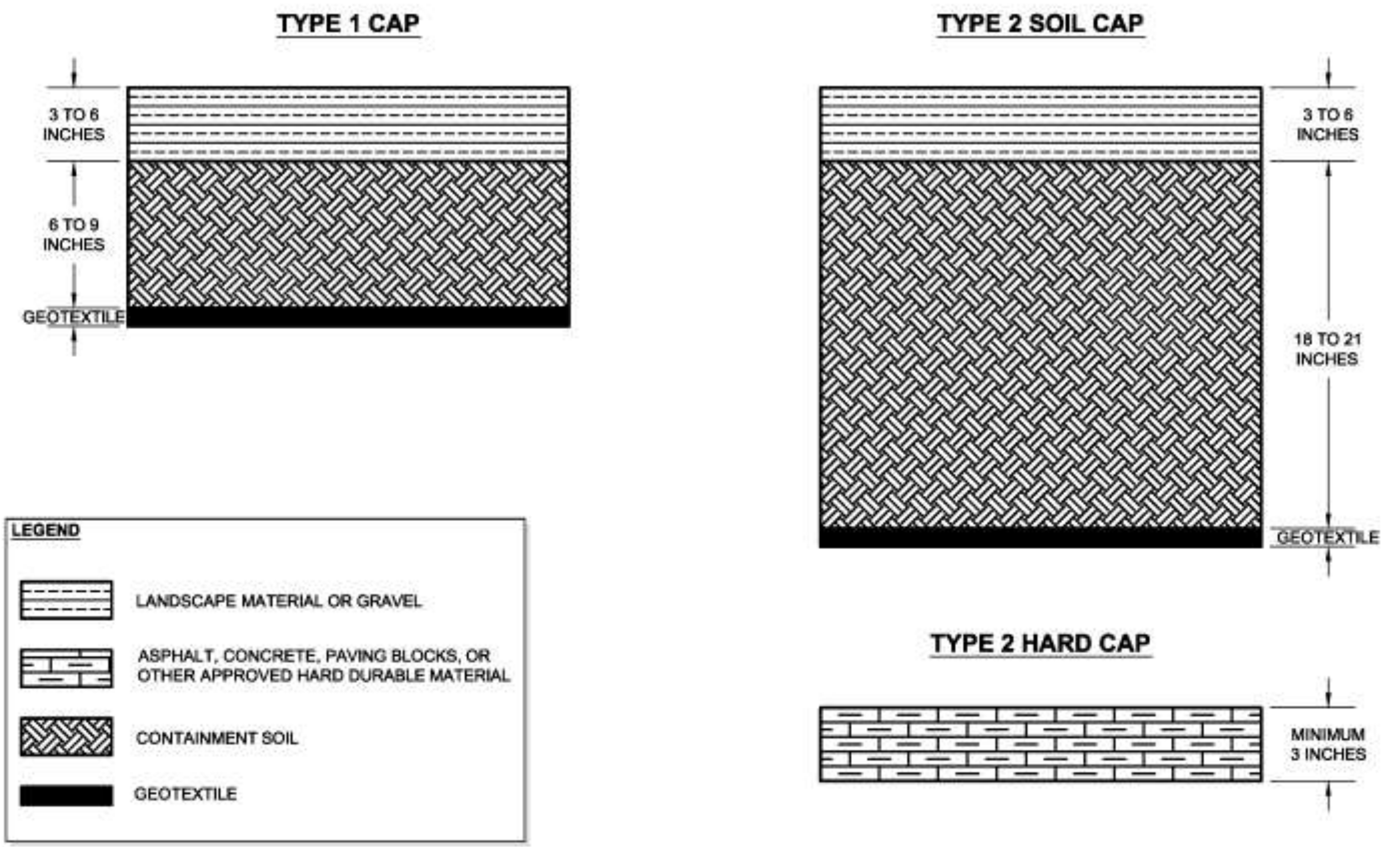
- Landscaping materials, such as topsoil, wood or bark chips, decorative sand or gravel, etc.
- Gravel traffic surfacing, typically a fine to medium crushed rock for use in residential driveways, parking areas, private roads, and similar applications.
- Containment soil, consisting of well graded, inorganic natural soil that can be readily compacted to a firm, dense condition with relatively low susceptibility to mechanical disturbance or erosion. In the Puget Sound region, such materials could include glacial till, glacial outwash, lacustrine deposits, and similar soil types.
- Geotextile, for use as a demarcation layer.
- Asphalt, concrete, paving blocks or other suitable hard material typically used for pavements.

All soil caps for Model Remedies have a bottom demarcation layer to show the interface between clean and contaminated soil. This demarcation layer is a geotextile with a minimum weight of 6 oz per square yard, or equivalent approved by Ecology.

The next two sections describe the two primary cap types developed for the Model Remedies.

5.3.3.2 Type 1 Cap

This cap type, illustrated in Figure 5-1, is for soil with relatively low contaminant levels (<100 mg/kg arsenic and <500 mg/kg lead). A Type 1 Cap has a total thickness of at least 12 inches. The bottom soil layer (above the geotextile demarcation layer) is 6 to 9 inches of containment soil. The upper 3 to 6 inches may be landscaping materials or gravel traffic surfacing.



NOTE:
SEE TEXT FOR DESCRIPTION OF CAP MATERIALS.

FIGURE **5-1**
SCHEMATIC OF CAP TYPES
TPCHD/TACOMA SMELTER PLUME FS/WA (US)

Vegetated topsoil is preferred to sand or bark chips, which are relatively easy to penetrate under point loads and are more easily eroded. Thus, in general, vegetated topsoil will require less maintenance. In addition, bark or other woody material will decompose, unlike soil layers, and require periodic replacement.

Another equivalent cap design may be used for a Type 1 Cap with the concurrence of Ecology.

5.3.3.3 Cap Type 2

This cap type, illustrated in Figure 5-1, is for soil with higher contaminant levels (>100 mg/kg arsenic or >500 mg/kg lead). It could also be used in place of Type 1 Cap. A Type 2 Cap may be either a soil cap or a "hard" cap.

A Type 2 soil cap has a total thickness of at least 24 inches. The bottom soil layer (above the geotextile demarcation layer) is 18 to 21 inches of containment soil. The top 3 to 6 inches is landscaping materials or gravel traffic surfacing. Vegetated topsoil is preferred to sand or finer soil and bark or wood chips because the latter materials are relatively easy to penetrate under point loads and are more are easily eroded. Bark or wood chips also decompose. Thus, in general, vegetated topsoil will require less maintenance.

A Type 2 hard cap consists of at least 3 inches of asphalt or concrete, paving blocks, or other hard and durable material approved by Ecology. A concrete building slab, sidewalk, or paved traffic area is considered a "hard" cap.

Another equivalent cap design may be used for a Type 2 Cap with the concurrence of Ecology.

5.3.3.4 Cap Maintenance

Erosion, settling, decomposition for some materials (like bark), and human activities (such as unauthorized digging through the cap) can impair a cap's effectiveness. Therefore, the cap must be inspected at least every year and repaired, as necessary, to maintain effectiveness.

5.3.3.5 Alternative 3a – Capping in Place with Type 1 Cap

In this alternative, a Type 1 cap is constructed over the contaminated soil with no soil excavation. A more protective, but more expensive Type 2 cap could be used. This alternative is for relatively low soil contaminant concentrations (<100 mg/kg arsenic and <500 mg/kg lead).

Because contaminated materials remain, institutional controls (Section 5.2.1) are required. Monitoring and maintenance are required for caps (Sections 5.2.2 and 5.3.3.4).

5.3.3.6 Alternative 3b – Capping in Place with Type 2 Cap

In this alternative, a Type 2 cap is constructed over the contaminated soil with no soil excavation. It is intended for higher soil contaminant concentrations (>100 mg/kg arsenic or > 500 mg/kg lead). Unlike some of the other alternatives, this alternative may be used for any soil arsenic or lead concentrations.

Because contaminated materials remain, institutional controls (Section 5.2.1) are required. Monitoring and maintenance is required for caps (Sections 5.2.2 and 5. 3.3.4).

5.3.3.7 Alternative 4a – Consolidation and Capping with Type 1 Cap

This alternative is similar to Alternative 3a, using a Type 1 Cap for relatively low soil contaminant concentrations (<100 mg/kg arsenic and <500 mg/kg lead). A more protective, but more expensive Type 2 Cap could be used. The difference in this alternative is that the cap area is reduced by excavating some of the contaminated soil and placing over other contaminated soil that remains in place.

Because contaminated materials remain, institutional controls (Section 5.2.1) are required. Monitoring and maintenance is required for caps (Sections 5.2.2 and 5. 3.3.4). Performance monitoring (Section 5.2.2) is required for excavated areas.

5.3.3.8 Alternative 4b – Consolidation and Capping with Type 2 Cap

This alternative is similar to Alternative 3b, using a Type 2 Cap for higher soil contaminant concentrations (<200 mg/kg arsenic or <1000 mg/kg lead). The difference in this alternative is that the cap area is reduced by excavating some of the contaminated soil and placing over other contaminated soil that remains in place.

Unlike Alternative 3b (Capping in Place with Type 2 Cap), Alternative 4b only applies to average soil concentrations below 200 mg/kg for arsenic and 1,000 mg/kg for lead. Ecology has concerns that consolidation of soils above this level has the potential for groundwater impacts. Groundwater impacts are not expected if the soils are left in place. The concentration limits are based on the Science Advisory Board conclusion that area-wide soil concentrations below these levels are unlikely to pose a significant threat to groundwater (SAB 2006). Consolidation and capping may be considered with arsenic or lead levels above these limits in consultation with Ecology through the Voluntary Cleanup Program.

Because contaminated materials remain, institutional controls (Section 5.2.1) are required. Monitoring and maintenance is required for caps (Sections 5.2.2 and 5. 3.3.4). Performance monitoring (Section 5.2.2) is required for excavated areas.

5.3.4 Alternative 5 – Soil Mixing

This alternative involves mixing with either clean imported soils, or clean soils underneath the contaminated surface soils. The contaminated soil is mixed with sufficient clean soil to meet cleanup levels in the resulting mixed soil. The average soil concentrations for the site or subarea ("decision unit") cannot exceed 40 mg/kg arsenic and 500 mg/kg lead before mixing to achieve the cleanup levels of 20 mg/kg for arsenic and 250 mg/kg for lead.

There are three main methods for mixing:

- Soils may be mixed in place with deeper, cleaner soils.
- Soils may be mixed in place with imported clean soil.
- Contaminated surface soils may be excavated, stockpiled, and mixed with cleaner imported or native soils (ex-situ mixing). The mixed soils can then be spread out and reused on the property.

Performance monitoring is required to demonstrate that the mixed soil meets cleanup levels. For ex-situ mixing, representative samples should be obtained from the mixed stockpile before spreading.

Institutional controls are not required for soil mixing, because the cleanup levels are achieved.

6.0 EVALUATION OF REMEDIAL ALTERNATIVES

This section evaluates the remedial alternatives (Model Remedies) using the MTCA regulation process (WAC 173-340-360). MTCA requires a three-step evaluation process. The first step is a "threshold" evaluation (Section 6.1), the second step is an evaluation of reasonable restoration time frame (Section 6.2), and the third step is a "permanence" evaluation (Section 6.3). In addition, an evaluation of net benefit (Section 6.4) and a disproportionate cost and overall evaluation are provided (Section 6.5).

The "Model Remedies" evaluated as alternatives are:

- Alternative 1 – Institutional Controls Only
- Alternative 2 – Excavation and Off-Site Disposal
- Alternative 3a – Capping in Place with Type 1 Cap
- Alternative 3b – Capping in Place with Type 2 Cap
- Alternative 4a – Consolidation and Capping with Type 1 Cap
- Alternative 4b – Consolidation and Capping with Type 2 Cap
- Alternative 5 – Soil Mixing

Normally, an FS evaluation compares alternatives and recommends a single alternative for selection as the remedy. However, here all of the alternatives are suitable for particular circumstances. Therefore, this evaluation rates each of the alternatives against the MTCA evaluation criteria in WAC 173-340-360 to illustrate applicability and present the advantages and disadvantages of the alternatives.

6.1 Threshold Evaluation

Under WAC 173-340-360(2)(a), cleanup actions must meet the following threshold requirements:

- Protection of human health and the environment
- Compliance with cleanup standards
- Compliance with ARARs
- Provision for compliance monitoring

6.1.1 Protection of Human Health and the Environment

This criterion addresses whether a remedial alternative achieves sufficiently low residual risk to human and ecological receptors after completion of the alternative, resulting in at least a minimum acceptable level of protection. The relative degree of protection provided by the alternatives is considered in the comparative evaluation. All of the alternatives are designed to provide sufficient protection of human health and the environment for the applicable site or property conditions, based on compliance with cleanup standards (Section 6.1.2).

If an alternative were applied to a site that did not meet applicability requirements (defined in Sections 5.1 and 5.3), it might not be protective of human health and the environment for that particular site. However, these alternatives could be considered for sites or properties that do not meet applicability requirements or limitations of the alternatives under the Voluntary Cleanup Program or a Consent Decree, Agreed Order, or Enforcement Order. In these cases, Ecology's Toxics Cleanup Program should be consulted.

6.1.2 Compliance with Cleanup Standards

This criterion is defined as meeting the requirements of WAC 173-340-700 through 173-340-760. Compliance with cleanup standards does not require removal of all waste or affected soil from a site; these regulations include provisions for meeting cleanup standards through containment (WAC 173-340-700(4)).

Alternative 1 (Institutional Controls), and the capping alternatives (3a, 3b, 4a, 4b) leave contaminated soil on site above MTCA cleanup levels for arsenic and lead. However, the concentration limits for applying these alternatives (see Section 5.3) constitute remediation levels. WAC 173-340-350(8)(c)(i)(D) states "Alternatives may, as appropriate, include remediation levels to define when particular cleanup action components will be used. Alternatives may also include different remediation levels for the same component…." Therefore, by definition, the alternatives comply with the remediation levels defined in the descriptions of the alternatives.

In Alternatives 2 (Excavation and Off-Site Disposal) and 6 (Soil Mixing), soil remaining on-site has concentrations below the arsenic and lead cleanup levels. Thus, these alternatives achieve MTCA cleanup standards.

6.1.3 Compliance with ARARs

Implementation of any of the alternatives must comply with all applicable laws and regulations. ARARs are discussed in Section 3.5.

6.1.4 Compliance Monitoring

All of the alternatives include compliance monitoring, as discussed in Section 5.2.2.

6.1.5 Summary of Threshold Evaluation

All of the alternatives meet the threshold evaluation requirements for the applicable site conditions. An alternative applied to a site not meeting the applicability requirements for that alternative may not be protective of human health and the environment, and therefore cannot be used as a Model Remedy (see additional discussion in Section 6.1.1).

6.2 Other Requirements

Under WAC 173-340-360(2)(b), cleanup actions must meet the following requirements in addition to the threshold requirements:

- Use of permanent solutions to the maximum extent practicable – This is evaluated in Section 6.3.
- Provide for a reasonable restoration time frame – In all of the alternatives, remedial action would be completed and achieve cleanup standards (see Section 6.1.2) relatively quickly. Therefore, all of the alternatives provide a reasonable restoration time frame.
- Consider public concerns - Public concerns will be considered by addressing public comments on the public draft of this document.

In addition, particularly relevant to this FS, WAC 173-340-360(2)(g) specifies that cleanup actions cannot rely primarily on dilution unless the incremental costs of other permanent alternatives grossly exceed the incremental benefit of the other alternatives. This disproportionate cost analysis is provided for the soil mixing alternative (Alternative 5) in Section 6.3.7.

6.3 Permanence Evaluation

A “permanent solution” or “permanent cleanup action” is defined in WAC 173-340-200 as:

> A cleanup action in which cleanup standards of WAC 173-340-700 through WAC 173-340-760 can be met without further action being required at the site being cleaned up or any other site involved with the cleanup action, other than the approved disposal of any residue from the treatment of hazardous substances.

The permanence evaluation process and criteria are specified in WAC 173-340-360(3). To determine that a cleanup action uses “permanent solutions to the maximum extent practicable”, alternatives are compared against the criteria in WAC 173-340-360(3)(f):

- Overall protectiveness
- Permanent reduction in toxicity, mobility, and volume of hazardous substances
- Long-term effectiveness
- Management of short-term risks
- Implementability
- Cost
- Consideration of public concerns

Public concerns will be considered by addressing public comments on the public draft of this document (Section 6.2.3).

6.3.1 Overall Protectiveness

Overall protectiveness of human health and the environment considers long-term and short-term risks to human health and the environment. It also considers whether cleanup standards are met. This criterion is not an independent criterion, but more a summary of the overall evaluation. Therefore, the net benefit of the other non-cost criteria is taken as the overall protectiveness of the alternative. Overall protectiveness is also evaluated as a threshold criterion in Section 6.1.1.

6.3.2 Permanent Reduction of Toxicity, Mobility, and Volume of Hazardous Substances

This criterion addresses the degree to which a remedial alternative permanently reduces the contaminant toxicity, ability of contaminants to migrate, or the quantity of contaminated material.

The contaminants of concern, arsenic and lead, are elements and cannot be destroyed. This fact limits the ability to reduce toxicity, mobility, and volume of contaminated media.

- Toxicity reduction – If a contaminant cannot be destroyed, changing the chemical form of the contaminant can sometimes reduce toxicity. However, treatment technologies were not retained due to high cost with marginal benefit (see Section 4). Therefore, none of the alternatives include treatment.
- Mobility reduction – Arsenic and lead are not highly mobile, and so reduction of mobility is not a major concern (see discussion of groundwater in Section 2.4.2). Capping and off-site disposal decrease mobility by preventing migration of contaminated soil in stormwater. Alternatives 1 (Institutional Controls) and 5 (Soil Mixing) do nothing to decrease the mobility of the contaminated soil.
- Volume reduction – Soil mixing (Alternative 5) increases, rather than decreases, the volume of contaminated soil. However, the mixed soil meets cleanup standards. None of the other alternatives increase or decrease the volume of contaminated soil.

6.3.3 Long-Term Effectiveness

This criterion addresses risks remaining at the site after the remedial alternative has been implemented. It also looks at the reliability of the alternative for reducing risks over an extended period of time. Risks during the implementation period are addressed under management of short-term risks (Section 6.3.4). Evaluation of long-term effectiveness involves estimating the residual risk associated with each alternative. It also considers reliability--the longevity of the remedy (such as the lifespan of institutional controls or containment) and the chances of remedy failure. Reliability includes qualitative evaluation of the amount of long-term maintenance and monitoring required. The greater the requirement for maintenance and monitoring, the lower the reliability is for an alternative.

Alternative 1 (Institutional Controls) provides the least long-term effectiveness because no active cleanup actions are included. This remedy could be selected if the ecological harm caused by active remediation exceeded the benefit of active cleanup (Sections 5.3.1 and 6.3.7.2). Institutional controls provide some assurance that the land use basis for selecting this alternative would not change. Fencing and warning signs, if included in the remedy, would provide some protection against human exposure.

Alternative 2 (Excavation and Off-Site Disposal) places the contaminated soil in a secure, permitted landfill with long-term maintenance and monitoring under regulatory oversight and financial assurance. The on-site capping alternatives (3a, 3b, 4a, 4b) also prevent direct contact and off-site migration of contaminated soil, and provide similar long-term effectiveness so long as the cap is properly maintained. However, the means of ensuring the long-term maintenance and monitoring are less reliable than for a permitted landfill. Therefore, the on-site capping alternatives are less reliable than off-site disposal (Alternative 2).

A Type 1 Cap is less protective than a Type 2 Cap (see Section 5.2.4 for cap types). Therefore, Alternatives 3a (Capping in Place with Type 1 Cap) and 4a (Consolidation and Capping with Type 1 Cap) are less protective than Alternatives 3b (Capping in Place with Type 2 Cap) and 4b (Consolidation and Capping with Type 2 Cap).

Consolidation of contaminated soil (Alternatives 4a and 4b) decreases the footprint of the capped area, meaning somewhat less maintenance is needed. In general, this is more reliable than capping without consolidation (Alternatives 3a and 3b). However, the effectiveness and practicability of consolidation vary based on site conditions. In addition, short-term risks from excavating and moving contaminated soils may make capping in place preferable. Therefore, for a given site, consolidation and capping may or may not be preferable to capping in place.

Alternative 5 (Soil Mixing) is the most effective and reliable because cleanup standards are achieved without need for long-term maintenance and monitoring, either on-site or off-site. However, soil mixing is only applicable to sites where cleanup levels can be achieved by mixing (see Section 5.3.8). Higher contaminant concentrations will require another alternative to be protective.

6.3.4 Management of Short-Term Risks

This criterion addresses short-term effects on human health and the environment during implementation of the alternative. Long-term effectiveness (Section 6.3.3.) covers potential risks after completion of remedial action. The short-term evaluation considers the following factors:

- Risk to site workers
  - Contaminant exposure risks during remedial action
  - Accident risks during remedy construction, operations, and maintenance.
- Risk to the community
  - Contaminant exposure risks during remedial action due to (a) off-site migration of contamination, or (b) spills during off-site transport of contaminated materials.
  - Accident risks due to increased traffic
  - Any other risks that remedial action might create for the community
- Risk to the environment (short-term ecological risk)
  - Contaminant exposure risks during remedial action
  - Temporary disruption of habitat during remedial action
  - Temporary discharges (air or water) during remedial action

All of these alternatives, if properly implemented, manage short-term risks sufficiently. Alternative 1 (Institutional Controls) has the least short-term risk because it involves no site actions (legal controls only) or minimal site actions (fencing and warning signs). These actions limit worker exposure and have little, if any, impact on ecological habitat.

Alternative 2 (Excavation and Off-Site Disposal) has the most short-term risk because of worker exposure to contaminated soil during excavation and community exposure during transportation. Alternative 5 (Soil Mixing) has about the same worker risk as Alternative 2, but has less community risk because it does not involve off-site transportation.

The capping alternatives (3a, 3b, 4a, 4b) have less short-term risk than Alternatives 2 or 5 because, although there would be some worker exposure to contaminated soil, capping involves less exposure than excavation or mixing. Consolidation includes limited excavation, so the consolidation and capping alternatives (4a and 4b) have worker exposure between Alternative 2 and the cap-in-place alternatives (3a and 4b). The cap type does not significantly affect short-term risk, so the short-term risk for Alternatives 3a and 3b are essentially the same, and the short-term risk for Alternatives 4a and 4b are essentially the same.

6.3.5 Implementability

This criterion addresses the degree of difficulty in implementing each alternative, including the potential for delays, cost overruns, and remedy failure. Known difficulties that have quantifiable costs are included in the cost estimates (see Section 6.3.6). The implementability evaluation focuses on less quantifiable known and potential difficulties and considers the following:

- Technical Feasibility – The potential for problems during implementation of the alternative and related uncertainties.
- Availability of Services and Materials – The availability of experienced contractors and personnel, equipment, and materials needed to implement the alternative. Availability of disposal capacity is included in the evaluation.
- Administrative Feasibility – The degree of difficulty from regulatory constraints and the degree of coordination required between agencies.
- Complexity – The more complex a remedial action, the more difficult it is to construct or implement. In addition, the more items there are that can go wrong, the greater the chance of remedy failure.

All of the alternatives are technically feasible, and are readily implemented using standard construction techniques. The relative technical difficulty of the alternatives will vary with site conditions. For example, excavation of contaminated soil under a building would be difficult, making cap-in-place using the building foundation easier. At another site, excavation and off-site disposal could be easier.

Contractors with remediation experience are readily available in the affected areas. Non-hazardous landfills capable of receiving contaminated soil are readily available. However, there is insufficient local landfill capacity for off-site disposal of all of the contaminated soil in the TSP (on the order of 10^9 cubic yards).

Alternative 2 (Excavation and Off-Site Disposal) is more difficult for properties on Vashon-Maury Island than other properties. There is no permitted landfill able to receive contaminated soil on the island, so the excavated soil requires barging off the island. Any alternative requiring construction equipment is more difficult on Vashon-Maury Island than other areas because it is only accessible by ferry.

All of the alternatives are administratively feasible. Alternatives with institutional controls have the most potential difficulties. The capping alternatives (3a, 3b, 4a, 4b) require long-term maintenance and monitoring to remain effective. Use of institutional controls to ensure this makes these alternatives more difficult than alternatives without institutional controls (Alternatives 2 and 5). Administratively, Alternative 1 (Institutional Controls) is less difficult than the capping alternatives because less long-term monitoring is involved. Alternative 1 is more difficult administratively than Alternatives 2 and 5.

None of the alternatives are particularly complex. The complexity of cleanup will depend on the complexity of the site.

6.3.6 Cost

This criterion considers the costs of performing each alternative, including capital, operation and maintenance, and monitoring costs. Alternative costs are compared on a net present value basis. Known implementation difficulties with quantifiable cost impacts are included in the cost estimates.

The costs of these alternatives will vary significantly depending on site conditions. Table 6-1 presents approximate cost ranges for capital, annual operating, and present value for 30 years. The unit costs assumed for these cost estimates are given in Table 6-2. The alternatives are expected to rank approximately as follows based on cost (lowest to highest) for typical sites:

- Alternative 5 – Soil Mixing
- Alternative 1 – Institutional Controls Only
- Alternative 2 – Excavation and Off-Site Disposal
- Alternative 4a – Consolidation and Capping with Type 1 Cap
- Alternative 4b – Consolidation and Capping with Type 2 Cap
- Alternative 3a – Capping in Place with Type 1 Cap
- Alternative 4b – Capping in Place with Type 2 Cap

The alternatives have limits on their applicability (see Sections 5.1 and 5.3), so not every site can use all of these alternatives. The relative costs of the alternatives can vary based on site conditions. Also, some alternatives may not be implementable at some sites.

Table 6-1: Comparison of Costs for Model Remedy Alternatives

Alternative		Estimated Capital Cost		Estimated Annual O&M Cost		Estimated Total PV Cost	
		Low	High	Low	High	Low	High
1	Institutional Controls	$15,000	$32,000	$1,202	$2,170	$39,000	$75,000
2	Excavation and Off-Site Disposal	$81,000	$242,000	$0	$0	$81,000	$242,000
3a	Capping in Place with Type 1 Cap	$49,000	$92,000	$1,833	$3,567	$85,000	$162,000
3b	Capping in Place with Type 2 Cap	$92,000	$310,000	$2,500	$8,250	$141,000	$472,000
4a	Consolidation and Capping with Type 1 Cap	$31,000	$57,000	$1,233	$2,400	$55,000	$104,000
4b	Consolidation and Capping with Type 2 Cap	$53,000	$166,000	$1,525	$4,650	$83,000	$257,000
5	Soil Mixing	$16,000	$48,000	$0	$0	$16,000	$48,000

Notes:

a. Costs are normalized to a hypothetical site with:

Area	1	acre
Perimeter length	835	feet
Depth of contamination	6	inches
Volume of contaminated soil	807	cubic yards

b. Costs do not include pre- or post-remediation sampling, which is similar for all alternatives.

c. Institutional controls assumed to consist of deed restrictions and fencing with warning signs

d. Consolidation assumed to reduce cap area to 1/2 of area if not consolidated.

e. Total cost is the sum of the capital cost and the net present value of operation and maintenance (O&M) cost.

Interest (discount) rate for PV calculation:	3.0%	
Duration of O&M for PV calculation:	30	years

f See Table 6-2 for unit costs assumed for these cost estimates

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Table 6-2: Assumed Unit Costs

Item	Low Cost	High Cost	Units	Notes
Legal institutional controls	$5,000	$15,000	LS	
Fencing & warning signs	$12	$20	lf	
Excavation for on-site consolidation	$10	$20	cy	
Excavation & off-site disposal	$100	$300	cy	Ecology cost data
Cap Type 1	$1.0	$2.0	sf	1' clay or 4" asphalt
Cap Type 2	$2.0	$7.0	sf	2' soil, 4" asphalt, 4" concrete
Soil mixing	$20	$60	cy	
Annual inspection/monitoring costs	$200	$500	year	

6.3.7 Disproportionate Cost Analysis and Overall Evaluation

Two alternatives provide permanent solutions as defined in WAC 173-340-200 (Section 6.3): Alternative 2 (Excavation and Off-Site Disposal), and Alternative 5 (Soil Mixing). Neither of these alternatives requires site actions (institutional controls, maintenance, or monitoring) following completion of remediation. However, Alternative 5 involves soil mixing, which requires a disproportionate cost analysis under WAC 173-340-360(2)(g) because it involves dilution of contaminated soil.

The capping alternatives (3a, 3b, 4a, 4b) require a disproportionate cost analysis because they require ongoing site actions (institutional controls, maintenance, and monitoring) after remedial action construction is complete.

Alternative 1 (Institutional Controls) requires a disproportionate cost analysis because it leaves soil on-site with contaminant concentrations above cleanup levels. Alternative 1 also requires ongoing maintenance of the institutional controls and long-term monitoring.

6.3.7.1 Disproportionate Cost Analysis for Alternative 5 (Soil Mixing)

Alternative 5 (Soil Mixing) achieves cleanup standards by dilution (mixing contaminated and clean soil). The potential risk to human health and the environment is thereby reduced to acceptable levels. While in some cases soil mixing may increase the area through spreading of mixed soil, at most sites the mixing will be restricted to the affected area by mixing with deeper clean soil. Direct contact happens at the surface, so if the contaminated surface area is not increased, then the dilution has not increased the potential for exposure. This alternative is a very reliable remedy because it does not require institutional controls or long-term maintenance and monitoring to be effective. In this sense, Alternative 5 is a more reliable remedy than Alternative 2 (Excavation and Off-Site Disposal).

For appropriate sites, Alternative 5 (Soil Mixing) will generally have the lowest cost of the alternatives considered in this FS. Off-site disposal (Alternative 2) has much higher cost, but is not more effective because it simply moves the contaminated soil from the site to another controlled location. The capping alternatives (3a, 3b, 4a, 4b) are not as reliable because their effectiveness relies on long-term maintenance and monitoring. Alternative 1 (Institutional Controls) leaves exposed contaminated soil above cleanup levels. Thus, the higher cost alternatives do not provide greater protection of human health and the environment. Therefore they have disproportionate added cost compared to Alternative 5, for appropriate sites.

6.3.7.2 Disproportionate Cost Analysis for Capping Alternatives

For the disproportionate cost analysis, the capping alternatives (3a, 3b, 4a, 4b) are compared to the generally higher cost, yet permanent, Alternative 2 (Excavation and Off-Site Disposal). The relative long-term cost of capping alternatives, compared to Alternative 2, will vary from site to site. In cases where off-site disposal is the less expensive option and technically feasible, Alternative 2 (Excavation and Off Site

Disposal) is preferred to capping. In cases where on-site capping is less expensive, capping is a suitable cleanup action for appropriate sites.

Both on-site capping and off-site disposal are containment options that prevent direct contact with the contaminated soil with a cap. Off-site disposal is more reliable because the institutional controls, maintenance, and monitoring are well established under agency oversight with financial assurance. This is not the case for on-site capping of many small sites. Nonetheless, on-site capping is effective if properly maintained. In addition, there is insufficient local landfill capacity for off-site disposal of all of the contaminated soil in the TSP (on the order of 10^9 cubic yards). At some sites, excavation and off-site disposal may not be technically feasible or practical (for example, contaminated soil beneath building foundations). Therefore, at sites where Alternative 2 (Excavation and Off-Site Disposal) is significantly more expensive than an on-site capping alternative (3a, 3b, 4a, 4b), the additional cost of Alternative 2 is disproportionate to the net benefit and on-site capping is an acceptable cleanup action.

6.3.7.3 Disproportionate Cost Analysis for Alternative 1

A disproportionate cost analysis for Alternative 1 (Institutional Controls) would need to be site-specific and is beyond the scope of this FS. This analysis should incorporate relevant aspects of a NEBA, and should be conducted in consultation with Ecology. A framework for conducting a NEBA is provided in Efroymson et al 2003.

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APPENDIX A
DEVELOPMENT OF SOIL CLEANUP LEVELS FOR ECOLOGICAL PROTECTION

A1 INTRODUCTION

Method A soil cleanup levels must comply with the requirements in WAC 173-340-704 and -740. Both sections specify that Method A soil cleanup levels must be at least as stringent as:

> "…[c]oncentrations that result in no significant adverse effects on the protection and propagation of terrestrial ecological receptors using the procedures specified in WAC 173-340-7490 through 173-340-7493, unless it is demonstrated under those sections that establishing a soil cleanup level is unnecessary…"

WAC 173-340-7490 through 173-340-7493 establish the process and procedures for completing a Terrestrial Ecological Evaluation (TEE). The TEE process includes several steps:

- WAC 173-340-7491(1) establishes criteria for deciding whether a particular site can be excluded from the requirements for preparing a simplified or site-specific TEE. Ecology has reviewed available information and concluded that the TSP does not meet the exclusion criteria in this section.
- WAC 173-340-7491(2) establishes criteria for deciding whether a particular site can be evaluated using the simplified TEE procedures in WAC 173-340-7492. Ecology has reviewed available information and concluded that the TSP does not meet the criteria for using the simplified TEE procedures.
- WAC 173-340-7493 establishes procedures for preparing site-specific TEEs. Ecology has conducted a site-specific TEE for the TSP (Sloan 2011). The results of that evaluation have been used to prepare this appendix.

The results of site-specific terrestrial ecological evaluation have been used to answer two questions

- Will cleanup levels based on human health protection also protect ecological receptors?[1]
- If no, what soil concentrations comply with the narrative standard for ecological protection specified in WAC 173-340-740?

The rest of this appendix is divided into three sections:

- Section A-2 identifies soil cleanup levels for arsenic that are protective for ecological receptors.
- Section A-3 identifies soil cleanup levels for lead that are protective for ecological receptors.
- Section A-4 summarizes some of the uncertainties that were taken into account when developing soil cleanup levels based on ecological protection.

[1] WAC 173-340-7493(1)(d) states that Ecology may determine that "…[n]o further site-specific ecological evaluation is necessary because the cleanup action plans developed for the protection of human health will eliminate exposure pathways of concern to all of the soil contamination.

A.2 SOIL CLEANUP LEVELS FOR ARSENIC THAT PROTECT ECOLOGICAL RECEPTORS

The MTCA Method A soil cleanup level for arsenic in Table 740-1 is 20 mg/kg. This value was established in 1991 when the initial cleanup standards were published in 1991. The current Method A value takes into account human health risks and soil background concentrations.

A.2.1 Overview of Arsenic Approach

The results of the TEE were used to evaluate whether the arsenic Method A soil cleanup level based on human health protection will also protect ecological receptors. The evaluation includes three comparisons:

- MTCA Table 749-3 Default Concentrations. The Method A soil cleanup level for arsenic was compared to the "default" Ecological Indicator Soil Concentrations (EISCs) specified in Table 749-3. For wildlife, the EISCs were developed using the default model parameter values shown in MTCA Tables 749-4 and 749-5. As shown in Table A-1, the EISCs for soil biota and wildlife (birds and mammals) are both higher than 20 mg/kg. This indicates that the current Method A value will also be protective for these ecological endpoints. However, the EISC for plants (10 mg/kg) is less than the Method A cleanup level indicating that some level of risk may remain at 20 mg/kg.
- TSP TEE Concentrations. The Method A soil cleanup level for arsenic was compared to the "TSP-specific" Ecological Indicator Soil Concentrations (EISCs) that are described in Sloan (2011). The TSP-specific values were developed using the methods specified in MTCA Tables 749-4 and 749-5 and site-specific data collected during the TEE for the TSP (Sloan 2011). As shown in Table A-1, the EISCs for plants, soil biota and wildlife (mammalian predators, avian predators and mammalian herbivores) are all higher than 20 mg/kg. This indicates that the current Method A value is also protective for these ecological endpoints.
- TSP TEE Concentrations With EPA Toxicity Data. The Method A soil cleanup level for arsenic was compared to the MTCA Ecological Indicator Soil Concentrations (EISCs) that were developed using the methods specified in Tables 749-4 and 749-5, information collected during the TEE for the TSP and EPA Ecological Soil Screening Level (Eco SSL) toxicological information (i.e., replacing Ecology Toxicity Reference Values, TRVs as specified in Table 749-5). These values are also discussed in Sloan (2011). As shown in Table A-1, the EISCs for plants, soil biota, avian predators and mammalian herbivores are all higher than 20 mg/kg. This indicates that the current Method A value is also protective for these ecological endpoints. However, the EISC for mammalian predators using the EPA TRV (11 mg/kg) is less than the Method A cleanup level indicating that some level of risk may remain at 20 mg/kg.

A.2.2 Arsenic Ecological Indicator Soil Concentrations

Considering the various methodologies presented above in A.2.1, Ecology has concluded that cleanup actions that comply with the current Method A soil cleanup levels for arsenic (20 mg/kg) and lead (250 mg/kg) will also protect ecological receptors in the TSP. The rationale for this conclusion includes:

1. **Plants**. The EISC in Table 749-4 is less than 20 mg/kg. However, the EISC value developed using the results from the site-specific TEE (Sloan, 2011) indicates that the current MTCA Method A soil cleanup level should also prevent significant adverse effects on plants. The MTCA Method A soil cleanup level is also similar to the plant Eco-SSL (18 mg/kg) developed by EPA.

2. **Soil biota**. The current Method A soil cleanup for arsenic (20 mg/kg) is lower (more protective) that the ecological screening values developed using all three approaches. Consequently, the current Method A soil cleanup should also prevent significant adverse effects on soil biota.

3. **Mammalian predators.** The EISC developed using Tables 749-4, 749-5 and results from the TEE indicate that the current Method A soil cleanup will prevent significant adverse effects on mammalian predators. The EISC of 11 mg/kg using EPA toxicity data instead of Ecology TRVs is less than the Method A cleanup level indicating that some level of risk may remain at 20 mg/kg. However, further evaluation of the screening levels and underlying information indicates that the current MTCA Method A soil cleanup level (20 mg/kg) should also prevent significant adverse effects on mammalian predators. This conclusion is based on the following considerations:

- EPA Eco-SSLs. The Method A soil cleanup level (20 mg/kg) is lower (more protective) than the EPA Eco-SSLs. EPA has calculated a range of mammalian Eco-SSLs for arsenic using three surrogate receptor groups. The lowest value (46 mg/kg) is based on a mammalian ground insectivore (shrew). The higher value (170 mg/g) is based on a mammalian herbivore (vole) and mammalian carnivore (weasel).

- Selected Toxicity Reference Value (TRV). The EPA toxicity reference values to support the arsenic EcoSSL were developed using a different approach[2] than the one specified in the MTCA rule. Specifically, WAC 173-340-7493(4) states that "…[t]oxicity reference values or soil concentrations established from the literature shall represent the lowest relevant LOAEL found in the literature…" Use of the LOAEL is considered more appropriate and is consistent with EPA's Ecological Risk Assessment Guidance for Superfund (USEPA 1997) given that NOAELs are without effect (by definition) and LOAELs are better predictors of the approximate threshold dose where potential for low level ecological effects may occur. The lowest unbounded mammalian LOAEL reviewed by EPA (2005) is 1.66 mg/kg/day. The EISC calculated using this toxicity value is 17 mg/kg and is largely equivalent to the Method A cleanup level (20 mg/kg). The Ecology LOAEL results in an EISC that is higher than that using the EPA LOAEL. The EPA and Ecology LOAELs result in EISC values equivalent to or higher than the Method A arsenic cleanup level (20 mg/kg) for mammalian predators.

- Depth of Contamination Versus Exposure. Reports on TSP soil contamination indicate that most of the arsenic soil contamination is found in the upper 6-12 inches of the soil (PHSKC & Glass 2000; Glass 2002; Glass 2004; PGG 2005). The MTCA wildlife exposure model provides a conservative (lower) estimate of an arsenic soil cleanup level because it does not take into account that small burrowing mammals (the MTCA target mammal species) are exposed to soil at multiple depth intervals over time and are not exposed to only the top few inches where contamination is highest.

4. **Avian predators**. The current Method A soil cleanup for arsenic (20 mg/kg) is lower (more protective) that the ecological screening values developed using all three approaches. The MTCA Method A soil cleanup level is also lower than the arsenic EPA Eco-SSL (43 mg/kg) for avian predators. Consequently, the current Method A soil cleanup should also prevent significant adverse effects on avian predators.

5. **Mammalian herbivores**. The current Method A soil cleanup for arsenic (20 mg/kg) is lower (more protective) that the ecological screening values developed using all three approaches. The MTCA Method A soil cleanup level is also significantly lower than the EPA Eco-SSL (170 mg/kg) for mammalian herbivores. Consequently, the current Method A soil cleanup should also prevent significant adverse effects on mammalian herbivores.

[2] EPA uses a different methodology to calculate TRVs and EcoSSLs. Specifically, EPA uses the NOAEL values for growth and reproduction endpoints to calculate a geometric mean NOAEL. This is then compared to the lowest bounded LOAEL for growth, reproduction and survival. If the geometric mean NOAEL is lower than the lowest LOAEL, the highest NOAEL less than the LOAEL is used to establish the TRV.

Table A-1: Ecological Indicator Soil Concentrations for Arsenic

	Default Screening Values Based on Information in Tables 749-4 and 749-5	TSP Screening Values Based on Information in Sloan (2011), and Tables 749-4 and 749-5	TSP Screening Values Based on Information in Sloam (2011), EPA Toxicity Values and Tables 749-4 and 749-5
Plants	10	38	38
Soil Biota	60	62	62
Mammalian Predator	132	368	11
Avian Predator	150	339	35
Mammalian Herbivore	1306	2957	88
ESA Species[1]	Site Specific	Site Specific	Site Specific
Lowest	10	38	11

1 If plants or animals addressed under the Endagered Species Act are present Ecology should be consulted to develop a site-specific cleanup level

A.3 SOIL CLEANUP LEVELS FOR LEAD THAT PROTECT ECOLOGICAL RECEPTORS

The MTCA Method A soil cleanup level for lead in Table 740-1 is 250 mg/kg. This value was established when the initial cleanup standards were published in 1991. The current Method A value is based on preventing unacceptable blood lead levels in children exposed to lead-contaminated soils.

A.3.1 Overview of Lead Approach

The results of the TEE were used to evaluate whether the lead Method A soil cleanup level based on human health protection will also protect ecological receptors. The evaluation includes three comparisons:

- MTCA Table 749-3 Default Concentrations. The Method A soil cleanup level for lead was compared to the "default" Ecological Indicator Soil Concentrations (EISCs) specified in Table 749-3. For wildlife, the EISCs were developed using the default model parameter values shown in MTCA Tables 749-4 and 749-5. As shown in Table A-2, the EISCs for soil biota and mammalian herbivores are both higher than 250 mg/kg. This indicates that the current Method A value is also protective for these ecological endpoints. However, the EISC for plants (50 mg/kg), mammalian predators (125 mg/kg) and avian predators (118 mg/kg) are less than the Method A cleanup level indicating that some level of ecological risk may remain at 250 mg/kg.
- TSP TEE Concentrations. The Method A soil cleanup level for lead was compared to the "TSP-specific" Ecological Indicator Soil Concentrations (EISCs) that are described in Sloan (2011). The TSP-specific values for wildlife were developed using the methods specified in Tables 749-4 and 749-5 and information collected during the TEE for the TSP. As shown in Table A-2, the EISCs for mammalian predators and mammalian herbivores are both higher than 250 mg/kg. This indicates that the current Method A value is also protective for these ecological endpoints. However, the EISC for plants (67 mg/kg), soil biota (200 mg/kg) and avian predators (225 mg/kg) is less than the Method A cleanup level, indicating that some level of ecological risk may remain at 250 mg/kg,
- TSP TEE Concentrations With EPA Toxicity Data. The Method A soil cleanup level for lead was compared to the Ecological Indicator Soil Concentrations (EISCs) that were developed using the methods specified in Table 749-4, information collected during the TEE for the TSP and EPA EcoSSL toxicological information. These values are also discussed in Sloan (2011). As shown in Table A-2, the EISCs for mammalian herbivores are higher than 250 mg/kg. This indicates that the current Method A value is also protective for this ecological receptor. However, the EISC values for plants (67 mg/kg), soil biota (200 mg/kg), mammalian predators (73 mg/kg) and avian predators (32 mg/kg) are less than the Method A cleanup level indicating that some level of ecological risk may remain at 250 mg/kg,

A.3.2 Lead Ecological Indicator Soil Concentrations (EISCs)

Considering the methodologies presented above in A.3.1, Ecology has concluded that cleanup actions that comply with the Method A soil cleanup levels for arsenic (20 mg/kg) and lead (250 mg/kg) will protect ecological receptors in the TSP. The rationale for this conclusion is as follows:

1. **Plants**. The current Method A soil cleanup level (250 mg/kg) is higher (less protective) than the EISCs in Table 749-3 (50 mg/kg) and Sloan (2011) (67 mg/kg). However, further evaluation of the screening levels and underlying information indicates that the

Method A soil cleanup level (250 mg/kg) should prevent significant adverse effects on plants. Specifically:

- Depth of Contamination Versus Exposure. Ecology soil toxicity tests with plants were based on surficial soil exposure only (top few inches) rather than an effective soil exposure that occurs across a deeper soil horizon, and which more accurately represents the horizon over which plant root exposure will actually occur. Therefore TSP TEE bioassay results conservatively represent potential exposure for vegetation in the TSP. Soil studies in the TSP area indicate that lead occurs in the top few inches of soil (PHSKC & Glass 2000; Glass 2002; Glass 2004; PGG 2005). The roots of most plants in TSP will extend well beyond the top few inches and result overall in lower effective exposures of plant roots to lead.

- Lead/Arsenic Soil Ratios. Soil data for TSP (PHSKC & Glass 2000; Glass 2002; Glass 2004; PGG 2005) indicate co-occurrence of lead and arsenic. Generally, lead co-occurs with arsenic at a 4:1 ratio across TSP soils (i.e., the soil lead concentrations are up to four times higher than co-occuring soil arsenic concentrations). Removal of soils to the proposed arsenic cleanup value of 20 mg/kg will also remove lead and translate to an effective lead cleanup level of 80 mg/kg; well below the Method A soil lead cleanup level of 250 mg/kg. Considering the plant root exposure uncertainties discussed above, the plant screening level discussed in Sloan (2011) of 67 mg/kg can reasonably be considered equivalent to the effective lead cleanup level (80 mg/kg) achieved with the arsenic cleanup level of 20 mg/kg. Thus, the effective exposure of plant roots to lead would be to concentrations considerably lower than the Method A cleanup level. Therefore, the effective lead cleanup level of 80 mg/kg will be protective of significant adverse effects on plants.

2. **Soil Biota**. The current Method A soil cleanup level (250 mg/kg) is lower (more protective) than the EISC (500 mg/kg) in Table 749-3. However, the EISC developed using the results from the TEE (200 mg/kg) is lower than the Method A cleanup level indicating that some level of risk may remain at 250 mg/kg Further evaluation of the screening levels and underlying information indicates that the lead Method Asoil cleanup level (250 mg/kg) should prevent significant adverse effects on soil biota. This conclusion is based on the following considerations:

    - EPA Eco-SSL. The Method A soil cleanup level (250 mg/kg) and the EISC developed from the TEE (200 mg/kg) are both significantly lower (more protective) than the EPA Eco-SSLs for soil invertebrates (1,700 mg/kg).

    - Depth of Contamination and Exposure. Ecology soil toxicity tests with soil biota (Sloan 2011) were based on surficial soil exposure only (top few inches) rather than an effective soil exposure across a deeper soil horizon, which more accurately represents the depth over which invertebrate and other soil biota exposures will occur. Soil studies across the TSP area indicate that lead contamination is limited to the top few inches of soil (PHSKC & Glass 2000; Glass 2002; Glass 2004; PGG 2005) and a higher cleanup level should protect against adverse effects on soil biota exposed across a broader soil horizon depth.

    - Lead/Arsenic Soil Ratios. Soil data (PHSKC & Glass 2000; Glass 2002; Glass 2004; PGG 2005) indicate co-occurrence of lead and arsenic in TSP soils. Lead co-occurs with arsenic at a 4:1 ratio in TSP soils (i.e., the soil lead concentrations are up to four times higher than co-occuring soil arsenic concentrations). Removal of soils to the proposed arsenic cleanup value of 20 mg/kg will remove lead and translate to an effective lead cleanup level of approximately 80 mg/kg; well below the TEE soil biota EISC (200 mg/kg) and the Method A soil lead cleanup level (250 mg/kg).

3. **Mammalian Predators**. The current Method A soil cleanup level (250 mg/kg) is lower (more protective) than the ecological screening value (309 mg/kg) developed using the results from the TEE (Sloan 2011). However, the default EISC calculated from Table 749-5 (125 mg/kg) and the EISC using EPA toxicity data (73 mg/kg) are both lower than the Method A cleanup level, indicating that some level of risk may remain at 250 mg/kg. Further evaluation of the screening levels and underlying information indicates that the Method A soil cleanup level (250 mg/kg) should prevent significant adverse effects on mammalian predators. This conclusion is based on the following considerations:

   - Bioavailability. The default MTCA wildlife exposure model (Table 749-3) provides a conservative estimate of a cleanup level because it assumes 100% of soil-bound lead is absorbed into the bloodstream. The most frequently-used human exposure models assume 12% (adults) and 30% (children) of soil-bound lead is absorbed into the bloodstream (USEPA 2001). The EISCs calculated with these bioavailability values range from 30 mg/kg to 329 mg/kg depending on which toxicity values (MTCA default or EPA) and bioaccumulation factors (MTCA default or TSP) are used in the calculations.

   - Lead/Arsenic Soil Ratios. Soil data (PHSKC & Glass 2000; Glass 2002; Glass 2004; PGG 2005) indicate co-occurrence of lead and arsenic in TSP soils. Lead co-occurs with arsenic at a 4:1 ratio across TSP soils (i.e., the soil lead concentrations are up to four times higher than co-occuring soil arsenic concentrations). Removal of soils to the proposed arsenic cleanup value of 20 mg/kg will remove lead and translate to an effective lead cleanup level of 80 mg/kg. The latter is largely equivalent to the EISC using EPA TRV (73 mg/kg) and is well below the proposed lead Method A cleanup level (250 mg/kg), the TEE EISC (309 mg/kg) and the Ecology default mammalian predator EISC (125 mg/kg).

4. **Avian Predator**. The current Method A soil cleanup level (250 mg/kg) is slightly higher (less protective) than the ecological screening value (225 mg/kg) developed using the results from the TEE (Sloan 2011). Additionally, the default Ecology EISC in Table 749-3 (118 mg/kg) and the EISC using EPA toxicity data (32 mg/kg) are also both lower than the Method A cleanup level indicating that some level of risk may remain at 250 mg/kg. Further evaluation of the screening levels and underlying information indicates that the Method A cleanup level (250 mg/kg) should prevent significant adverse effects on avian predators. This conclusion is based on the following considerations:

   - Depth of Contamination and Exposure. Soil studies across TSP indicate that lead contamination is limited to the upper few inches of soil (PHSKC & Glass 2000; Glass 2002; Glass 2004; PGG 2005). Soil invertebrates such as earthworms, which are a typical prey item for avian predators, burrow throughout the soil column to depths of up to 12 inches (Suter 2007) or more in some soil types; a distance at least twice as deep as the contamination depth for lead in TSP. This translates to lower effective lead concentrations in soil biota tissue and overall reduced exposure for avian predators.

   - Lead/Arsenic Soil Ratios. Soil data (PHSKC & Glass 2000; Glass 2002; Glass 2004; PGG 2005) indicate co-occurrence of lead and arsenic in TSP soils. Lead co-occurs with arsenic at a 4:1 ratio across TSP soils (i.e., the soil lead concentrations are up to four times higher than co-occuring soil arsenic concentrations). Removal of soils to the proposed arsenic cleanup value of 20 mg/kg will remove lead and translate to an effective lead cleanup level of 80 mg/kg, which is well below the Method A soil cleanup level of 250 mg/kg and also lower than the default Ecology EISC of 118 mg/kg. An effective soil cleanup level for lead of 80 mg/kg is also more comparable to the EISC based on EPA toxicity data (32 mg/kg), but as discussed in the bullet below, the EPA toxicity data based on LOAEL provides an EISC of approximately 65, which is also comparable to an effective soil cleanup level for lead of 80 mg/kg.

- Selected Toxicity Reference Value (TRV). The EISC based on EPA toxicity data (32 mg/kg) was developed using a different approach[3] than the one specified in the MTCA rule. Specifically, WAC 173-340-7493(4) states that "…[t]oxicity reference values or soil concentrations established from the literature shall represent the lowest relevant LOAEL found in the literature…" Use of the LOAEL is considered more appropriate and is consistent with EPA's Ecological Risk Assessment Guidance for Superfund (USEPA 1997) given that NOAELs are without effect (by definition) and LOAELs are better predictors of the approximate threshold dose where potential low level ecological effects may occur. The lowest bounded LOAEL reviewed by EPA (2005) to support SSL development is 3.26 mg/kg/day. The EISC calculated using this toxicity value is 65 mg/kg, which is comparable to the effective soil lead cleanup level (80 mg/kg) achieved based on an arsenic cleanup level (20 mg/kg) and would not result in significant effects to avian predators.
- Bioavailability. The EISC calculated using the default MTCA wildlife exposure model (Table 749-3) provides a conservative estimate of a cleanup level because it assumes 100% of soil-bound lead is absorbed into the bloodstream. No data on lead oral absorption from soil or diet in terrestrial birds is available[4]. In sheep and cattle, 1-2% inorganic lead is reported to be absorbed and the most frequently-used human exposure models assume 12% (adults) and 30% (children) of soil-bound lead is absorbed into the bloodstream (USEPA 2001). The avian EISCs calculated with these bioavailability values (2%, 12%, 30%) range from 20 mg/kg to 386 mg/kg depending on which toxicity values (MTCA default or EPA) and bioaccumulation factors (MTCA default or TSP) are used in the calculations.
- **Mammalian Herbivores**. The current Method A soil cleanup for lead (250 mg/kg) is lower (more protective) that the ecological screening values developed using all three approaches (Table A-2). The MTCA Method A soil cleanup level is also significantly lower than the EPA Eco-SSL (1,200 mg/kg) for mammalian herbivores and will be protective of all ecological receptors.

Table A-2: Ecological Indicator Soil Concentrations for Lead

	Default Values Based on Information in Tables 749-4 and 749-5	TSP Values Based on Information in Sloan (2011), and Tables 749-4 and 749-5	TSP Values Based on Information in Sloan (2011), EPA Toxicity Values and Tables 749-4 and 749-5
Plants	50	67	67
Soil Biota	500	200	200
Mammalian Predator	125	309	73
Avian Predator	118	225	32
Mammalian Herbivore	2132	1157	286
ESA Species[1]	Site Specific	Site Specific	Site Specific
Lowest	50	67	32

1 If plants or animals addressed under the Endagered Species Act are present Ecology should be consulted to develop a site-specific cleanup level

[3] EPA uses a different methodology to calculate TRVs and EcoSSLs. Specifically, EPA uses the NOAEL values for growth and reproduction endpoints to calculate a geometric mean NOAEL. This is then compared to the lowest bounded LOAEL for growth, reproduction and survival. If the geometric mean NOAEL is lower than the lowest LOAEL, the highest NOAEL less than the LOAEL is used to establish the TRV.

[4] Available literature data address lead shot ingestion by waterfowl (as grit), which is not relevant to the lead soil exposure scenario evaluated for TSP.

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A.4 UNCERTAINTIES IN UPDATED ECOLOGICAL INDICATOR SOIL CONCENTRATIONS (EISCS))

The uncertainties associated with the conditions of soil exposure for ecological receptors were considered in recommending the most appropriate cleanup level for the TSP.

A.4.1 Toxicity Reference Values

A significant source of uncertainty in the EISC values is the source of the selected TRV for either mammals or birds. Ecology EISC values were updated using either Ecology (WAC 173-340-9000 Table 749-5) or EPA (USEPA 2005) Toxicity Reference Values (TRVs) (Tables A-1, A-2). The EPA TRVs are more current than Ecology's TRVs but are derived using a different methodology using No-Observed-Adverse-Effect levels (NOAELs) instead of Low-Observed-Adverse-Effect Level (LOAELs) TRVs as specified in MTCA (WAC 173-340-7493(4)). The LOAEL more accurately represents the threshold where low levels of adverse effects can begin to occur and are used in baseline ecological risk assessments (USEPA 1997).

Wildlife EISC values developed using EPA NOAEL TRV values were predictably lower than those estimated using Ecology LOAEL TRVs. Ecology recognizes that there is potentially significant uncertainty in the literature-based wildlife TRVs for both lead and arsenic and that development of TSP-specific TRVs was beyond the scope of the TSP TEE. Accordingly, Ecology made a policy decision to utilize the TRVs established in MTCA (WAC 173-340-7493(4)) recognizing that the basis for TRVs underlying EISC values will likely be revisited during future MTCA rule-making activities.

A.4.2 Depth of Contamination

Depth of contamination in TSP soil versus the depths over which exposure occurs is a source of uncertainty in developing EISC values for cleanup. Plants and soil biota (surrogate invertebrate species) naturally occur over a deeper soil horizon than the shallow surficial soil horizon (top few inches) that was sampled and tested (bioassay) in the TSP TEE (Sloan 2011).

For plants in general, water, nutrient and contaminant absorption (uptake) from soil occurs across the length (and width) of the root system (Green et al 2006), which for TSP vegetation (e.g., a large variety of shrubs, forbs and grasses) will vary notably in terms of soil vertical depth (some may be shallower but many will also be deeper). Similarly, soil invertebrates such as the earthworm burrow throughout the soil column to depths of up to 12 inches (Suter 2007) or more in some soil types; a distance at least twice as deep as the TSP soil sample collection depth.

The TSP bioassay results for lettuce seed and earthworm using the top few inches of TSP soil are conservative in application as an ecological cleanup level to a 1000 square-mile area where vegetation and invertebrate exposures to soil will occur over depths greater than the contamination horizon. Sweet Cicely (licorice root), a perennial herb sampled in the TSP study, is reported by cultivators to have roots that grow quite deep (Alternative Nature 2011; Herbs2000 2011), while salal, evergreen huckleberry and

Oregon Grape are reported to have roots that grow to “medium” (as opposed to surficial) soil depths (Bosky Dell Natives 2011). The roots of salal and Oregon grape are reported to grow to greater than 12 inches (Gardenguides 2011). For birds, time spent foraging in TSP surficial soil is likely to be more representative of actual exposures (exceptions would be burrowing birds of prey) than would be the case for small mammals like shrews where burrowing is the rule rather than the exception.

A.4.3 Bioavailability

Bioavailability (absorption into the bloodstream from soil) is a source of uncertainty for bird and mammal EISC values because complete absorption of arsenic and lead is assumed in the values shown in Tables A-1 and A-2. Incorporating bioavailability predictably results in higher cleanup values using all calculation methods (Sections A.2.2, A.3.2), while the assumption of complete absorption assumed in the cleanup values of Tables A-1 and A-2 result in more protective (conservative) cleanup values. Given the site-specific nature of the TSP TEE, consideration of bioavailability is appropriate for determining EISC values for wildlife (birds, mammals) in the TSP study area and is consistent with the Agency’s established TEE procedures.

A.4.4 Other Considerations

Finally variability in the cleanup level for lead that will be achieved across the TSP when arsenic is remediated to its soil cleanup level of 20 mg/kg should be recognized. Data indicate that lead/arsenic soil ratios occurring across TSP result in an “effective” cleanup level for lead that is notably lower than the recommended Method A lead cleanup level of 250 mg/kg. In general, the TSP studies (PHSKC & Glass 2000; Glass 2002; Glass 2004; PGG 2005) indicate that the ratio of lead to arsenic in TSP soil varies around the 4:1 ratio (some locations with lower and some with slightly higher ratios) but a majority of soils fall within the 4:1 ratio. Overall, the 4:1 ratio is representative of TSP and during actual remediation provides a margin of safety to protect bird and mammal receptors from lead exposure when the arsenic cleanup level is achieved.

A.5 RECOMMENDED SOIL CLEANUP LEVELS FOR TSP

As shown in Table A-3, Ecology is recommending the MTCA Method A cleanup levels for both arsenic (20 mg/kg) and lead (250 mg/kg) in TSP soils. These values will be protective of both human and ecological receptors based on the findings of the TSP TEE discussed in A.2. In selecting the cleanup level for lead specifically, Ecology considered the benefit gained by remediating soil to a lower cleanup concentration protective of invertebrate and plant communities in light of the potential for destroying these communities and their habitat during a property soil cleanup. As discussed in A.4 for lead, higher cleanup levels than those based on plant community protection should still be protective given uncertainties in the exposure of vegetation and invertebrate communities across the TSP and the conservatism inherent in the Ecology TEE toxicity test results (Sloan 2011).

Ecology's TEE evaluated soil toxicity to plants and soil biota based on surficial soil exposure only (top few inches) rather than an effective soil exposure across the full soil horizon over which plants and soil biota are generally exposed. Similarly, higher cleanup levels than those in Table A-2 for avian predators should still be protective given both bioavailability considerations and the lower effective lead cleanup level achieved when arsenic is remediated to the recommended level of 20 mg/kg. The effective lead soil cleanup level of approximately 80 mg/kg achieved during arsenic cleanup results in an effective EISC that is closer to the lower screening levels established in Table A-2 for plants and avian predators.

Table A-3. Recommeneded TSP Soil Cleanup Levels

Chemical	Arsenic	Lead
Cleanup Level	20 mg/kg	250 mg/kg

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Appendix D
Tacoma Smelter Plume Cleanup Levels, Action Levels, and Human Health Risk

Cleanup Levels, Action Levels, and Human Health Risk

D.1 Introduction

This appendix explains the arsenic and lead action levels and cleanup levels for Tacoma Smelter Plume cleanup. It also describes how the Environmental Protection Agency (EPA) set action levels for the Asarco Superfund cleanup. The different cleanup levels and action levels are summarized in Tables D.1 and D.2. The following sections cover

- **State cleanup levels** – The Model Toxics Control Act (MTCA) establishes soil cleanup levels for arsenic and lead. Section D.2 describes the cleanup levels for arsenic and lead that Ecology will meet when cleanup is done (Table D.1).
- **Former interim action trigger levels** – the levels in a play area at which Ecology used to advise people to do cleanup (Table D.2).
- **Tacoma Smelter Plume action levels** – Ecology is cleaning up part of the Tacoma Smelter Plume. The plume is part of the larger Asarco Tacoma Smelter site. It is the area impacted by air emissions from the former Asarco smelter in north Tacoma. Arsenic and lead pollute surface soils across over 1,000 square miles. Section D.4 describes the levels that prompt Ecology to do cleanup (Table D.2).
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- **EPA action levels** – EPA is cleaning up yards in the Ruston/North Tacoma Study Area. This is about a one square mile area around the former smelter. However, EPA has a higher action level than Ecology. This leaves some yards with what Ecology believes is a high level of contamination. Ecology plans to offer voluntary cleanup to these homeowners, even though they are in the Superfund site. Section D.5 describes the levels that prompt EPA to do cleanup within the Ruston/North Tacoma Study Area (Table D.2).

Table D.1 Cleanup levels in parts per million (ppm)

Arsenic		Lead	
Average	**Maximum**	**Average**	**Maximum**
20	40	250	500

Table D.2 Ecology current and past action levels and EPA's action level (ppm)

Type of action level	Arsenic		Lead	
	Average	Maximum	Average	Maximum
Interim Action Trigger Levels				
Childcares and schools	100	200	500	1,000
Parks and camps	200	400	700	1,400
Current Ecology action levels				
Soil Safety Program (play areas)	20	40	250	500
Yard sampling and cleanup	100	200	500	1000
EPA action levels				
Yard cleanups	230	--	500	--

D.2 State Cleanup Levels for Arsenic and Lead

Ecology used Model Toxics Control Act (MTCA) Method A to set soil cleanup levels for arsenic and lead. Method A may be used at routine cleanup sites or sites with a limited number of hazardous substances [WAC 173-340-704(1)]. Arsenic and lead are the indicator hazardous substances for areas impacted by Asarco smelter emissions. Cleanup of arsenic and lead will address any other soil contamination from Asarco smelter air emissions, such as cadmium. The soil cleanup level for arsenic is 20 parts per million (ppm) and lead is 250 ppm. These cleanup levels protect human health and the environment.

D.2.1 The arsenic cleanup level is 20 parts per million.

Arsenic is known to cause certain cancers. The most common of these are bladder, lung, non-melanoma skin cancer, liver, and kidney. Other toxic effects include decreased production of red and white blood cells, abnormal heart function, blood vessel damage, liver damage, kidney damage, diabetes mellitus, and impaired nerve function.

MTCA sets cleanup levels for cancer-causing chemicals like arsenic so that the risk of cancer is small. For places people live, the goal is to reduce the lifetime risk of cancer from any one chemical to one-in-one million or less. That is one more cancer than you would expect to see in a group of one million people. Lifetime cancer risk refers to the likelihood that a person will get cancer during their life.

MTCA provides a risk-based formula for calculating soil cleanup levels for residential properties [WAC 173-340-740(3)(b)(iii)(B)(II) Equation 740-2] as follows:

$$\textbf{Soil Cleanup Level (mg/kg)} = \frac{\textbf{RISK x ABW x AT x UCF}}{\textbf{CPF x SIR x AB1 x ED x EF}}$$

RISK = Acceptable cancer risk level (**1E-6**)(one-in-one million)
ABW = Average body weight over the exposure duration (**16 kg**)
AT = Averaging time (**75 years**)
UCF = Unit conversion factor (**1,000,000 mg/kg**)
CPF = Carcinogenic Potency Factor (for arsenic **1.5 kg-day/mg**)
SIR = Soil ingestion rate (**200 mg/day**)
AB1 – Gastrointestinal absorption fraction (**1.0**) (unitless)
ED = Exposure duration (**6 years**)
EF = Exposure frequency (**1.0**)(unitless)

Pollutants have more of an effect on children than on most adults. Therefore, the risk formula includes numbers based on a child's exposure. For example, it assumes that a child eats 200 milligrams (mg) of soil every day for the first six years of childhood. If the child grows up to be 75 years of age, their risk of cancer from that exposure should only be one-in-one million.

Beyond the age of 6, one's exposure to soil decreases. Adults are believed to ingest around 50 mg per day.

Why children?
Pollutants have more of an effect on children than most adults because

- Developing organs such as the brain can be damaged by even small toxic exposures.
- They drink more water, eat more food, and breathe more air per pound of body weight.
- They are more exposed by being closer to pollutants on or near the ground.
- They play in the dirt and put dirty hands and toys in their mouths.
- Their lungs and intestines absorb a greater proportion of many pollutants than adults'.

A risk-based cleanup level for arsenic that reduces the lifetime cancer risk to one-in-one million is 0.67 ppm.

However, arsenic occurs naturally in soils at background levels higher than the risk-based level of 0.67 ppm. MTCA requires that cleanup levels not be set below natural background levels [WAC 173-340-700(6)(d)]. The upper end of the normal range of arsenic in soil is about 20 ppm. **Hence the MTCA Method A cleanup level for arsenic is 20 ppm**. The arsenic cleanup level of 20 ppm translates to a risk of three-in-one-hundred-thousand people.

See Table D.5 for all the exposure assumptions used in the risk assessment formula.

Background values

In 1988, EPA looked at background levels of arsenic and other metals in the Ruston/North Tacoma Study Area. This was part of the Endangerment Assessment for the study area (Black & Veatch, 1988). The data came from other studies in Pierce County, beyond the Ruston study area. Urban and rural background levels for arsenic were 20 ppm and 6 ppm. Ecology used the background value of 20 ppm to set the MTCA Method A value.

In 1994, Ecology published Natural Background Soil Metals Concentrations in Washington State. The study gave a range of natural levels for metals in surface soils throughout the state. The arsenic range is 7-10 ppm. While the later study gave a lower natural background for arsenic than the Method A value, Ecology has not revised the standard.

Ecology studied soil arsenic uptake by invertebrates (such as worms) and plants from throughout the plume. Ecology also did lab studies of soil toxicity to invertebrates and plants (Ecology 2011). These data helped in developing arsenic cleanup levels for

- Soil biota – 62 ppm
- Plants – 38 ppm
- Wildlife – 339 ppm

See Appendix C, Model Remedies Feasibility Study, for details of the methods used to develop these cleanup levels. **The Method A cleanup level of 20 ppm for arsenic also protects ecological receptors.**

D.2.2 The State's lead cleanup level is 250 parts per million.

Ecology set the MTCA Method A lead cleanup level of 250 ppm in 1991. Ecology set this level to protect children against the toxic effects of lead. Levels of lead in the blood predict a child's risk. In 1991, the Centers for Disease Control and Prevention (CDCP) believed that a level of 15 micrograms of lead per deciliter of blood (ug/dL) posed a serious risk.

Ecology set the state cleanup level using a model that links soil lead to blood lead levels. Ecology used the model to estimate the soil lead level where there was less than a one percent chance of causing blood lead levels above 15 ug/dL.

Ecology used a simple slope factor model to set the lead cleanup level. Figure D.1 shows the model. Key features of the model include:

- **The cleanup level prevents unacceptable lead risks in young children.** Ecology's decision was based on three main factors:

  (1) Infants, young children, and fetuses are more vulnerable because lead interferes with the development of the central nervous system.

  (2) Young children are more likely to be exposed to lead contaminated soils because of greater contact with soil and house dust. Children play in the dirt and put dirty hands and toys in their mouths.

  (3) Children absorb a greater percent of the lead they ingest than adults do.

- **The cleanup level prevents blood lead levels over 15 ug/dL in over 99% of children exposed to lead-contaminated soils.** Ecology calculated the **average** (mean) blood lead level where 99 percent of children are predicted to have blood lead levels below 15 ug/dL. Using a standard deviation of 3.1, a mean blood lead level of 7.8 ug/dL should ensure this.

- **Children are exposed to lead from many sources.** Ecology used information from the Agency for Toxic Substances and Disease Registry (ATSDR) to estimate non-site or "background" lead exposure. At that time, ATSDR estimated that background levels in rural areas resulted in average blood lead levels of 6.4 ug/dL.

- **The blood lead to soil ratio is 4.5 ug/dL/1000 mg/kg.** Blood lead to soil ratios given in the scientific literature range from 0.6 to 6.8 ug/dL/1000 mg/kg. Ecology used a value of 4.5 to predict soil lead levels likely to not increase child blood levels by more than 1.4 ug/dL.

Ecology used a simple slope factor model to set the soil cleanup level. It assumes that

1. A mean blood lead level of 7.8 ug/dL ensures that over 99 percent of young children have blood lead levels under 15 ug/dL.
2. Background exposure in rural areas results in average blood lead levels of 6.4 ug/dL.
3. The ratio of blood lead to soil is 4.5 ug/dL/1000 mg/kg.

Ecology used the following equation to calculate a lead cleanup level of 300 ppm, then adjusted it downward to 250 ppm. Ecology based this change on a review of other regulatory programs and the coming CDCP decision to lower the blood lead screening guidelines.

Figure D.1 Slope Factor Equation Used To Establish 1991 Soil Cleanup Level for Lead

$$\textbf{Cleanup Standard} = \frac{\textbf{(BLL (total) – BLL (bkgd))}}{\textbf{Slope Factor}}$$

BLL(tot) = Target Blood Lead Concentration (7.8 ug/dL)
BLL (bkgd) = Background or Non-site Lead Exposure (6.4 ug/dL)
Slope factor = Blood lead to soil ratio (4.5 ug/dL/1000 mg/kg)

Since 1991, two major changes have impacted how Ecology sets cleanup levels for lead for certain sites:

- First, the Centers for Disease Control and Prevention (CDCP) published new blood lead guidelines (see Table D.3). Children have elevated lead if the amount in blood is equal to or greater than 10 ug/dL. The CDCP also recommends investigation and action if blood lead levels remain at or above 15 ug/dL. The CDCP is now reviewing the federal guidelines based on more recent science showing blood levels below 10 ug/dL may be harmful to children.
- Second, EPA developed a new child blood lead model called the Integrated Exposure Uptake Blood Kinetic (IEUBK) Model. State and federal agencies now use this model to set site-specific cleanup levels.

Ecology reviewed the MTCA cleanup level for lead in 2001 and chose not to revise it. The agency was considering changes to this level in 2010, before the Governor’s freeze on rule-making. Ecology continues to use the current value of 250 ppm to set site cleanup levels. Ecology believes this level will protect children’s health, particularly when used in combination with the arsenic cleanup level of 20 ppm.

Table D.3 How to read blood lead test results and what actions to take

Class	Blood lead level (µg/dl)	Action
I	= or < 9	Not considered to be lead-poisoned
IIA	10-14	Many children or a large proportion of children in this range should trigger community-wide childhood lead poisoning prevention. Children in this range may need screening more often.
IIB	15-19	Take actions to improve the child's diet and educate them and their family. Do more frequent screening of the child. If levels stay in this range, look for and reduce exposures at home or other places the child spends time.
III	20-44	**This is a high level.** Look for and reduce exposures in the home or other places the child spends time. Take the child to the doctor. They may need drug treatment for lead poisoning.
IV	45-69	This is a **dangerous level**. Begin medical treatment, including chelation therapy, and reduce exposures.
V	= or > 70	This is a **medical emergency.** Begin medical treatment and reduce exposures right away**.**

Adapted from CDCP, Preventing Lead Poisoning in Young Children. A Statement by the Centers for Disease Control, October, 1991. U.S. Department of Health and Human Services/Public Health Service.

See Table D.6 for some of the exposure assumptions used in the lead model.

Ecology studied soil lead uptake by invertebrates (such as worms) and plants from throughout the plume. Ecology also did lab studies of soil toxicity to invertebrates and plants (Ecology 2011). These data helped in developing cleanup levels for

- Soil biota – 200 ppm
- Plants – 67 ppm
- Wildlife – 225 ppm

See Appendix C, Model Remedies Feasibility Study, for the methods used to develop these cleanup levels.

For lead, the Method A human health cleanup level is less protective of ecological receptors. However, Ecology believes a lead cleanup level of 250 ppm will still protect overall ecological health. Three factors that support this choice:

1. Plant roots and the depths to which soil biota burrow can vary from inches to several feet. However, lead contamination is mainly in the top six inches of soil.
2. The ratio of lead to arsenic in the Tacoma Smelter Plume is about four-to-one. An arsenic cleanup level of 20 ppm will result in cleanup of lead to around 80 ppm. This is close to the plant cleanup level of 67 ppm.
3. The harm of habitat destruction during cleanup may outweigh the benefit of soil cleanup to plants and soil invertebrates.

D.3 Interim Action Trigger Levels

Ecology can do partial cleanup, interim actions, to reduce risk before making a final cleanup plan. In fall 2000, during the child-use area study on Vashon-Maury Island, Ecology began looking into doing interim actions for play areas at schools, childcares, parks, and camps.

Ecology decided to do interim actions because the plume was so large. Finding the extent of the plume and coming up with cleanup plans would take years. Meanwhile, children would be exposed to contaminated soils.

Ecology could not clean up all child-use areas with arsenic over state cleanup levels (20 ppm and 250 ppm) right away because of limited resources. Ecology set interim action trigger levels to decide which child-use areas needed to be cleaned up first (Ecology, 2001). These are arsenic and lead levels that trigger an interim action (Table D.4)

The trigger levels for schools and childcares are lower because children tend to play more often at those places. **Ecology no longer uses the interim action trigger levels, but instead set action levels (Section D.4).**

Table D.4 Interim Action Trigger Levels

	Arsenic (mg/kg or ppm)		Lead (mg/kg or ppm)	
	Average	Maximum	Average	Maximum
Schools/childcares	100	200	700	1400
Parks/camps	200	400	1000	2000

D.3.1 Arsenic Interim Action Trigger Levels

Ecology set arsenic levels to prevent children from getting sick or having unacceptable cancer risks. Ecology used the risk assessment methods in the MTCA rule. However, the agency used a cancer risk level of one-in-ten thousand instead of one-in-one-million. That means one person from among ten-thousand people exposed to the risk factor would develop cancer from it, versus one person in one-million. Ecology also assumed that exposure would be less frequent than the exposure used for setting cleanup levels (Ecology, 2001).

Ecology changed the MTCA risk formula for calculating cleanup levels for residential properties based on the following points:

Acceptable cancer risk level – In the U.S., acceptable cancer risks are mainly between one-in-one million and one-in-ten thousand. Cleanup laws across the U.S. almost always require action when cancer risks are over one-in-ten-thousand. On the other hand, action is rarely required when cancer risks are less than one-in-one-million. Ecology set the interim action trigger levels for arsenic using a cancer risk of one-in-ten-thousand in the MTCA risk-based formula. This is the upper or less protective end of the cancer risk range.

Potential exposure situations - For residential land, MTCA assumes that a child is exposed to soils every day for six years. For the interim action trigger levels, Ecology assumes that a child is exposed every day that they

- Attend school or childcare (180 – 250 days/year for six years).
- Play at parks or children's camps (50 – 100 days/year for six years).

See Table D.5 for the exposure assumptions used in the risk assessment formula.

Table D.5 Comparison of different exposure assumptions for arsenic risk calculation

	Ecology Cleanup Level	**Ecology Interim Action Trigger Level**		**Ecology Action Level**	**EPA Action Level**	
	Resident	**School, childcare**	**Park, camp**	**Resident**	**Resident**	**Resident**
Age	**Child**	**Child**	**Child**	**Child**	**Child**	**Adult**
RISK (unitless)	1E-6	1E-4	1E-4	1E-4	5E-4	5E-4
ABW (kg)	16	16	16	16	15	70
AT (years)	75	75	75	75	30	30
UCF (mg/kg)	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
CPF (kg-day/mg)	1.5	1.5	1.5	1.5	1.75	1.75
SIR (mg/day)	200	200	200	200	200	100
AB1 (unitless)	1	1	1	1	0.8	0.8
ED (years)	6	6	6	6	6	24
EF (unitless)	365/365	250/365	100/365	365/365	350/365	350/365
Calculated level (mg/kg)	0.67	98	247	70	140	326
Final level (mg/kg)	20*	100	200	100**	230***	

*adjusted for background
**adjusted to match school/childcare trigger level
***average of 140 and 326

RISK = Acceptable cancer risk level
ABW = Average body weight over the exposure duration
AT = Averaging time
UCF = Unit conversion factor
CPF = Carcinogenic Potency Factor
SIR = Soil ingestion rate
AB1 – Gastrointestinal absorption fraction
ED = Exposure duration
EF = Exposure frequency

D.3.2 Lead Interim Action Trigger Levels

Ecology set the trigger levels for lead using EPA's child blood lead model. The agency estimated soil levels with less than a five percent chance of causing over 15 micrograms of lead per deciliter of blood (ug/dL). The Centers for Disease Control and Prevention (CDCP) uses this guideline. This is also the same model Ecology uses to set cleanup levels for certain sites. However, for setting the trigger levels, Ecology changed some of the assumptions and inputs to the model (Ecology, 2001):

- **The interim action trigger levels prevent blood lead levels over 15 ug/dL.** The CDCP advises finding and reducing exposures if blood lead levels stay in the 15-19 ug/dL range after taking certain actions (Table D.3). Ecology and local health departments provide outreach on keeping children safe from lead. Thus, Ecology believed the 15 ug/dL guideline was a good basis for deciding which play areas to address first.

- **Children spend less than 350 days per year at school, childcare, parks, and camps.** Ecology usually assumes that children spend 350 days/year in a place, when setting cleanup levels. When setting the trigger levels, Ecology assumed children would spend 180 days/year at schools and childcares, and 100 days/year at parks and camps. This takes into account the length of the school year and seasonal use of camps.

- **Children are exposed to other sources of lead on a daily basis.** The soil and dust insides their homes contains lead, as does their drinking water and food.

See Table D.6 for some of the exposure assumptions used in the lead model.

Table D.6 Comparison of different assumptions for lead risk calculation

Lead	Ecology Cleanup Level	Ecology Interim Action Trigger Level		Ecology Action Level	EPA Action Level
	resident	school/childcare	park/camp	resident	resident
	child	child	child	child	child
Acceptable blood lead level	<15 ug/dl	<15 ug/dl	<15 ug/dl	<15 ug/dl	<10 ug/dl
Percent of population	99%	95%	95%	95%	95%
Exposure frequency	365/365	180/365	100/365	350/365	350/365
Model	PBPK LEAD4*	IEUBK**	IEUBK**	IEUBK**	PBPK LEAD4*
Calculated level (mg/kg)	250	700	1000	500	500

*PBPK – physiologically based pharmoacokinetic model
** IEUBK – Integrated Exposure Uptake and Biokinetic Model

D.4 Ecology's Tacoma Smelter Plume Action Levels

Ecology no longer uses the Interim Action Trigger Levels set in 2001. Instead, action levels show when to take action in the Soil Safety Program and the voluntary yard sampling and cleanup program (Table D.7). The science behind the interim action trigger levels still supports the use of these action levels.

Table D.7 Tacoma Smelter Plume Action Levels

	Arsenic (mg/kg or ppm)		Lead (mg/kg or ppm)	
	Average	**Maximum**	**Average**	**Maximum**
Soil Safety Program	20	40	250	500
Yard sampling and cleanup program	100	200	500	1000

D.4.1 Ecology's Soil Safety Program

For the Soil Safety Program, the action levels are the state's cleanup levels for arsenic and lead. The program addresses schools, licensed childcares, parks, camps, and public multi-family housing within the Soil Safety Program Service Area (map in Appendix A.3). Ecology will clean up play areas above 20 ppm average arsenic (40 ppm maximum), and 250 ppm average lead (500 ppm maximum).

School and childcare play areas are used often by large numbers of children. Public housing serves lower income people and Ecology assumes housing agencies have few resources to clean up on their own. Ecology believes there are enough settlement funds to clean all the play areas in the service area over the cleanup level. Thus, Ecology set the Soil Safety Program action levels at the cleanup levels.

D.4.2 Ecology's Yard Sampling and Cleanup Program

For the yard sampling and cleanup program, the action levels are 100 ppm average arsenic (200 ppm maximum) and 500 ppm average lead (1000 maximum). Ecology does not have enough funding to clean up all yards over the arsenic or lead state cleanup levels. Instead, the program focuses on areas more likely to have high arsenic levels, over 100 ppm. This targets the communities at highest risk, but also property types likely to have child play areas now or in the future.

D.4.2.1 Ecology's arsenic action level for yard cleanups

The science behind the arsenic action level of 100 ppm is the same as the for the interim action trigger level (Table D.5). Ecology used a cancer risk level of one-in-ten thousand, rather than the one-in-one-million used in setting cleanup levels. Ecology looked at adjusting the interim action level for schools and childcares (100 ppm) based on potential differences in exposure frequencies between residential yards and those exposure scenarios. Under this approach, Ecology would have used 70 ppm as an action level for yard cleanups.

However, Ecology has decided to use the previous interim action level of 100 ppm for residential yards. This was a risk management decision. In making that decision, Ecology concluded that the small differences in exposure estimates were not significant when we considered the uncertainties and variability in all of the exposure parameters used in the risk calculations.

Ecology also considered the soil to groundwater pathway. Arsenic levels below 200 ppm are not likely to impact groundwater. This is based on a conservative leaching model used to estimate impacts of area wide soil contamination and these three factors:

1. Soil profile data show that area-wide arsenic and lead have not migrated significantly over a span of 50 years.
2. Drinking water systems on Vashon-Maury Island—an area with high Tacoma Smelter Plume soil contamination—do not show impacts to groundwater[1].
3. Modeling shows arsenic and lead have not migrated significantly in terms of depth. Arsenic and lead from the plume have low mobility, except in soils with high organic content, biodegradable organic compounds like petroleum, and very low pH and waste material (SAB, 2006).

D.4.2.2 Ecology's lead action level for yard cleanups

The science behind the lead action level of 500 ppm is the same as for the interim action trigger level (Table D.6). The action level prevents blood lead levels greater than 15 micrograms of lead per deciliter of blood. Ecology changed the exposure frequency to reflect daily exposure at home (350-365 days per year).

D.5 EPA Action Levels for the Ruston/North Tacoma Study Area

D.5.1 EPA Arsenic Action Levels

The Ruston/North Tacoma Study Area is a unit of the Commencement Bay/Nearshore Tideflats Superfund site. EPA issued a cleanup plan, called a Record of Decision (ROD) in 1993. In the ROD, EPA set the arsenic cleanup level at 20 ppm, based on the MTCA Method A cleanup level. The MTCA cleanup level of 20 ppm still applies to the study area as an "applicable state law." The arsenic action level is 230 ppm. This means

- EPA does clean up yards with levels above 230 ppm
- EPA does not clean up yards with levels below 230 ppm.
- EPA does provide education where levels are between 20 and 230 ppm. Measures include encouraging people to lower their exposure through behavior changes.

Ecology and EPA use similar methods to assess risk, with some differences in the exposure assumptions (see Table D.5). Ecology and EPA also use different acceptable risk ranges. This explains much of the difference between Ecology's action levels and EPA's action levels.

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[1] A 2007 drinking water system study on Vashon and Maury Islands showed that all but one well sampled did not exceed the 10 microgram per liter drinking water standard (King County, 2008). The one well had arsenic concentrations over 40 micrograms per liter.

Federal law does not have standardized cleanup levels in the way that the state does under MTCA. Under Superfund, EPA manages risks within an acceptable risk range for each site. Federal regulations set this range as one-in-one million (same as MTCA) to one-in-ten thousand increased risk of cancer. EPA guidance says the one-in-ten thousand risk can include risks slightly above one-in-ten thousand in some cases. The risk level must be supported by site-specific information. **At the Ruston/North Tacoma Study Area, EPA set the cancer risk level at five-in-ten thousand (same as one-in-two thousand). This resulted in an action level of 230 ppm**.

See Table D.5 for all the exposure assumptions used in the risk assessment formula.

D.5.2 EPA Lead Action Levels

EPA set an action level of 500 ppm for lead. The number is based upon a national goal of reducing children's blood lead levels to no greater than 10 micrograms of lead per deciliter of blood (ug/dL). It is also based on EPA guidance that advises setting soil lead cleanup levels of 500 ppm to 1000 ppm.

EPA used the LEAD4 model to predict when a child might have over 10 ug/dL. EPA looked at a range of soil lead levels within the Ruston/North Tacoma Study Area. Based on the soil data, the risk of a child having over 10 ug/dL varied from 1 percent to 98 percent.

For lead, unacceptable risks occur when a person has greater than a five percent chance of having a blood lead level of 10 ug/dL. **EPA used a model to determine levels of lead in soils that would have less than a five percent chance of causing blood lead levels above 10 ug/dL.**

See Table D.6 for some of the exposure assumptions used in the lead model.

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Appendix E
State Environmental Policy Act Early Scoping, Determination, and Checklist for the Tacoma Smelter Plume Interim Action Plan

DEPARTMENT OF ECOLOGY State of Washington

45-Day Public Comment Period: February 2 – March 20, 2009 **FSID #89267963**

Summary

The Washington State Department of Ecology (Ecology) wants your input! Ecology is seeking comments on potential environmental impacts of a proposed cleanup plan for the Tacoma Smelter Plume (TSP) site. The former Asarco copper smelter in north Tacoma caused widespread arsenic and lead soil contamination. In parts of King, Pierce, and Thurston counties, the arsenic and lead in soils pose a risk to human health and the environment. Ecology is working on a long-term plan to protect human health and clean up the environment. This plan will be called the **Interim Cleanup Action Plan (ICAP)**.

The draft ICAP will go out for public review and comment under the Model Toxics Control Act. At that time, Ecology must make a determination whether the project is likely to have significant adverse environmental impacts. There are three possible outcomes, or "determinations":

- If impacts are significant, Ecology must develop an Environmental Impact Statement (EIS). An EIS looks at possible environmental impacts and describes how to mitigate (lessen) them.
- If impacts are not significant, Ecology may issue a Determination of Non Significance (DNS).
- If there are few environmental impacts and they can be mitigated, Ecology may issue a Mitigated Determination of Non Significance (MDNS) and make changes to the cleanup plans.

Early SEPA scoping (WAC 197-22-265) will help Ecology identify issues that should be considered when making a State Environmental Policy Act determination. How significant are the environmental impacts from this project? Is an environmental impact statement needed? This scoping notice is being sent to state, county, and local agencies involved in SEPA review. It is also being sent to agencies and organizations that may be affected by parts of the ICAP. Your input is very important to us!

What to Comment On

Ecology is proposing a complex strategy to address TSP contamination. Some parts of the strategy may have impacts on the environment and surrounding communities. Please review this document and submit comments on **what Ecology should consider in its assessment of potential environmental impacts from the project**. This information will help the agency determine what impacts are significant and how they can be mitigated.

Later, the public will have the chance to comment on the specific contents of the draft ICAP, aside from the specific environmental impacts that are being scoped now. Ecology expects the draft ICAP and SEPA determination to be issued for public review and comment in late 2009 or early 2010.

What's Inside This Document

Contact Information

For further information about this early scoping notice, please contact Hannah Aoyagi, Public Involvement Coordinator at 360.407.6790 or by e-mail at haoy461@ecy.wa.gov.

A. Introduction

The purpose of early scoping is to gather information about all possible environmental impacts of a project. The Tacoma Smelter Plume (TSP) is a very large and complex site that impacts many different communities, agencies, and organizations. The Interim Cleanup Action Plan (ICAP) is also large and complex, with several different cleanup strategies. Ecology needs your help to identify the full range of **environmental and community impacts** that may result from this proposed cleanup plan. Section C describes the ICAP. See Section E for more information about the types of environmental impacts that are typically analyzed during the SEPA process.

Estimated Schedule

SEPA Early Scoping – comment period	February 2 – March 20, 2009
Ecology review and summary of comments	April – May, 2009
Draft SEPA determination and draft ICAP public comment period	Late 2009 – Early 2010

B. Background

Tacoma Smelter Plume: The Asarco Company operated a copper smelter in Ruston, Washington for nearly 100 years. Air pollution from the smelter's smokestack settled on surface soils over 1,000 square miles of the Puget Sound basin (see Figure 1 on page 3). As a result, many parts of King, Pierce, Thurston, and Kitsap counties have arsenic and lead soil contamination.

The Asarco smelter property and surrounding neighborhood became a federal Superfund site in the 1980s. Starting in 1999, Ecology worked with local health departments in King, Pierce, Kitsap, and Thurston counties to study the extent of contamination beyond the Superfund site. The "footprint" of contamination covered over 1,000 square miles, with a wide range of arsenic and lead concentrations. To address this large area, Ecology provided grant funding to Tacoma-Pierce County Health Department (TPCHD), Public Health – Seattle & King County (PHSKC), and Thurston County Public Health and Social Services Department. The counties continued studying contamination, focusing on child play areas, and began offering education and outreach.

Tacoma Smelter Plume studies and maps can be found at: http://www.ecy.wa.gov/programs/tcp/sites/dirt_alert/studies_and_maps/s_and_m.html.

Area-Wide Task Force: In 2001, the Washington State Departments of Agriculture, Ecology, Health, and Community, Trade & Economic Development chartered a task force on area-wide soil contamination in Washington. The Task Force made recommendations for addressing contaminated areas like the Tacoma Smelter Plume. The foundation of the recommendations was education and awareness-building. Other ideas included focusing on child play areas, assisting residential property owners with cleanup, and working with local governments and organizations to institutionalize soil safety. For exam-

This map is currently being updated to reflect more recent data on soil contamination.

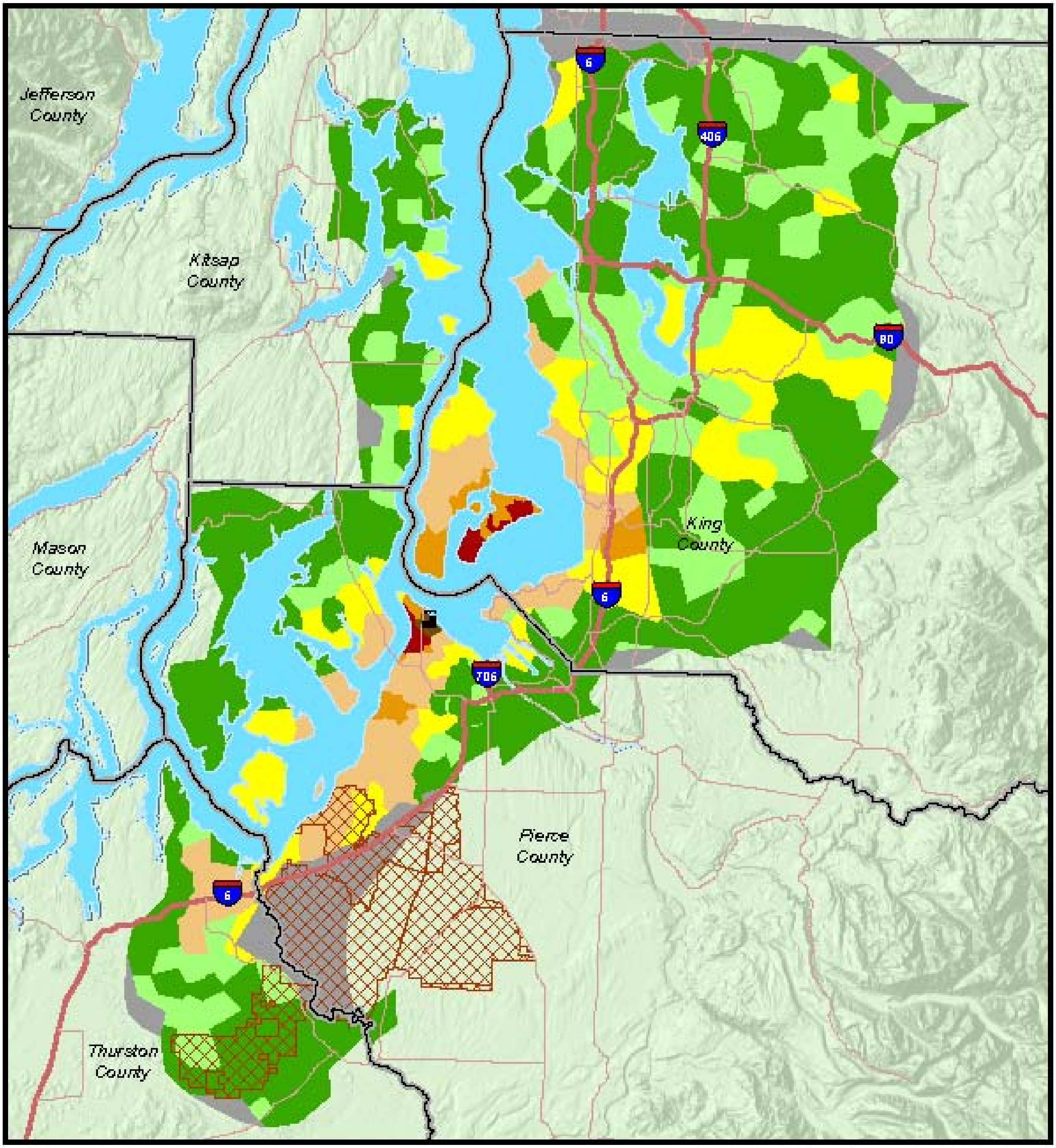
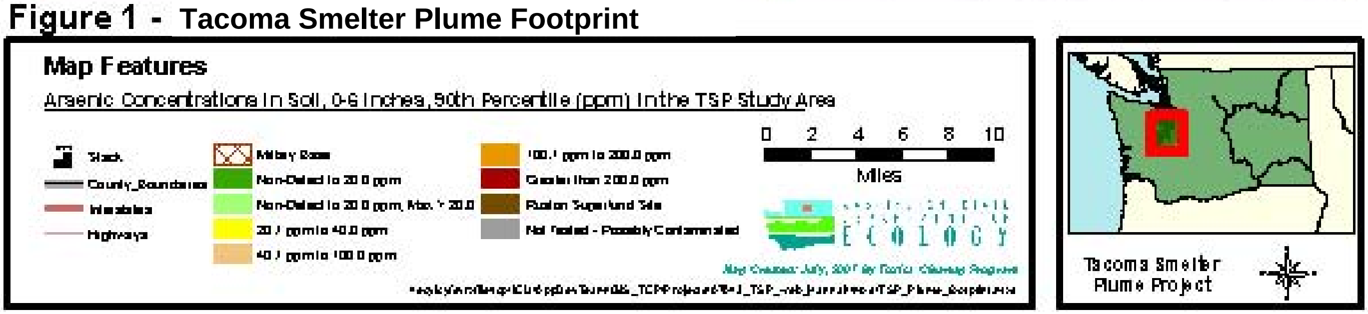


Figure 1 - Tacoma Smelter Plume Footprint



ple, the Task Force suggested working with realtors to educate their clients, and working with developers to do soil sampling before they begin developing a site.

The Task Force recommendations can be found at: http://www.ecy.wa.gov/programs/tcp/area_wide/Final-Report/index.htm.

Arsenic and Lead

Long-term exposure to arsenic has been linked to a variety of health problems, including heart disease, diabetes, and cancer of the bladder, lung, skin, kidney, liver, and prostate. Lead exposure can cause behavioral problems, permanent learning difficulties, and reduced physical growth. Young children are the most vulnerable. They are more likely to play in soil, put dirty fingers in their mouths, and eat with dirty hands. The small amount of polluted soil they may swallow is more harmful to children because they are still growing.

Model Toxics Control Act (MTCA) cleanup levels for unrestricted land use:

- Arsenic = 20 parts per million (ppm)
- Lead = 250 ppm

Current Strategy: Ecology and the local health departments developed a strategy based on the Area-Wide Task Force recommendations. The basis for the strategy is ongoing outreach and education. Local health departments currently use television advertising, billboards, mailings, and other methods to increase public awareness of TSP. The Soil Safety Program, funded by the Washington State Legislature, provides free soil sampling and cleanup for contaminated child play areas at schools and childcares. The program ends in June 2009, although Ecology will resume childcare and school sampling and cleanup under the ICAP.

Ecology also provides recommendations and technical assistance for some local governments that permit development in the affected area. The agency is working on soil sampling and cleanup guidance for developers, as well as outreach to realtors. This strategy is described in more detail in the Tacoma Smelter Plume Management Plan: http://www.ecy.wa.gov/programs/tcp/sites/tacoma_smelter/tsp_mgmt_plan.html

More information about the Soil Safety Program can be found at: http://www.ecy.wa.gov/programs/tcp/sites/dirt_alert/soilSafety/SoilSafety.htm

Asarco Bankruptcy: In 2005, Asarco filed for bankruptcy. Ecology filed a claim with Asarco for past and future costs of the Tacoma Smelter Plume contamination. Although the final court settlement is still pending, Ecology is developing a cleanup plan to prioritize spending the funds. The settlement will remain in a special account, to be used only for the TSP site.

Cleanup plan: The Tacoma Smelter Plume (TSP) site is the largest and one of the most complex cleanup sites in Washington. Cleanup will require a mix of traditional and non-traditional actions, and a phased strategy. At a typical cleanup site, Ecology writes a Cleanup Action Plan for the full cleanup, across the entire site. This is required by the Model Toxics Control Act (Figure 2). In this case, the agency is proposing an *Interim* Cleanup Action Plan (ICAP) to:

1. Continue with existing strategies that have been successful, such as outreach and education.
2. Begin using traditional cleanup methods to address areas of highest contamination.
3. Gather public input on future cleanup strategies that require more research and planning.

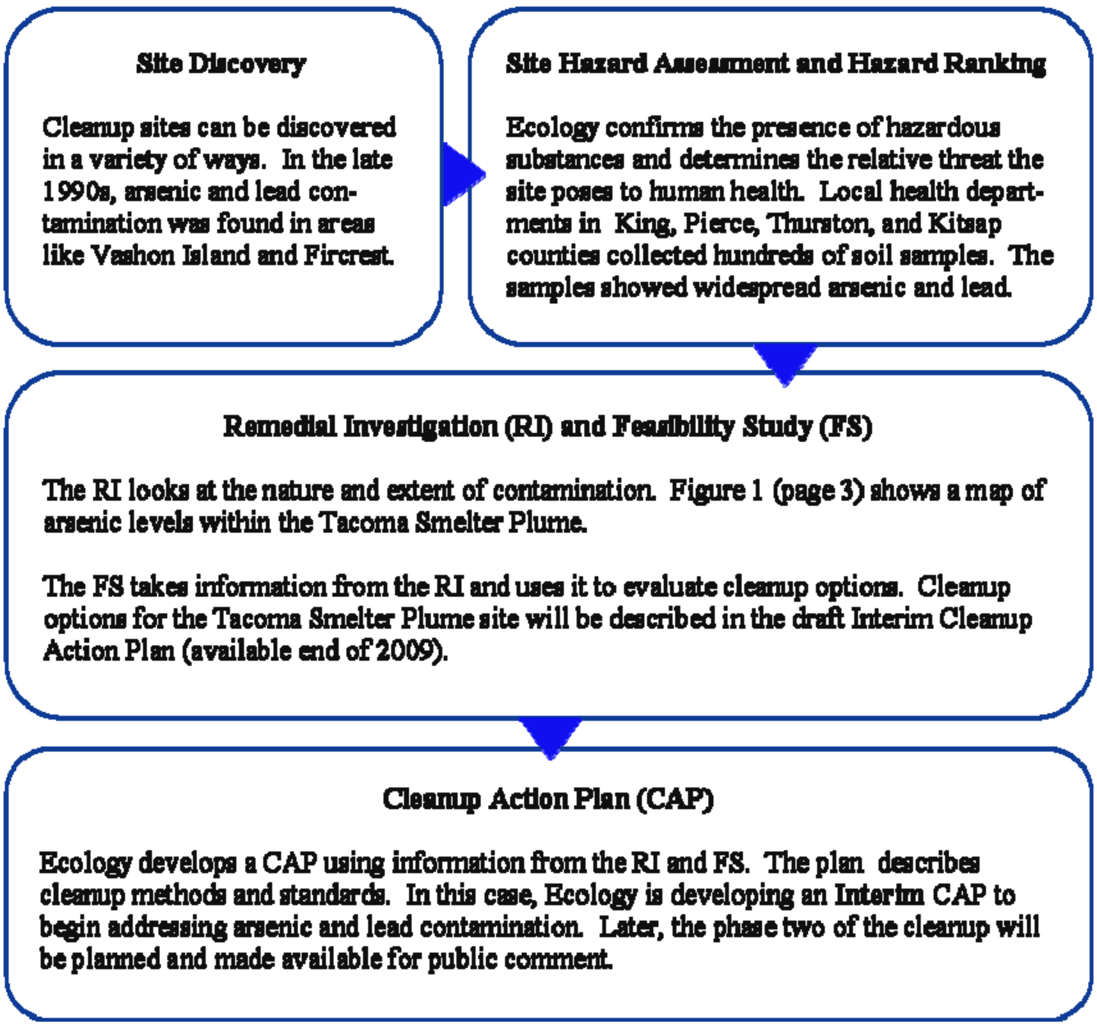


Figure 2. Steps in the Model Toxics Control Act (MTCA) cleanup process

C. Interim Cleanup Action Plan (ICAP)

The Interim Cleanup Action Plan (ICAP) outlines several approaches that may be used to address Tacoma Smelter Plume contamination. This section describes the general strategies, although the full plan is not yet ready for review. Ecology expects to make the draft ICAP available for public comment in late 2009 or early 2010.

Phased approach: Ecology is proposing a phased approach to cleanup (Figure 3). Phase One prioritizes sampling and cleaning up properties where people are at greatest risk of exposure to contaminated soils, including childcares and schools. Phase One also continues existing education and outreach, efforts to work with other government agencies, and encouraging cleanup during land development. Phase Two will have a separate Cleanup Action Plan and SEPA review process. It will focus on broader strategies that require more research and planning. For example, Ecology plans to explore *requiring* soil sampling and cleanup through local development permitting processes. While Phase One focuses on the highest contamination, Phase Two will look more broadly at strategies for the whole plume area.

The phased approach allows Ecology to do permanent cleanups and prioritize funding in the highest risk areas. However, it also allows Ecology to address lower risk areas without using costly, traditional cleanup methods at every property. This meets the Area-Wide Task Force's recommendation for a balanced approach that is effective, practical, and affordable.

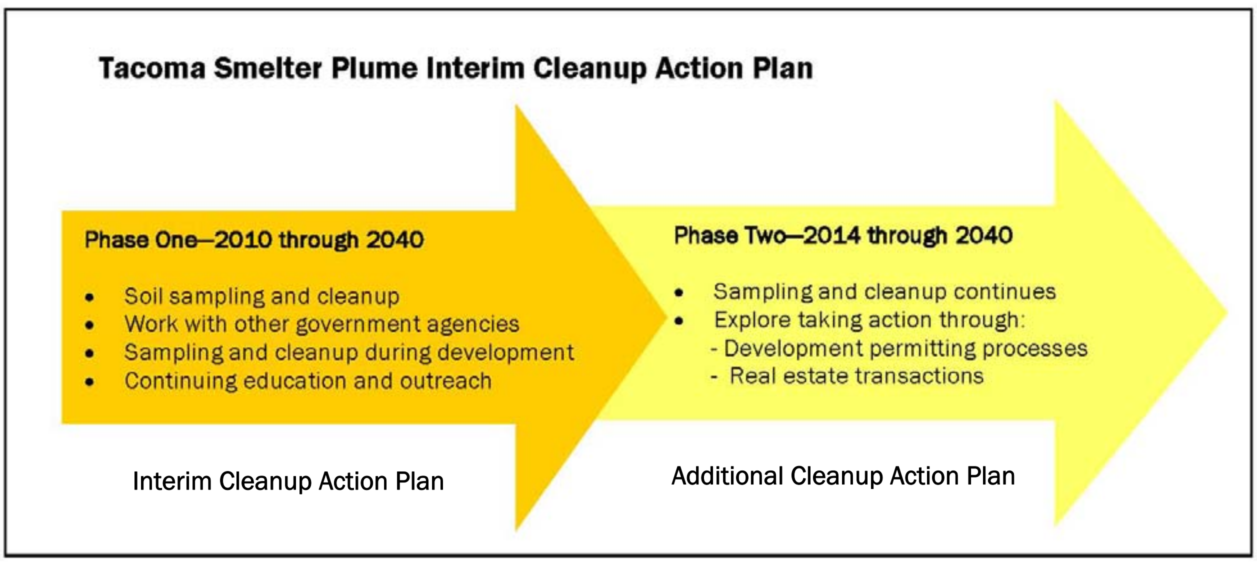


Figure 3. Phased Approach

Phase one actions

1. Property Sampling and Cleanup – Ecology will design and manage a program that provides soil sampling and cleanup. The program will target the most contaminated areas of the Tacoma Smelter Plume, where arsenic levels are expected to be over 100 parts per million (ppm) and lead levels over 500 ppm. Within the targeted area, residential properties containing arsenic or lead above state standards (see box on page 4) will be cleaned up using Asarco settlement funds. In most cases, contaminated soils will be dug up and trucked to a landfill. Clean soils will then be brought in to backfill the excavated areas.

Ecology estimates that roughly 125 properties could be cleaned up each year, as settlement funds allow. It is expected that most of these properties will be standard residential lots. The program will likely begin in North Tacoma neighborhoods and on Vashon-Maury Island, where the highest contamination is found.

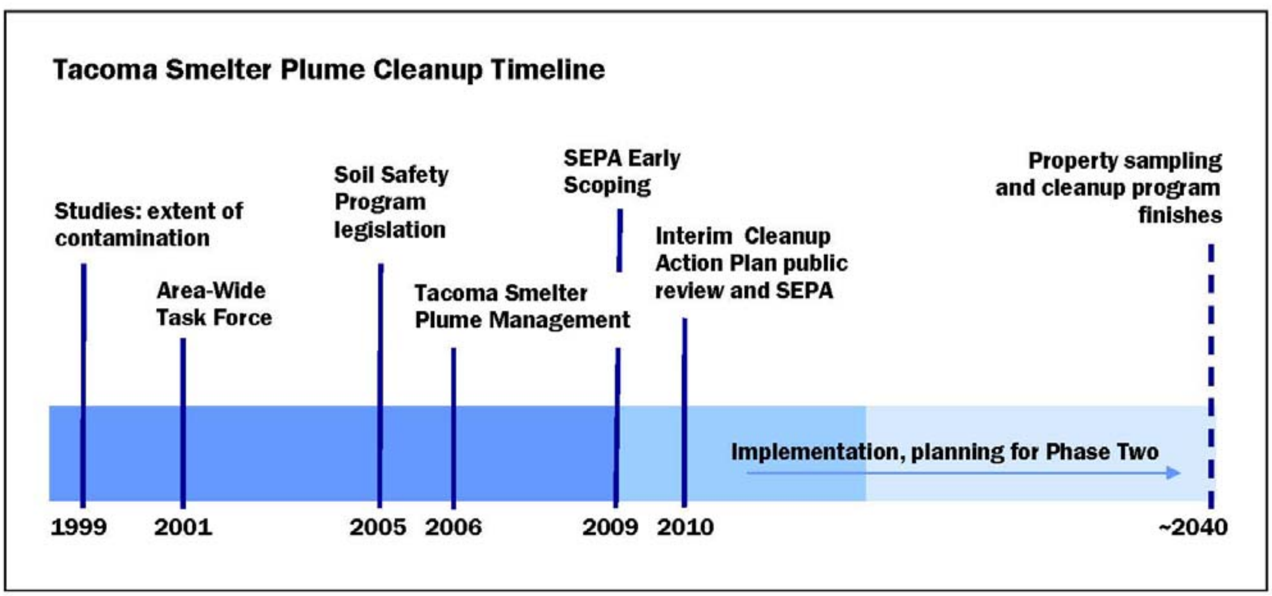
2. Childcares and Schools – Ecology will continue the work of the Soil Safety Program under the ICAP. The agency will sample and clean up play areas at new childcares and schools. Asarco settlement funds would offset the cost to childcares. Ecology and the Department of Early Learning (DEL) are already exploring making soil sampling a condition of childcare licensure.

3. Properties Managed or Regulated by Other Government Agencies – Ecology will work with other government agencies to address soil safety on properties that they manage or regulate. The Soil Safety Program covers currently operating schools and childcares in the program's service area—future schools and childcares, as well as parks and camps, need long-term soil safety measures to ensure that children are protected. These measures are designed to be permanent, beyond the lifespan of the Soil Safety Program.

4. Property Development – Ecology will encourage local planning offices to require property sampling and cleanup when permitting new developments or major redevelopment. The agency will provide guidance to both the planning offices and developers or property owners doing sampling and cleanup. Property development plans often already include actions that clean up contaminated soil. For example, removing surfaces soils, landscaping, and covering soils with buildings or pavement can limit or prevent future exposure to arsenic and lead.

5. Outreach and Education – Broad-based outreach and education by local health departments will continue. Current outreach includes television advertising, billboards, targeted mailings, and community presentations. Additional outreach and education is needed to support the four actions listed above.

Overall Timeline



D. Other Cleanup Approaches Considered

Ecology considered and rejected three alternatives to the ICAP.

- The first alternative is to take **no action**. This is not consistent with MTCA or the Area-Wide Task Force recommendations. Taking no action is not an option, as Ecology will have funding from the Asarco settlement for cleanup and other actions.
- The second alternative is to **sample and clean up all properties** within the Tacoma Smelter Plume. Although this meets MTCA goals of permanent cleanup, there are several problems. Ecology does not have the resources to address all properties within the plume. Further, cleaning up all properties would create a significant environmental impact. Removing, transporting, and landfilling large volumes of soil would create large traffic, noise, air emissions, and waste disposal impacts.
- The third alternative is to not do cleanup and focus instead on **"institutional controls."** Institutional controls attempt to limit human exposure through education and outreach, and by restricting future land use using deed restrictions or environmental covenants. This alternative does not adequately protect people in the highest risk areas of the plume. Funding will be available to do cleanup in addition to institutional controls.

E. The SEPA Process

Early Scoping: The planned cleanup process will likely have impacts on communities and environments within the Tacoma Smelter Plume site. Early scoping will help Ecology identify possible environmental impacts of the ICAP. This is also a chance for Ecology to share some preliminary cleanup plans with stakeholders. <u>The agency will not ask for comments on the ICAP until late 2009 or early 2010.</u>

This document is being sent to the following types of agencies and organizations:

- State agencies that conduct SEPA reviews for Ecology cleanups.
- County governments and planning agencies.
- County health agencies.
- Municipal governments and planning agencies.
- Environmental organizations.
- Building, development, and real estate associations.
- Individuals who have expressed an interest in the Tacoma Smelter Plume cleanup.

Ecology will compile all comments and make them publicly available in spring of 2009 (see page 9). The agency will consider these comments when making a SEPA determination.

What types of impacts are considered? A SEPA review looks at impacts to the environment and to surrounding communities. These typically include, but are not limited to:

- Land – stability, potential for erosion.
- Air – possible air emissions.
- Water – surface water, ground water, and runoff (includes storm water).
- Plants and animals – what types are present and whether they are threatened or endangered.

- Energy usage and natural resources.
- Environmental health – potential for exposure to health hazards, including noise.
- Land and shoreline use – current land use, zoning, potential for displacing people.
- Housing, aesthetics, light and glare, and recreation.
- Historic and cultural preservation.
- Transportation, public services, and utilities.

SEPA Determination and ICAP Public Review: Ecology plans to make the draft ICAP and SEPA determination available for public review in late 2009 or early 2010. The ICAP will describe more details of the sampling and cleanup work, and the other strategies listed in Section C. Ecology will use public comments to revise the ICAP, if appropriate, and produce a final draft. This second public review process will also be a chance to share cleanup plans with a wider range of stakeholders.

For more information about SEPA, visit http://www.ecy.wa.gov/programs/sea/sepa/e-review.html.

F. Call for Public Comments

Please send written comments to Hannah Aoyagi by e-mail at haoy461@ecy.wa.gov, or by mail to:

Hannah Aoyagi
TCP SWRO
WA Dept. of Ecology
P.O. Box 47775
Olympia, WA 98504-7775

Ecology will review your comments and create a summary. This summary will be made publicly available on Ecology's Web site: http://www.ecy.wa.gov/programs/tcp/sites/tacoma_smelter/ts_hp.htm. A hard copy can be requested by contacting Hannah Aoyagi at the above address, or by calling 360.407.6790.

What types of comments are helpful? Ecology is trying to determine the types of environmental impacts the agency should consider. Please send your comments on what Ecology should include in the SEPA review process. There will be a chance to comment on the cleanup process itself once the draft ICAP is ready for public review (late 2009/early 2010).

Staying Involved: If you received an e-mail or mailing from Ecology, you are on the permanent mailing list for the project. If you would like to be added or removed from to the mailing list, please contact Hannah Aoyagi at 360.407.6790 or by e-mail at haoy461@ecy.wa.gov.

Please check Ecology's Tacoma Smelter Plume Web site for periodic updates:
http://www.ecy.wa.gov/programs/tcp/sites/tacoma_smelter/ts_hp.htm

DEPARTMENT OF
ECOLOGY
State of Washington
PO Box 47775
Olympia, WA 98504-7775

Tacoma Smelter Plume Site King, Pierce, and Thurston Counties, WA

State Environmental Policy Act (SEPA) Early Scoping for Cleanup

Public Comment Period:

February 2—March 20, 2009

What am I being asked to comment on?

Ecology will be proposing an interim cleanup plan for the Tacoma Smelter Plume. Please submit comments on what Ecology should consider in assessing potential environmental impacts from this project.

What is inside this document?

- Background on the Tacoma Smelter Plume and current cleanup efforts.
- Information about the proposed interim cleanup plan.
- How the State Environmental Policy Act review process works.

To be added or removed from the mailing list:

Contact Hannah Aoyagi, Public Involvement Coordinator at 360.407.6790 or by e-mail at haoy461@ecy.wa.gov.

If you need this publication in an alternative format, call reception at (360) 407-6300. Persons with hearing loss, call 711 for Washington Relay Service. Persons with speech disability call 877-833-6341

DEPARTMENT OF ECOLOGY
State of Washington

April 2009 PUBLIC COMMENTS RECEIVED **FSID #89267963**

Summary

Ecology received three formal comments during the February 2—March 20, 2009 State Environmental Policy Act (SEPA) Early Scoping public comment period. Ecology requested public input on potential environmental impacts of the proposed Interim Cleanup Action Plan for the Tacoma Smelter Plume (TSP) site. This document describes the next steps in the SEPA and public review process, and lists the three comments received.

What Happens Next?

The draft ICAP will go out for public review and comment under the Model Toxics Control Act. At that time, Ecology must make a determination whether the project is likely to have significant adverse environmental impacts. There are three possible outcomes, or "determinations":

- If impacts are significant, Ecology must develop an Environmental Impact Statement (EIS). An EIS looks at possible environmental impacts and describes how to mitigate (lessen) them.
- If impacts are not significant, Ecology may issue a Determination of Non Significance (DNS).
- If there are few environmental impacts and they can be mitigated, Ecology may issue a Mitigated Determination of Non Significance (MDNS) and make changes to the cleanup plans.

Ecology expects the draft ICAP and SEPA determination to be issued for public review and comment in late 2009 or early 2010.

Contact Information

For further information about the Interim Cleanup Action Plan, please contact Hannah Aoyagi, Public Involvement Coordinator at 360.407.6790 or by e-mail at haoy461@ecy.wa.gov.

Public Comments

Comment 1: Stephanie Jewett, City of Burien

I understand that the Tacoma Smelter Interim Cleanup Action Plan will include ways to encourage government planning offices to require property soil sampling and cleanup at the time of new development/ redevelopment. With this as a potential recommendation of the ICAP, the SEPA review should look at possible impacts to landslide hazard areas (such as stability and potential for erosion). Landslide Hazard Areas, as defined in our Critical Area regulations, are located along the Puget Sound waterfront in our jurisdiction and this same area appears to have been affected by the smelter plume as shown in Figure 1 of the early Scoping notice.

Thank you for the opportunity to comment and please feel free to contact me if you need any clarification on the above comment,

Stephanie Jewett, AICP
Planner, City of Burien

Comment 2: Alexander Callender, Washington State Department of Ecology

The Puget Sound basin is used extensively for aquaculture. As a matter of public health, marine sediments and shellfish should be sampled according to the TSP model to determine if shellfish uptake of the smelter plume toxins is occurring in known aquaculture areas.

Alex Callender
Wetland/Shoreland Specialist for Thurston and Pierce Counties
Shorelands and Environmental Assistance Program
WA Department of Ecology

Comment 3: William Brant

I live in Normandy Park, WA which had been in the Tacoma Smelter Plume. Some time ago a measurement from the nearby Nature Trails Park had a reading for arsenic which was much higher than the levels indicated in the footprint map on page three of the interim plan. This may have been because this is a wetland that drains the upper levels of Normandy Park and perhaps concentrates the finding. I know that many people collect blackberries from this area. Many of us who live nearby have never had our property tested for plume contaminants to our knowledge. I would suggest that the State should retest these areas and also sample sufficient private properties in Normandy Park to establish the level of contaminants remaining in the soil in both mixed soils and undisturbed soils. The following activities could then be addressed: Children playing in school yards with little ground cover, playing on ground covered with an established lawn, and gardening and food growing in mixed soils. The final report should also address whether food grown in local soils are safe and what precautions will make it safe. If arsenic is not taken up in food grown locally, how well does washing act to remove contaminants. You indicate the State is not prepared to clean up the plume, even where it appears to be at action levels, so at least provide sufficient education about the plume areas and what actions can make our local activities safer.

Thank You,
Wm Clarke Brant

Mitigated Determination of Nonsignificance (MDNS)
Tacoma Smelter Plume Interim Action Plan

Description of proposal
The Interim Action Plan describes how Ecology will clean up part of the Tacoma Smelter Plume and manage risk. contamination. The plan proposes a new yard sampling and cleanup program for residential properties in the highest contaminated zones. It continues the existing Soil Safety Program, which provides free soil sampling and cleanup for childcares, schools, parks, camps, and multi-family public housing. It also continues existing education and outreach, efforts to work with other government agencies, and encouraging cleanup during land development.

For more detail, please see the attached SEPA Checklist.

Proponent Washington State Department of Ecology, Toxics Cleanup Program, Southwest Region

Location of proposal, including street address, if any The Tacoma Smelter Plume covers over 1,000 square miles of parts of King, Pierce, Thurston, and Kitsap counties. For further detail, see the Tacoma Smelter Plume interactive map:
http://apps.ecy.wa.gov/website/facsite/viewer.htm?sp_area=Tacoma%20Smelter%20Plume

Lead agency Washington State Department of Ecology,

The lead agency for this proposal has determined that it does not have a probable significant adverse impact on the environment. An environmental impact statement (EIS) is not required under RCW 43.21C.030 (2)(c), provided the SEPA conditions listed below are used to mitigate potential adverse impacts. This decision was made after review of a completed environmental checklist and other information on file with the lead agency. This information is available to the public on request.

☐ There is no comment period for this MDNS.

☐ This MDNS is issued after using the optional MDNS process in WAC 197-11-355. There is no further comment period on the MDNS.

☒ This MDNS is issued under WAC 197-11-340(2); the lead agency will not act on this proposal for 60 days from the date below. Comments must be submitted by **December 20, 2011**.

Responsible official Rebecca Lawson, P.E., LHG

Position/title Section Manager, Toxics Cleanup Program Southwest Regional Office

Phone. 360-407-6241

Address PO Box 47775, Olympia, WA 98504-7775

Date. 10/20/2011 Signature Rebecca S. Lawson

SEPA Conditions

Proposed measures to reduce or control erosion, or other impacts to the earth:

Erosion and soil stability issues will be addressed in two ways. First, contamination in steeply-sloped areas and bluffs will typically not be addressed using physical soil cleanup methods (excavation and removal, capping, or mixing). These methods could cause damage to the sensitive ecosystems, outweighing the benefits of reducing arsenic concentrations. These are also areas where human exposure is less likely. In most cases, human health can be protected using institutional controls, such as signage or educating residents about how to reduce exposure to soil contaminants.

Second, best management practices will be used during each cleanup, to minimize erosion and runoff. Any stockpiled soils will be covered during wet weather and surrounded by berms. Fill and remaining soils will be graded to minimize erosion and covered with stabilizing materials such as sod, plantings, permeable surfaces, or paving.

These measures are also recommended for local land use planners and developers doing sampling and cleanup during property development or major redevelopment.

Proposed measures to reduce or control emissions or other impacts to air, if any:

Fugitive dust will be controlled by watering down soils during the cleanup process. Ecology has found this method to be effective during past soil cleanup projects in the Tacoma Smelter Plume. Vehicle exhaust and greenhouse gas impacts can be reduced by minimizing truck trips. For example, the same truck that brings in clean fill can be used to take contaminated soils to the landfill. Routes can be planned to minimize the miles that need to be driven. Excavators and other soil moving vehicles will not be idled unnecessarily.

Air emission control measures will also be included in Ecology's guidance to property owners conducting cleanup during property development or redevelopment. Property redevelopment may sometimes involve removal of existing structures, which may release asbestos or other hazardous materials. Ecology will encourage property owners and developers to follow all applicable regulations and refer inquiries to Puget Sound Clean Air Agency.

Proposed measures to reduce or control surface, ground, and runoff water impacts:

Best management practices will include covering soil stockpiles and building berms around stockpiles and significantly sloped areas to prevent runoff. Physical soil cleanup will not be done in steeply sloped areas. Interceptor dikes and swales will be used to control runoff that does occur, and storm drains will be protected with filters or impounding areas. Mulching, matting, seeding, and preservation of natural vegetation will be used to prevent erosion. Vehicles and equipment will be washed before leaving the site.

Proposed measures to reduce or control environmental health hazards:

The purpose of this Interim Action Plan is to broadly reduce environmental health risks from arsenic from the Tacoma Smelter Plume. However, the proposed soil sampling and cleanup work has the potential to put workers, property owners, residents, and neighbors at a short term risk of exposure to arsenic. Ecology will require the following measures to limit human exposure and prevent the spread of contamination:

- Watering down soils to limit dust.
- Educating workers about limiting their exposure by using gloves, washing hands, and wearing protective clothing, and dust masks, if necessary.
- Washing truck wheels before leaving a contaminated property.
- Covering soils being removed from a contaminated property.

Proposed measures to reduce or control noise impacts, if any:

Work will be done only during normal business hours. An Ecology project manager will be available to assist with community concerns and needs throughout the cleanup process.

Proposed measures to reduce or control transportation impacts, if any:

Traffic impacts during soil cleanup will be mitigated by carefully planning truck routes to minimize miles driven, and informing neighbors when work is occurring and what roads may be impacted. Load out areas may be used to transfer soils from smaller trucks to truck-trailer combinations for long-haul transport to disposal facilities. An Ecology project manager will be available to assist with community concerns and needs throughout the cleanup process.

Programmatic State Environmental Policy Act (SEPA) Checklist
Tacoma Smelter Plume Interim Action Plan

Determination: Mitigated Determination of Non Significance (MDNS)

WAC 197-11-960 Environmental Checklist

Purpose of checklist

The State Environmental Policy Act (SEPA), chapter 43.21C RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. The purpose of this checklist is to provide information to the agency to identify impacts from the proposal, and to reduce or avoid impacts from the proposal, if it can be done.

Contents

A. Background

1. Name of proposed project: Tacoma Smelter Plume Interim Action Plan

2. Name of applicant: Washington State Department of Ecology

3. Address and phone number of applicant and contact person:
Cynthia Walker, Project Manager
PO Box 47775
Olympia, WA 98504-7775
(360) 407-6245, Cynthia.Walker@ecy.wa.gov

4. Date checklist prepared: October 1, 2011

5. Agency requesting checklist: Washington State Department of Ecology

6. Proposed timing or schedule (including phasing, if applicable): This checklist will go out for public review at the same time as the draft Interim Action Plan.

7. Plans for future additions, expansion, or further activity related to or connected with this proposal:

By around 2015, Ecology will write a Phase Two Supplemental Interim Action Plan. This plan will explore taking actions through the development permitting process, and through real estate transactions. The extent of this future work depends on availability of funding and the Phase Two plan would go through a separate SEPA process. All soil sampling and cleanup actions, however, will be conducted under the current proposal.

8. Environmental information that has been prepared, or will be prepared, directly related to this proposal:

Ecology has done a series of studies that examine the area-wide nature of the Tacoma Smelter Plume contamination. These studies look at undisturbed areas, child use (play) areas, and an "extended footprint" of contamination across the region. The following studies can be found at http://www.ecy.wa.gov/programs/tcp/sites/dirt_alert/studies_and_maps/footprint_studies.html:

- Vashon-Maury Island – Undisturbed Area Study (2000)
- Survey of Typical Soil Arsenic Concentrations in Residential Areas of the City of University Place (2001)
- Vashon-Maury Island Child-use Area Study (2001)
- Dockton Park Resample Study (2002)
- Mainland King County Preliminary Study (2002)
- Pierce County Footprint Study (2002)
- Mainland King County Child-use Area Study (2003)
- Pierce County Child-use Area Study (2003)
- Vashon-Maury Island School District Child-use Area Resample (2003)
- Extended Footprint Study (2005)

The Credible Evidence Report and Tracer Report used to name Asarco Inc. as the potentially

liable person are available at
http://www.ecy.wa.gov/programs/tcp/sites/dirt_alert/studies_and_maps/sources.html.

9. Applications that are pending for governmental approvals or other proposals directly affecting the property covered by your proposal:

Property owners within the Tacoma Smelter Plume area have the option of conducting soil sampling and cleanup under Ecology's Voluntary Cleanup Program. For a fee, applicants can receive technical assistance and an opinion letter. Currently, there are several properties under development that have entered the Voluntary Cleanup Program. These properties would not be included under Ecology's proposed sampling and cleanup program, as described in the Interim Action Plan.

Ecology is also currently conducting soil sampling and cleanup at schools, childcares, parks, camps, and public multifamily housing, under the Soil Safety Program. All cleanup work goes through SEPA review and will continue to do so. To maintain a consistent approach, Ecology proposes continuing the work of the Soil Safety Program in the Interim Action Plan.

Ecology is not aware of any other applications pending approval.

10. List of government approvals or permits that will be needed for the proposal:

Large sites with soil cleanup actions will require a construction stormwater permit. Excavation and removal actions will require waste disposal authorizations for disposing of contaminated soils, depending on the local jurisdiction. Certain jurisdictions will require grading permits.

11. Brief, complete description of the proposal, including the proposed uses and the size of the project and site:

The Interim Action Plan outlines a phased approach to addressing Tacoma Smelter Plume contamination. Phase One prioritizes sampling and cleaning up properties where people are at greatest risk of exposure to contaminated soils, including childcares, schools, parks, camps, and residential properties. Property sizes and future uses vary throughout the plume. Ecology's work focuses on residential properties and child play areas.

Phase One also continues existing education and outreach, efforts to work with other government agencies, and encouraging cleanup during land development. The phased approach allows Ecology to do permanent cleanups and prioritize funding in the highest risk areas. However, it also allows Ecology to address lower risk areas without using costly, traditional cleanup methods at every property. **This environmental review focuses mainly on the impacts of property sampling and cleanup for certain land uses in the areas of highest potential contamination.**

Phase one actions

1. Property Sampling and Cleanup – Ecology will design and manage a program that provides soil sampling and cleanup. The program will target the most contaminated

areas of the Tacoma Smelter Plume, where arsenic levels are expected to be over 100 parts per million (ppm). Within the targeted area, residential properties, schools and childcares, and existing parks and camps containing arsenic above state standards will be cleaned up. In most cases, contaminated soils will be dug up and trucked to a landfill. Clean soils will then be brought in to backfill the excavated areas. Ecology estimates that roughly 125 properties could be cleaned up each year, as settlement funds allow. It is expected that most of these properties will be standard residential lots. The program will likely begin in North Tacoma neighborhoods and on Vashon-Maury Island, where the highest contamination is found. Detailed project phasing will be based on the most recent spatial information about contamination, at the time the program is designed.

2. Child Play Areas – Ecology will continue the work of the Soil Safety Program under the Interim Action Plan. The agency will sample and clean up play areas at childcares and schools, as well as existing parks, camps, and multi-family public housing.

3. Encouraging Cleanup During Development – Ecology will encourage local planning offices to require property sampling and cleanup when permitting new developments or major redevelopment. The agency will provide guidance to both the planning offices and developers or property owners doing sampling and cleanup. Property development plans often already include actions that clean up contaminated soil. For example, removing surfaces soils, landscaping, and covering soils with buildings or pavement can limit or prevent future exposure to arsenic. Certain jurisdictions may have additional requirements for property owners conducting independent cleanups.

   Ecology will also work with other government agencies to address soil safety on properties that they manage or regulate

4. Outreach and Education – Broad-based outreach and education by local health departments will continue. Current outreach includes television advertising, billboards, targeted mailings, and community presentations. Additional outreach and education is needed to support the three actions listed above.

Further detail about each of these actions can be found in the text of the Interim Action Plan.

12. Location of the proposal: Portions of King, Pierce, and Thurston counties. For further detail, see the Tacoma Smelter Plume interactive map:
http://apps.ecy.wa.gov/website/facsite/viewer.htm?sp_area=Tacoma%20Smelter%20Plume

B. Environmental Elements

1. Earth

a. General description of the site:

Properties within the areas estimated to have over 100 parts per million soil arsenic have varying land types. Land types are mainly flat and rolling, or sloped along the shores of the Puget Sound. Sampling and cleanup work would likely start in Ruston and north Tacoma or on Vashon-Maury Island. North Tacoma neighborhoods in the vicinity of the Asarco Superfund site tend to be on flat or rolling terrain. Some areas slope steeply down towards the shoreline. Vashon-Maury Island has a combination of rolling terrain and steep slopes or bluffs meeting the shoreline. Ecology is unable to provide specific information about other potential cleanup areas at this time.

b. What is the steepest slope on the site (approximate percent slope)?

Within the areas Ecology expects to do soil sampling and cleanup, the steepest slopes are likely in the bluff areas surrounding Puget Sound. Parts of some of these properties may have nearly vertical slopes.

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? Specify the classification of agricultural soils and note any prime farmland.

Properties within the areas estimated to have over 100 parts per million soil arsenic have varying soil types. Most local soils in the Puget Sound region are glacial—glacial till, glacial outwash (sand and gravel), or lacustrine (lakebed). The areas where Ecology expects to do soil sampling and cleanup are either residential or child play areas.

d. Are there surface indications or history of unstable soils in the immediate vicinity?

Unstable soils may be found on properties near Puget Sound with steep slopes or bluffs. These are common landslide areas. Ecology will generally avoid cleanup work on steep slopes.

e. Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill.

The general purpose of filling and grading would be to replace contaminated soils removed during the cleanup process. Fill type and volume would vary depending on the characteristics of individual properties and the area and depth of contamination. Backfill will typically be to the original grade, unless grade changes are requested by the property owner and agreed to by Ecology. Given that the majority of properties cleaned up will be residential, fill will mainly be soil that can support landscaping. Fill sources will be from local vendors and must meet state Model Toxics Control Act standards for at least arsenic and lead.

f. Could erosion occur as a result of clearing, construction, or use?

Erosion may occur during soil cleanup, particularly during excavation, removal, and bringing in clean fill. Ecology plans to use best management practices to minimize soil runoff in stormwater. Landscaping, such as sod, will be used to stabilize soils. In some cases, Ecology may cap contaminated soils with a geotextile cover and gravel, woodchips, or other landscaping material.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

Soil cleanup will not include any building construction. However, hard caps such as concrete or asphalt are considered a cleanup option. Property owners' preferences will be taken into consideration in planning the cleanup. Based on Ecology's experience with a cleanup program for child play areas, including family home childcares, residential property owners have a strong preference for permeable surfaces such as sod, gravel, and woodchips.

h. Proposed measures to reduce or control erosion, or other impacts to the earth:

Erosion and soil stability issues will be addressed in two ways. First, contamination in steeply-sloped areas and bluffs will typically not be addressed using physical soil cleanup methods (excavation and removal, capping, or mixing). These methods could cause damage to the sensitive ecosystems, outweighing the benefits of reducing arsenic concentrations. These are also areas where human exposure is less likely. In most cases, human health can be protected using institutional controls, such as signage or educating residents about how to reduce exposure to soil contaminants.

Second, best management practices will be used during each cleanup, to minimize erosion and runoff. Any stockpiled soils will be covered during wet weather and surrounded by berms. Fill and remaining soils will be graded to minimize erosion and covered with stabilizing materials such as sod, plantings, permeable surfaces, or paving.

These measures are also recommended for local land use planners and developers doing sampling and cleanup during property development or major redevelopment.

2. Air

a. What types of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? Generally describe and give approximate quantities, if known.

This proposal has two major, potential impacts to air quality—dust and vehicle exhaust. During drier months, soil cleanup activities produce dust. Stripping vegetation from soils, excavation, removal, and importing fill all produce dust.

The volume of soil to clean up will require vehicles for excavation, soil removal, and bringing in fill. Past residential soil cleanups have required an excavator (usually a mini-excavator), large trucks to take contaminated soils to the landfill and deliver clean fill, and vehicles to transport workers. These vehicles have a local impact from their exhaust, as well as a climate change impact from emission of greenhouse gases.

b. Are there any off-site sources of emissions or odor that may affect your proposal?

There are no known off-site sources of emissions that may impact this proposal.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

Fugitive dust will be controlled by watering down soils during the cleanup process. Ecology has found this method to be effective during past soil cleanup projects in the Tacoma Smelter Plume. Vehicle exhaust and greenhouse gas impacts can be reduced by minimizing truck trips. For example, the same truck that brings in clean fill can be used to take contaminated soils to the landfill. Routes can be planned to minimize the miles that need to be driven. Excavators and other soil moving vehicles will not be idled unnecessarily.

Air emission control measures will also be included in Ecology's guidance to property owners conducting cleanup during property development or redevelopment. Property redevelopment may sometimes involve removal of existing structures, which may release asbestos or other hazardous materials. Ecology will encourage property owners and developers to follow all applicable regulations and refer inquiries to Puget Sound Clean Air Agency.

3. Water

Given the size of the Tacoma Smelter Plume, there has not been a study of the hydrogeology for the entire area. Most arsenic from the smelter emissions is still in the top foot of the soil column. Arsenic binds strongly to soil and does not readily migrate. The Model Toxics Control Act Science Advisory Board has determined that there is limited risk of ground water contamination from Tacoma Smelter Plume contamination. Possible exceptions include areas with: (1) soils high in natural organic content (peat, wetlands); (2) biodegradable organic compounds (petroleum); (3) very high pH from waste material like cement kiln dust; or (4) phosphate additives and deeper contamination than typical from smelter emissions.

a. Surface:

i. Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

Some water bodies fall within areas estimated to have over 100 parts per million soil arsenic. North Tacoma areas within the proposal have several streams entering the Puget Sound, as well a few small lakes or ponds. Vashon-Maury Island areas also have streams and small lakes or ponds. These areas are all relatively near Puget Sound.

ii. Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

Soil sampling will indicate which properties require cleanup. Ecology will evaluate areas within 200 feet of a waterway to determine if human health risk warrants physical soil cleanup. If so, Ecology will take special measures to protect the waterway. As with steeply sloped areas, human health can be protected using institutional controls, such as signage or educating residents about how to reduce exposure to soil contaminants.

iii. Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

Not applicable.

iv. Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

Not applicable.

v. Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

A very small portion of the areas estimated to have over 100 parts per million soil arsenic fall within a 100-year floodplain. None of the north Tacoma properties are in a floodplain. A few Vashon-Maury island properties may be within a floodplain because they are located within 200 feet of a stream.

vi. Does the proposal involve discharges of waste materials to surface waters?

Not applicable.

b. Ground:

i. Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose, and approximate quantities, if known.

Not applicable.

ii. Describe waste material that will be discharged into the ground from septic tanks or other sources.

Not applicable.

c. Water runoff (including stormwater):

i. Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

Most cleanup work will take place between the driest months of May and October. Runoff may occur during soil cleanup in wetter months, particularly during excavation, removal, and bringing in clean fill. Runoff will be controlled using best management practices outlined in section 3d below.

ii. Could waste materials enter ground or surface waters? If so, generally describe.

Materials of concern include arsenic soil contamination. Surface waters will be protected through controlling runoff from each property cleanup. Contaminated soils will be properly disposed of in a landfill. Arsenic is relatively immobile in soil and will not enter groundwater.

d. Proposed measures to reduce or control surface, ground, and runoff water impacts:

Best management practices will include covering soil stockpiles and building berms around stockpiles and significantly sloped areas to prevent runoff. Physical soil cleanup will not be done in steeply sloped areas. Interceptor dikes and swales will be used to control stormwater that does occur, and storm drains will be protected with filters or impounding areas. Mulching, matting, seeding, and preservation of natural vegetation will be used to prevent erosion. Vehicles and equipment will be washed before leaving the site.

4. Plants

a. Types of vegetation found on the site:

The area covered by the proposal includes many different types of vegetation. Soil cleanup will mainly be done in residential areas, with a mix of native and ornamental vegetation, mainly in gardens. Natural areas with native vegetation will not be part of this sampling and cleanup effort, although some of these areas may fall under Ecology's guidance if they are part of a development project.

b. What kind and amount of vegetation will be removed or altered?

Landscaping vegetation on mainly residential properties may be removed or altered during soil cleanup. The amount depends on the size of the area of contamination on each property. Typically, large trees and bushes will not be removed. Restoration may include lawns, landscape plants, or other vegetation, as requested by the property owner.

c. List threatened or endangered species known to be on or near the site.

According to the Center for Biological Diversity, Puget Sound has several hundred imperiled species. This proposal is focused mainly on residential properties already developed. Ecology plans to avoid soil cleanup of natural areas, particularly near bodies of water or in steeply sloped areas.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

Ecology will work with property owners to replace the original or similar landscaping, including native plants, after soil cleanup is complete.

5. Animals

a. Circle any birds and animals which have been observed on or near the site or are known to be on or near the site:

The area covered by the proposal is likely used by a number of animal species. Soil cleanup will mainly be done in developed, residential areas. Natural habitats will be avoided.

b. List any threatened or endangered species known to be on or near the site.

Generally, Puget Sound has a number of imperiled animal species. This proposal is focused mainly on developed, residential areas. Natural habitats, particularly riparian areas, will be avoided.

c. Is the site part of a migration route? If so, explain.

In general, Puget Sound in on the Pacific Flyway, a major migration route for many types of birds. However, the properties that are likely to be cleaned up are too few and scattered to have an impact on this migration route.

d. Proposed measures to preserve or enhance wildlife, if any:

Natural habitats, particularly riparian areas, will be avoided.

6. Energy and natural resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

None anticipated.

b. Would your project affect the potential use of solar energy by adjacent properties?

It is not anticipated.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

Not applicable.

7. Environmental health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste that could occur as a result of this proposal?

Different portions of the Tacoma Smelter Plume have varying probabilities of elevated soil arsenic levels. Actual levels vary widely, and depend on the history of individual properties. Property-specific sampling is needed to determine the amount of arsenic on a given property. Typical levels found within the plume that exceed state cleanup standards may pose a chronic health risk, but not an acute risk or health emergency.

i. **Describe special emergency services that might be required.**

Not applicable. Soil arsenic and does not pose a fire, explosion, or hazardous waste risk.

ii. **Proposed measures to reduce or control environmental health hazards:**

The purpose of this Interim Action Plan is to manage environmental health risks from arsenic from the Tacoma Smelter Plume. However, the proposed soil sampling and cleanup work has the potential to put workers, property owners, residents, and neighbors at a short term risk of exposure to arsenic. Ecology will require the following measures to limit human exposure and prevent the spread of contamination:

- Watering down soils to limit dust.
- Washing truck wheels before leaving a contaminated property.
- Covering soils being removed from a contaminated property.

Department of Labor and Industries regulates workplace safety and should be consulted about worker safety requirements.

b. Noise

i. **What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?**

None.

ii. **What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (traffic, construction, operation,**

other)? Indicate what hours noise would come from the site.

Soil cleanup activities will generate typical construction noises during normal business hours. Depending on the type of cleanup required, noises come from equipment used to remove and replace soils (excavators), and trucks used to remove soils or bring in fill or capping materials.

iii. Proposed measures to reduce or control noise impacts, if any:

Work will be done only during normal business hours. An Ecology project manager will be available to assist with community concerns and needs throughout the cleanup process.

8. Land and shoreline use

a. What is the current use of the site and adjacent properties?

Ecology's sampling and cleanup efforts will be focused on residential properties and childcares. Work would likely start in Ruston and north Tacoma or on Vashon-Maury Island. North Tacoma areas estimated to have over 100 parts per million soil arsenic are primarily residential. Vashon-Maury Island residential properties are mainly zoned rural and are surrounded by other residences and farms.

b. Has the site been used for agriculture? If so, describe.

Ecology will not sample or clean up agricultural properties. Some properties on Vashon Island in areas estimated to have over 100 parts per million soil arsenic may have once been used for agriculture.

c. Describe any structures on the site.

Most properties that fall under this sampling and cleanup program will have residential structures, schools, or childcare facilities on site.

d. Will any structures be demolished?

No structures will be demolished during the sampling and cleanup process.

e. What is the current zoning classification of the site?

There are two general areas Ecology expects to begin sampling and cleanup: Ruston/North Tacoma and Vashon-Maury Island. North Tacoma areas estimated to have over 100 parts per million soil arsenic are primarily residential, but may include commercial and other zoning. Vashon-Maury Island residential properties are mainly zoned rural. The larger Tacoma Smelter Plume area encompasses a wide range of zoning classifications.

f. What is the current comprehensive plan designation of the site?

The Tacoma Smelter Plume area includes a wide range of comprehensive plan designations. Vashon-Maury Island's entire designation is Rural.

g. What is the current shoreline master program designation of the site?

On Vashon-Maury Island, properties may fall within a variety of shoreline master plan program designations, including rural, natural, and conservancy. A very small portion of the north Tacoma properties may be on a shoreline, and will be evaluated on a case-by-case basis.

h. Has any part of the site been classified as an "environmentally sensitive" area?

Some parts of the Tacoma Smelter Plume, and specifically properties targeted for soil sampling and cleanup, fall within environmentally sensitive areas. Some of these properties may be situated on bluffs or steep terrain. However, as noted in section 3a, Ecology will do less soil cleanup in areas that fall within flood hazard zones, near streams, or in wetlands or habitat areas. Ecology will take special measures to ensure sensitive areas are protected.

i. Approximately how many people would reside or work in the completed project?

The Tacoma Smelter Plume covers approximately 1,000 square miles, including heavily populated parts of Thurston, Pierce, and King Counties (see attached map). However, the area covered by Ecology's proposed soil sampling and cleanup program is much smaller. Ecology cannot estimate the number of people potentially impacted by soil sampling and cleanup due to uncertainty about the number of properties that can be sampled and the percentage that will require cleanup. Over 17,000 residential properties may qualify for sampling, but Ecology estimates only 1,000-2,000 will need cleanup.

j. Approximately how many people would the completed project displace?

This project would not displace any people. The purpose of the proposal is to reduce exposure to arsenic where people live and where children play.

k. Proposed measures to avoid or reduce displacement impacts, if any:

Not applicable.

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

The overall proposal seeks to work with existing and planned land uses, while reducing the potential for exposure to arsenic. The soil sampling and cleanup component will reduce risks on residential, school, and childcare properties. This will allow families to continue living in their homes and daycares to continue operating, within some of the most highly contaminated zones.

9. Housing

a. Approximately how many units would be provided, if any?

Not applicable.

b. Approximately how many units, if any, would be eliminated?
Not applicable.

c. Proposed measures to reduce or control housing impacts, if any:

Ecology does not anticipate that this proposal will have any impact on housing supply.

10. Aesthetics

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

No structures will be built under this proposal.

b. What views in the immediate vicinity would be altered or obstructed?

Ecology does not believe that this proposal will impact views. Any soil cleanup will work around large landscaping or trees, although property owners could opt to alter their landscaping at that time, using their own funds. Limited soil cleanup will be done in forested areas, wetlands or natural areas, or steep slopes.

c. Proposed measures to reduce or control aesthetic impacts, if any:

Ecology will work with individual property owners to ensure they are satisfied with the restoration of their landscaping once soil cleanup is complete. No major aesthetic impacts are expected.

11. Light and glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

This proposal does not include any actions that would create light and glare. Any soil cleanup work would be done during daylight hours.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

Not applicable.

c. What existing off-site sources of light or glare may affect your proposal?

Ecology does not anticipate any significant sources of light and glare that would affect soil cleanup or other portions of the proposal.

d. Proposed measures to reduce or control light and glare impacts, if any:

No measures are needed.

12. Recreation

a. What designated and informal recreational opportunities are in the immediate vicinity?

The Tacoma Smelter Plume area includes many different parks, beaches, wildlife areas, and other recreational opportunities.

b. Would the proposed project displace any existing recreational uses? If so, describe.

Ecology does not anticipate that the proposal will displace any recreational uses.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

For the most part, this proposal addresses just play areas of parks and camps. Part of the proposal also involves working with other agencies to institutionalize soil safety. This might include working with county and local park districts to educate visitors about reducing their potential exposure to arsenic in park soils. These areas may undergo physical soil cleanup that would temporarily limit recreational use.

13. Historic and cultural preservation

a. Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.

There are many known cultural and historic resources throughout the Tacoma Smelter Plume area. Ecology will work with Department of Archeology and Historic Preservation and tribes to identify areas of cultural or historic significance within or near soil sampling and cleanup areas.

b. Generally describe any landmarks or evidence of historic, archaeological, scientific, or cultural importance known to be on or next to the site.

Ruston and north Tacoma have known cultural resources, including Native American village sites and a large burial area. Vashon Island has known village sites and other areas with potential cultural resources. Shorelines and riverbanks or stream banks throughout the plume area are more likely to have cultural artifacts. Ruston, north Tacoma and Vashon-Maury Island have several historic residences and businesses, and a historic bridge.

c. Proposed measures to reduce or control impacts, if any:

Ecology will evaluate historic properties or properties where soil cleanup might impact a cultural resources or a historic landmark, on a case-by-case basis. All soil sampling and cleanup in potentially sensitive areas will be coordinated with the Department of Archeology and Historic Preservation and tribes. Other proposals under the Interim Action Plan—education and outreach, coordinating with other agencies, and encouraging sampling and cleanup during development—are not expected to have any impacts on historic and cultural preservation.

14. Transportation

a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.

The Tacoma Smelter Plume area covers a large network of public streets and highways. The areas Ecology expects to begin soil sampling and cleanup are mostly residential (Ruston and north Tacoma) or rural (Vashon-Maury Island), with arterial routes throughout. Access points to North Tacoma include Highway 16 to Pearl Street (Highway 163) and Interstate 705 to Schuster Parkway, to Ruston Way. Access points to Vashon Island are the Tahlequah Ferry, Southworth Ferry, and Fauntleroy Ferry. The main route on the island is Vashon Highway.

b. Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?

The area is served by several public transit authorities, including Pierce Transit, King County Metro Transit, and Sound Transit (bus and rail). Other public transportation is provided by Washington State Ferries.

c. How many parking spaces would the completed project have? How many would the project eliminate?

No parking spaces would be directly created or eliminated under this proposal. However, land owners could opt to pave a portion of their property as part of an Ecology-managed or independent soil cleanup.

d. Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, generally describe (indicate whether public or private).

This proposal will not require new roads or streets. Existing roadways should accommodate traffic related to soil cleanup activities, such as soil removal by truck.

e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

While the Tacoma Smelter Plume area generally includes water, rail, and air transportation networks, Ecology does not expect that soil sampling and cleanup will be done in their immediate vicinity.

f. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.

The completed project is not expected to generate any additional traffic. Soil cleanup activities will generate additional vehicular trips through worker commutes and the transport of equipment, soil, and other materials. Ecology estimates soil cleanups will generate approximately 19 trips per day. Narrow residential streets would require the use of 10-20 cubic yard capacity trucks. This is a reasonable estimate for the proposed soil cleanup program.

g. Proposed measures to reduce or control transportation impacts, if any:

Traffic impacts during soil cleanup will be mitigated by carefully planning truck routes to minimize miles driven, and informing neighbors when work is occurring and what roads may be impacted. Load out areas may be used to transfer soils from smaller trucks to truck-trailer combinations for long-haul transport to disposal facilities. An Ecology project manager will be available to assist with community concerns and needs throughout the cleanup process.

15. Public services

a. Would the project result in an increased need for public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe.

Encouraging soil sampling and cleanup during development and major redevelopment may increase the workload of local planning departments. Staff will need training and may need to spend time working with permit applicants and Ecology staff. Some cleanup measures will require environmental covenants to ensure the remedy is protective for the long term—filing the covenants will take staff time.

Local solid waste divisions may also see an increase in processing Waste Disposal Authorizations for contaminated soils. For jurisdictions already requesting soil sampling, this program may eventually reduce their workload by streamlining soil sampling and cleanup guidance.

b. Proposed measures to reduce or control direct impacts on public services, if any.

The current proposal *encourages* local jurisdictions to require soil sampling. Ecology will work closely with planning and permitting departments to develop guidance and provide technical assistance. Ecology will also work closely with other government agencies to ensure they have the educational materials and technical support to institutionalize soil safety within their day to day operations.

16. Utilities

a. Utilities currently available at the site:

There are a number of utilities currently available within the Tacoma Smelter Plume area, including electricity, natural gas, water, refuse service, telephone, sanitary sewers, and septic systems.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

No utilities are proposed. Where necessary, Ecology will work around existing utilities during soil cleanup.

C. SIGNATURE

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: Cynthia Walker

Date Submitted: 10/20/2011

Appendix F
Model Toxics Control Act (MTCA) Evaluation Criteria

Appendix F – MTCA Evaluation Criteria

These criteria have been used to help evaluate the broader cleanup action alternatives for the entire Tacoma Smelter Plume and the property-specific Tacoma Smelter Plume Model Remedy options (Chapter 11). They are based on Model Toxics Control Act requirements identified in WAC 173-340-360 (Selection of Cleanup Actions) and WAC 173-340-390 (Model Remedies).

Threshold requirements state that the preferred alternative shall:

- Protect human health and the environment.
- Comply with cleanup standards.
- Comply with applicable state and federal laws.
- Provide for compliance monitoring.

Further, cleanup actions are to:

- Use permanent solutions to the maximum extent practicable.
- Provide for a reasonable restoration time frame.
- Consider public concerns.

The following are additional descriptions of criteria considerations that should be factored into the decision making.

Permanent solutions analysis
The alternatives are evaluated relative to the most permanent solution to illustrate the pros and cons between the alternatives and to assist in identification of the most permanent alternative to the extent practicable. In considering the degree to which alternative cleanup actions (remedies) use permanent solutions to the maximum extent practicable, the following criteria are to be considered:

Protectiveness
Overall protectiveness of human health and the environment, including the following considerations:

- Degree to which existing risks are reduced.
- Time required to reduce the risks and attain cleanup standards.
- Onsite and offsite risks resulting from implementation of the alternative (remedy).
- Improvement in the overall environmental quality.

Permanence - The degree to which the alternative permanently reduces the toxicity, mobility, or volume of hazardous substances, including the following considerations:

- Adequacy of the alternative in destroying hazardous substances.
- Reductions or elimination of hazardous substance releases or sources of releases.
- Degree of irreversibility by the waste treatment process.
- Characteristics and quantity of treatment residuals generated.

Cost - The cost to implement the alternative (remedy), including the following costs:

- Cost of construction (cost estimates for treatment technologies include pre-treatment, analytical, labor and waste management costs; the cost of replacement and repair of major elements for estimated design life of the project is included).
- Net present value of any long term costs (includes operations and maintenance costs, monitoring costs, equipment replacement costs, and the cost of implementing institutional controls.
- Agency over-sight costs that are cost- recoverable.

Long-term effectiveness - Long-term effectiveness includes the following considerations:

- Degree of certainty that the alternative (remedy) will be successful.
- Reliability of the alternative (remedy) during the period of time that the hazardous substances are expected to remain on site (property) at concentrations exceeding cleanup levels.
- Magnitude of residual risk with the alternative (remedy) in place.
- Effectiveness of controls required to manage the treatment residues or remaining waste.
- The following type of cleanup actions (remedies) may be used as a guide, in descending order, when assessing the relative degree of long-term effectiveness:

    - Reuse or recycling
    - Destruction or detoxification
    - Immobilization or solidification
    - On-site or off-site disposal in an engineered , lined and monitored facility
    - On-site isolation or containment with institutional controls
    - Institutional controls and monitoring

Management of short-term risks - Short-term risk includes the risk to human health and the environment associated with the alternative (remedy) during construction and the use of mitigation measures—measures taken to manage such risks.

Ability to implement technically and administratively - The ability of the alternative (remedy) to be implemented includes the following considerations:

- Technical possibility of alternative.
- Availability of necessary offsite facility, services and materials.
- Administrative and regulatory requirements.
- Scheduling, size and complexity.
- Monitoring requirements.
- Access for construction operations and monitoring.
- Integration with existing facility operations and other current or potential remedial actions.
- Other current or potential remedial actions.

Considerations of public concerns - Consideration of public concerns includes whether the community has concerns regarding the alternative and, if so, the extent to which the alternative addresses those concerns. This criterion includes concerns from individuals, community groups, local governments, tribes, federal and state agencies, or any other organization that may have an interest in or knowledge of the site.

Restoration Timeframe considerations

- Potential risks posed by the site to human health and the environment
- Practicability of achieving a shorter timeframe
- Current site use, surrounding areas, and associated resources that are or may be affected by releases from the site.
- Potential future site use, surrounding areas, and associated resources…
- Availability of alternative water supplies
- Likely effectiveness of institutional controls
- Ability to control and monitor migration of hazardous substances from the site
- Toxicity of hazardous substances at the site
- Potential for natural attenuation- natural processes that reduce concentrations of hazardous substances and have been documented to occur at the site or under similar site conditions.

Table F.1 Evaluation of Interim Action Plan Alternatives

Evaluation Criteria	Alternative A – No Action	Alternative B (preferred alternative) – Phased Prioritized Action	Alternative C – All Properties Sampled and Remediated	Alternative D – Limited Action
Overall protectiveness of human health	Not protective of human health	Permanently removes arsenic from most properties with the highest contamination and where the most vulnerable populations are at risk of exposure. Non-permanent remedies have institutional controls such as environmental covenants, signage, and education. These measures greatly reduce potential contact with contaminated soils.	The most protective alternative—properties with both high and moderate contamination are remediated. Remediation includes permanent remedies and non-permanent remedies with institutional controls.	Not as protective as alternatives B and C—relies only on institutional controls and not engineered remedies. This alternative relies entirely on increased public awareness and individual behavior change to reduce exposure.
Protectiveness – environment	Not protective of ecological receptors	Ecology's ecological evaluation (See Appendix C) finds that cleanup levels are protective of ecological receptors, except where contamination is left in place. However, in some cases, leaving natural areas will have a net ecosystem benefit because soil cleanup can be disruptive.	Cleanup levels are protective of ecological receptors, except where contamination is left in place.	Not protective of ecological receptors.
Permanence	Not applicable	Properties with the highest contamination are cleaned up using Tacoma Smelter Plume Model Remedies. Most high levels are permanently cleaned up using soil excavation and removal. Some properties with high levels may have non-permanent remedies, with institutional controls such as environmental covenants. Properties with moderate contamination are addressed over time through a range of mostly voluntary mechanisms.	The most permanent remedy—permanently removes a greater portion of contamination from the environment, compared to Alternative B. Remaining contamination is addressed by limiting exposure through non-permanent remedies and institutional controls.	Does not permanently remove contamination from the environment.
Cost	None	Implementation costs include: soil sampling and remediation (mainly excavation, removal, and soil disposal). Long-term costs include staff to manage the proposed cleanup actions, and Phase Two planning and implementation. These costs are not recoverable, but are covered by Ecology's settlement with Asarco.	Implementation costs include: soil sampling and remediation for hundreds of thousands of properties. Long-term costs include staff to manage the proposed cleanup actions. These costs far exceed Asarco settlement funds.	Ecology and local government staff time to implement institutional controls, outreach costs, and individual costs to take protective actions. The cost is shifted to individuals and may not fully use Asarco settlement funds.
Effectiveness over the long term	Not applicable	Effective for the long term for most of the properties and land uses impacted by high contamination, since most will have permanent remedies. Non-permanent remedies have institutional controls to ensure they are effective in the long term.	Greatest long-term effectiveness—all properties are remediated. The greatest number of properties has permanent remedies.	Less effective than alternatives B or C. Relies entirely on increased public awareness and individual behavior change to reduce exposure.
Management of short term risks	Not applicable	Short term risks are minimized using best management practices and mitigation measures outlined in the SEPA checklist (Appendix E), including protecting workers, and managing storm water runoff and fugitive dust.	Short term risks are minimized using best management practices and mitigation measures outlined in the SEPA checklist (Appendix E). Cumulative risks to worker safety increase over the very long span of the project.	Not applicable

Technical and administrative implementability	Not applicable	The number of properties to be addressed makes this a complex alternative, but prioritizing and phasing makes it manageable. Funding and resources for this alternative are available through the Asarco settlement. Tacoma Smelter Plume Model Remedies will reduce the complexity of cleanup on many properties.	Most complex to implement—addresses hundreds of thousands of properties in the Tacoma Smelter Plume. Ecology lacks staff and funding resources to use this option. Landfills lack the capacity to receive all contaminated soils. Model Remedies reduce the complexity of cleanup on many properties.	Complex to implement—potentially addresses all properties in the plume. Local jurisdictions may implement deed restrictions and zoning overlays inconsistently. Overall, it takes fewer resources than engineered actions proposed in Alternatives B and C, but places an administrative burden on local governments.
Reasonable restoration timeframe	Not applicable	Property cleanups are complete in ten years. The Soil Safety Program and outreach and education continues beyond ten years.	Exceeds a reasonable restoration timeframe. Sampling over 700,000 properties and cleanup could take in the range of 100-200 years.	Properties would not be restored, but would require ongoing Institutional Controls.
Consideration of community concerns	Contradicts the recommendations of the Area Wide Soil Contamination Task Force, and a wide range of stakeholder interests (parents, schools, childcares, local governments, developers, real estate agents)	The Area Wide Soil Contamination Task Force (2003) discussed this type of alternative, supporting prioritization and action to address the most at risk populations with available resources. The Legislature mandated soil safety actions at schools and childcares in response to stakeholder concerns. Fact finding during implementation of the Tacoma Smelter Plume Management Plan (2006-2009) supports a phased and prioritized approach. Ecology will consider other public concerns after the public comment period for this plan. Ecology may change the selected cleanup alternative to address public concerns.	The Area Wide Soil Contamination Task Force (2003) discussed this type of alternative and did not think it was practical or cost-effective. The Task Force recommended addressing moderate contamination through outreach and education, and other measures, including voluntary cleanup Ecology will share his alternative during the public comment period.	The Area Wide Soil Contamination Task Force (2003) discussed this type of alternative. While the Task Force supported and encouraged use of institutional controls, especially outreach and education, it also recommended physical cleanup, especially at properties where children play. Ecology will share his alternative during the public comment period.

Appendix G
Area-Wide Soil Contamination Task Force Recommendations
Tacoma Smelter Plume Summary Status Report
2003-2010

Area-Wide Task Force Recommendations
Tacoma Smelter Plume Summary Status Report 2003-2010

Activity	Recommendations	Ecology Accomplishments 2003-2010	Future Plans – Interim Action Plan
Section 5: Nature and Extent of Contamination			
Communicating the nature and extent of area-wide soil contamination	Develop maps and accompanying narrative information. Emphasize the need for soil sampling to determine where area-wide soil contamination is present on individual properties.	Facility Site Atlas has a Tacoma Smelter Plume layer with high and moderate zones (Appendix A.4). Ecology encourages property-specific sampling to determine the actual arsenic level. Ecology provides guidance for sampling child use areas, and for taking protective actions.	Ecology will continue to use maps to communicate with homeowners and the general public. The new map shows high and moderate zones, but sampling is still needed to tell whether a property is contaminated.
Developing and updating maps, using Task Force maps as a starting point	Maintain and update state maps. Coordinate with local governments to regularly update local maps, especially for smelter areas. Define "area-wide zones" to help inform the application of the Model Toxics Control Act.	Ecology worked with health departments in Pierce, King, Kitsap, and Thurston counties on several studies to determine the extent of plume contamination. In 2009, Ecology used new data and methods to update the map (Ch. 2).	Ecology will use new data collected during the expanded soil safety and yard sampling and cleanup programs to update the map.
Section 7: Broad Based Education and Awareness Building			
Developing an information toolbox that includes information about steps people can take to reduce exposure	Include: maps; guidance on qualitatively evaluating potential exposure; sampling guidance by land use; health risk information; individual protective measures; further measures to reduce exposure on a property; and organizations that can provide assistance. Make information available in multiple languages, and tailored to different audiences, such as educators, health care practitioners, and local governments.	Ecology and local health departments in Pierce, King, and Thurston counties have educational posters in nine languages. Other materials include brochures, videos, a curriculum, posters, and mailings. The counties also produced television, radio, billboard, transit, and newspaper ads. Outreach mainly focuses on childcare providers, teachers, parents, students, homeowners, and gardeners.	Ecology will continue to develop educational information and outreach materials, and plans to continue funding local health departments. Although childcares have been a major focus of past outreach, many facilities and childcare providers have already been reached. This effort will be scaled back slightly so that other populations can be reached, such as non-English speaking communities.
Using a stepwise approach to providing information	1. Make educational materials available to all WA residents, through Web sites, libraries, Ecology offices, and local health departments. 2. Do additional outreach to areas where area-wide contamination is likely. Provide training and information to local health and land use planning departments, school	Ecology has an area-wide soil contamination website and provides materials through health departments in King, Pierce, and Thurston counties. Health departments give trainings and presentations to childcare licensors and providers, and teachers and school districts. Outreach focuses on areas of highest	Ecology will continue basic outreach to a wide audience, while targeting high contamination zones and certain groups, such as young children and their caregivers. Ecology will work more with park districts, planning offices, real estate agents, and others as part of both Phases One and Two.

Activity	Recommendations	Ecology Accomplishments 2003-2010	Future Plans – Interim Action Plan
	districts, and park districts, who should then educate their communities. 3. Provide additional outreach to areas where contamination is found through soil testing.	contamination. Ecology has done some outreach to park districts. Ecology's technical assistance coordinator does outreach to local planning departments. Health departments have done outreach to homeowners that requested home soil testing.	Ecology will develop educational materials and finalize model remedies guidance for land under development. Ecology will provide outreach and technical assistance to local planning and permit offices and property owners and developers.
Monitoring and evaluating effectiveness	Monitor and evaluate the effectiveness of education and individual protective measures, including behavior changes and exposure reduction.	Pierce County surveyed several areas, finding increasing rates of taking off shoes—a key protective measure. King County did a baseline survey in 2009. Ecology tracks calls, materials distributed, and number of people reached.	Ecology will continue to support evaluation by local health departments and track public contacts. The agency may develop additional evaluation tools for Phase One and Two work.
Section 8: Specific Land Use Scenarios			
Child use areas: schools, parks, childcare facilities	Owners and operators of facilities should implement individual protective measures and maintain good soil cover unless a qualitative evaluation shows that exposure is unlikely, or soil sampling shows no elevated arsenic or lead. Agencies should work with local health departments to encourage and assist with these activities.	For existing childcares and schools within the Soil Safety Program service area, Ecology offered free qualitative evaluations, soil sampling, and cleanup. Health departments did the evaluations and sampling, while Ecology managed any needed cleanup. Childcares and schools outside the service area can use Ecology guidance to do the work on their own. As part of the Soil Safety Program, Ecology offers childcare providers, teachers, children, and families outreach materials about protective measures. Health departments oeld childcare provider trainings and upon request. Ecology generally followed CPSC guidelines for playgrounds, such as depth of play chips under play equipment.	Under Phase One, Ecology will continue to address new schools and childcares in both high and moderate contamination zones. The expanded Soil Safety Program includes existing parks, camps, and public multi-family housing. Those outside of the service area may use Ecology guidance developed in the past or Model Remedies (Ch. 11). Ecology will continue to support outreach and education through local health departments, including trainings and presentations, although less often.
	Owners and operators should do qualitative evaluations for potential soil exposure in areas used by children, and sample soils and take additional protective measures, if needed. Agencies should work with local health departments to do soil testing and implement protective measures.		
	Consumer Product Safety Commission (CPSC) guidelines should be followed for playgrounds.		
	School and park officials should test soils during child use area site selection and design, and incorporate protective measures into construction plans, where soil sampling	Ecology has worked with several schools and parks within the Tacoma Smelter Plume during property development, assisting with interpreting results and planning for cleanup during the	Ecology plans to continue to sample and remediate school play areas. Ecology also plans to offer technical assistance, as needed, to schools with Tacoma Smelter

Activity	Recommendations	Ecology Accomplishments 2003-2010	Future Plans – Interim Action Plan
	shows elevated arsenic or lead. Agencies should work with the Office of the Superintendent of Public Instruction to interpret sampling results and choose protection measures. Local health inspectors should confirm that actions have been taken.	construction process. The State Board of Health's School Rule revision requires environmental sampling during site selection for new schools. The revision passed but is currently unfunded.	Plume contamination. Ecology plans to monitor the status of funding for the School Rule.
	Agencies should work with Department of Social and Health Services (DSHS) to provide information to child care professionals and encourage actions to reduce exposure. DSHS should establish and administer a voluntary daycare certification program.	Ecology provided training and materials to licensors in the northwest and southwest regions of the Department of Early Learning (DEL), which licenses childcares. Childcares can get certificates through the Soil Safety Program. DEL provides regular updates on license applicants so Ecology can sample play areas and provide outreach.	Ecology plans to provide free sampling and cleanup for childcares for the duration of the Soil Safety Program. Phase Two will explore long term strategies to address childcares. Ecology will work with DEL as it considers rule language to require licensees to sign an Ecology access agreement for evaluation and sampling.
Residential properties	Increase awareness with targeted education and outreach by local health departments. Residents should use individual protection measures and maintain good soil cover unless a qualitative evaluation shows that exposure is unlikely, or soil sampling shows no elevated arsenic or lead. Offer technical and financial assistance to encourage action by residents. Residents should do qualitative evaluations, and sample soils and take protective measures, if needed. Agencies should work with health departments to provide incentives such as sampling kits, subsidize their costs, or help residents interpret their results. Keep sampling data confidential, not linked with specific locations in agency records, except if: individuals volunteer their data for updating maps; they request a No Further	Local health departments use mass media advertising, direct mailings, events, and other outreach techniques to reach residents. The main goal is to raise awareness and promote behavior changes such as taking off shoes. Pierce and King counties piloted home soil testing programs. The voluntary programs provided outreach to interested homeowners. Staff visited the property, took 2-3 samples, and used the results to educate residents about protective measures they could take. Pierce County has an informational sheet about appropriate and effective ground coverings. King County has a handout on gardening in contaminated soils. Ecology does not keep a record of home soil testing data. Any Ecology data are publicly disclosable.	Under the yard sampling and cleanup program (Ch. 6), Ecology will offer all residential properties in high zone evaluation, and sampling and cleanup, if needed. Ecology's program will not cover residential properties in the moderate zone, except play areas of home childcares and public multifamily housing. Homeowners can use Ecology's guidance to sample and clean up. Through outreach, Ecology will encourage all residents take protective measures. Ecology will finalize the model remedies guidance. Ecology's technical assistance coordinator will help with using the model remedies.

Activity	Recommendations	Ecology Accomplishments 2003-2010	Future Plans – Interim Action Plan
	Action letter; or results show contamination not from area-wide sources. Provide guidance on affordable, effective, and practical ways to cover, remove, or replace contaminated soils, including advice on proper disposal and finding clean soils.	Ecology drafted model remedies guidance for the Tacoma Smelter Plume. They provide clear guidelines on how to take samples and five possible cleanup methods.	
Commercial properties	No further response is needed where soils are covered with buildings or parking lots. Mixed use areas should follow recommendations for non-commercial uses, such as child use areas.	Task force recommendations are generally consistent with current practice.	Ecology recommends addressing any soils exposed during work on commercial properties. Employers are responsible for following Labor and Industries guidelines for protecting their workers.
Open land	Developers should do qualitative evaluations and soil testing, where needed, and incorporate protective measures into development plans. State and federal worker safety requirements should be met. Agencies should set an example and adopt these practices for their construction projects. They should also ensure that dust, erosion, and runoff control regulations are met. Agencies should educate local SEPA officials and support amending the SEPA checklist to consider area-wide soil contamination. Agencies should try to reach SEPA exempt development activities. Ecology should work with local governments to explore developing standard protocols. Local governments are encouraged to use notices to show if a property has been sampled and if protective measures are in place.	Ecology's draft model remedies guidance applies to open land undergoing development. Ecology has provided technical assistance to several developments that were identified through the SEPA process. The draft guidance includes advice for preventing dust, erosion, and runoff. Department of Labor and Industries regulates worker safety and has information about area-wide contamination on their website. Ecology uses boilerplate language for SEPAs in the Tacoma Smelter Plume area. Local planning offices recommended providing standard guidance for soil sampling and cleanup, prompting Ecology to develop model remedies. Major issues include mechanisms for enforcing sampling and cleanup, and the use of deed notices or environmental covenants for contamination left in place.	In Phase One, Ecology will provide technical assistance and model remedies guidance to local planning offices. Ecology will encourage them to incorporate soil sampling and cleanup into permit requirements. Ecology will also provide technical assistance to developers who want to do cleanup. In Phase Two, Ecology will explore requiring soil sampling and cleanup during development. Ecology will continue to support local sampling and cleanup requirements. Ecology will also work with other agencies on soil sampling and cleanup for properties they own or manage. These actions will also address major redevelopments.

<table>
<tr><th>Activity</th><th>Recommendations</th><th>Ecology Accomplishments 2003-2010</th><th>Future Plans – Interim Action Plan</th></tr>
<tr><td></td><td>Measures should be taken to limit trespassing and windblown dust on open land not being developed, near residential areas.</td><td>Ecology has not yet addressed these issues.</td><td></td></tr>
<tr><td>Root vegetables</td><td>Information about protective measures should be distributed to home gardeners and local growers.</td><td>Ecology and local health departments have provided information for gardeners within the Tacoma Smelter Plume.</td><td>Ecology will continue to work through local health departments to educate gardeners and growers.</td></tr>
<tr><td colspan="4">Section 9: Real Estate Disclosure</td></tr>
<tr><td>Property transfer disclosure</td><td>The WA Association of Realtors (WAR) is encouraged to work on legislation requiring a real property transfer disclosure statement for open land. Meanwhile, agencies should work with WAR on voluntary notification.</td><td rowspan="3">Ecology supported 2007 legislation (SB 5895) for seller disclosure to include discovery of toxic materials. Meetings with real estate agent associations prompted Ecology to include certain activities in the Phase Two scoping. Main recommendations included
Developing training for their core curriculum for relicensing.
Pursuing a disclosure mechanism like the lead paint form.
Not requiring sellers to sample soils.</td><td rowspan="3">Ecology plans to pursue these recommendations as part of Phase Two, or earlier, if possible (Ch. 7).</td></tr>
<tr><td>Use of lead-based paint disclosure form and EPA pamphlet</td><td>Agencies should work with WAR to encourage real estate agents to use the lead-based paint disclosure form and EPA pamphlet, or similar, where area—wide soil contamination is likely.</td></tr>
<tr><td>Information and training for real estate professionals</td><td>Agencies should support WAR in creating an educational course about area-wide soil contamination, and draft an article for the Washington Realtor.</td></tr>
<tr><td colspan="4">Section 10: Application of Model Toxics Control Act</td></tr>
<tr><td>Alternatives to the MTCA site listing process</td><td>Ecology should set up an alternative to site listing that describes area-wide zones instead of listing individual properties. Ecology should describe conditions for addressing properties within these zones using MTCA.</td><td>The Tacoma Smelter Plume is on the Confirmed and Suspected Contaminated Sites List (CSCSL), but not individual properties. Ecology currently only lists on the CSCSL properties that enter the Voluntary Cleanup Program. Ecology is using the high zone (Appendix A.4) to prioritize action.</td><td>Ecology plans to address how to track cleanups as part of the yard sampling and cleanup program design.</td></tr>
<tr><td>Enforcement forbearance</td><td>Ecology should establish an enforcement forbearance policy for property owners choosing to use task force recommendations, and a checklist to document property status.</td><td>Ecology already has an enforcement forbearance policy for residential landowners (Policy 540A).</td><td>Ecology proposes enforcement forbearance for non-residential land. Ecology will address how to track property status in a database for the yard sampling and cleanup program.</td></tr>
</table>

Activity	Recommendations	Ecology Accomplishments 2003-2010	Future Plans – Interim Action Plan
Streamlined recognition that a site is clean	Ecology should streamline the process for recognizing when a site with area-wide contamination is clean.	Currently, one must enter the Voluntary Cleanup Program for a written determination on cleanup of Tacoma Smelter Plume contamination.	Ecology plans to address this issue as part of Phase Two (Ch. 7), or earlier, if possible.
Apply MTCA to site-specific cases	Ecology should continue to use MTCA for Voluntary Cleanup Program sites or when other contaminants are present.	Ecology is currently using the MTCA approach in these cases.	Model Remedies (Ch. 11)—a MTCA tool—will be an option for cleaning up Tacoma Smelter Plume contamination only.
Section 11: Additional Information Needed			
Research on ecological risks	Ecology should evaluate potential ecological impacts of moderate soil contamination.	Ecology did a study on the mobility and toxicity of arsenic and lead to terrestrial receptors, including plants and soil biota (Sloan 2010)	Ecology incorporated the findings of the ecological study into the TSP Model Remedies Feasibility Study (Golder 2011).
Section 12: Cost and Funding			
Financial assistance	Agencies should provide financial assistance to local governments, particularly health agencies.	Ecology provided biennial grants or interagency agreements to local health in King, Pierce, and Thurston counties for outreach, and sampling in King and Pierce counties. Grants and agreements totaled nearly $2 million in 2009-2011.	Ecology will continue outreach funding to local health, and will explore supporting local planning office efforts to address contamination during development.
Funding sources	Agencies should seek funding from federal, state, and private sources, including State and Local Toxics Control Accounts.	Ecology has used State and Local Toxics Control Accounts to fund outreach, and soil sampling and cleanup under the Soil Safety Program.	Ecology plans to fund future work from a settlement with Asarco, the Potentially Liable Person.

Appendix H
Tacoma Smelter Plume Public Participation Plan

Public Participation Plan
Interim Action Plan Appendix H

Tacoma Smelter Plume
Asarco Tacoma Smelter Site

Prepared by
Washington State Department of Ecology
Southwest Regional Office
Toxics Cleanup Program
Lacey, WA

October 2011

Table of Contents

H.1 Introduction

For almost 100 years, the Asarco Company operated a copper smelter in Tacoma (Ruston) Washington. Air pollution from the smelter settled on the surface soil over a vast region of the Puget Sound basin. The extent of contamination is over 1,000 square miles and is called the Tacoma Smelter Plume. The Asarco Tacoma Smelter site covers both the plume and parts of the Commencement Bay Nearshore/Tideflats Superfund Site.

This contamination varies widely across the plume and poses a risk to human health. Children are particularly at risk due to their small size, developing bodies, and potential for soil contact. Ecology is using a phased cleanup plan to address these risks through a variety of approaches. Ecology developed this public participation plan to promote meaningful community involvement during cleanup planning for the Tacoma Smelter Plume. This plan describes the tools that the agency uses to inform the public about site activities and identify opportunities for public participation.

H.2 Tacoma Smelter Plume Background and Cleanup Plans

The Tacoma Smelter Plume covers parts of Pierce, King, Thurston, and Kitsap counties (Figure 1). Arsenic, lead, and other heavy metals are still in the soil as a result. This pollution poses a risk to humans working or playing in the dirt, especially children.

Arsenic and lead are toxic metals. Scientists have linked long-term exposure to arsenic to a variety of health problems, including heart disease, diabetes, and cancer of the bladder, lung, skin, kidney, liver, and prostate. Lead can cause behavioral problems, permanent learning difficulties, and reduced physical growth. Whether someone is affected depends on the amount of arsenic and lead taken into their body over time.

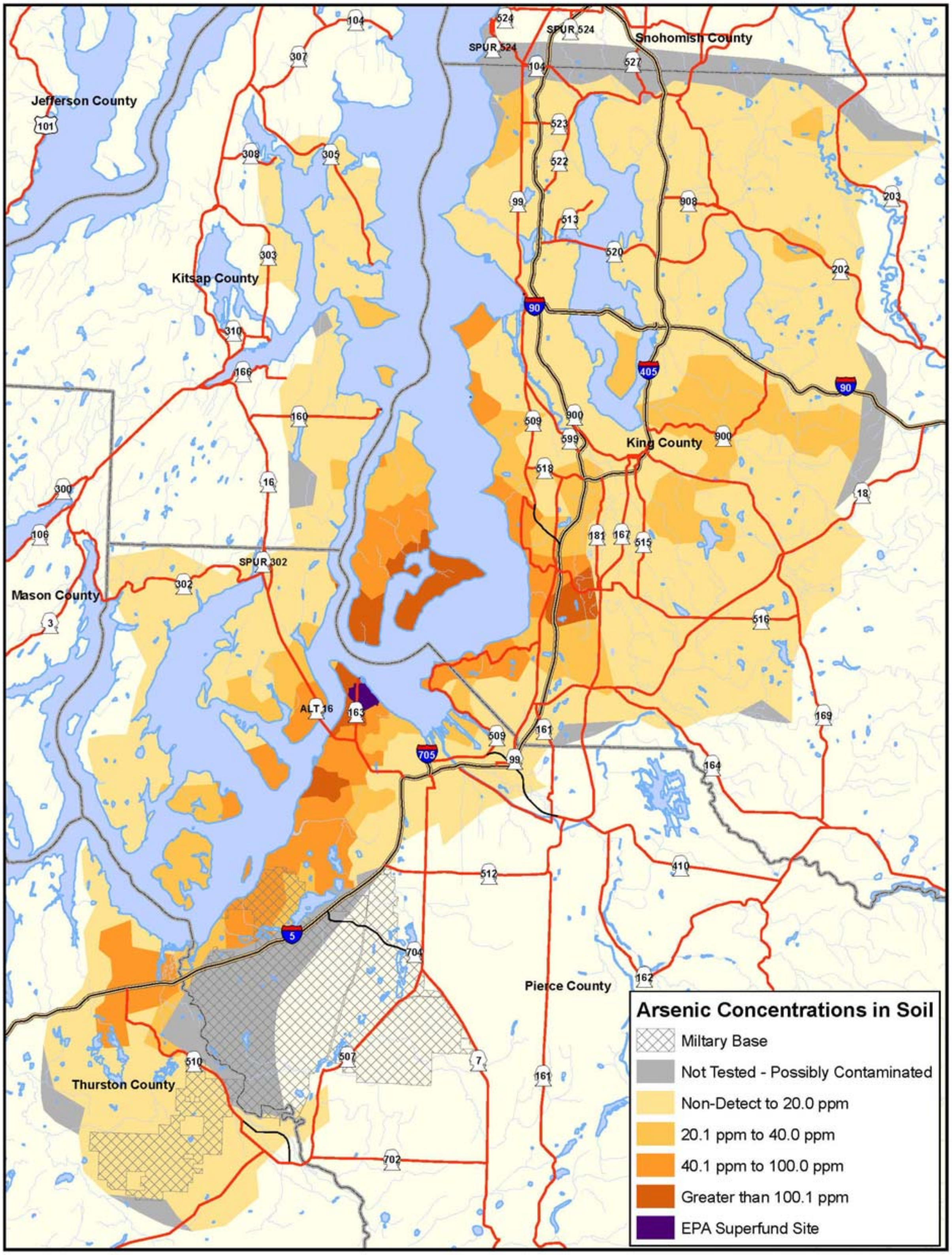
More information about the Tacoma Smelter Plume is available at Ecology's website: http://www.tinyurl.com/tacoma-smelter.

H.2.1 Site Management

Ecology's approach to the Tacoma Smelter Plume has been different than any other cleanup site the agency has managed. The very large size of the site and lack of participation by the Potentially Liable Person, Asarco, has required different strategies. Ecology investigated the plume area with a series of studies between 2000 and 2005.

Based on stakeholder input, the agency has managed the site by focusing resources on child use areas (schools, childcares) and using outreach to inform and educate the public. Recent efforts include the Soil Safety Program, which provided free soil sampling and cleanup for play areas at all schools and licensed childcares in the most highly contaminated areas of the plume. Ecology has also provided grant funding to local health departments in King, Pierce, and Thurston counties to do soil sampling and outreach.

Figure 1. Tacoma Smelter Plume Map



H.2.2 Cleanup Phases and Public Involvement

Ecology is addressing the Tacoma Smelter Plume in a unique way. The area is larger and more complex than any other cleanup site and requires a phased approach (see Figure 2). Phase One prioritizes sampling and cleaning up properties where people are at greatest risk of exposure to contaminated soils, including childcares and schools. Phase One also continues existing education and outreach, efforts to work with other government agencies, and encouraging cleanup during land development. An Interim Action Plan for this phase will be made available for public review and comment.

Once the **Phase One** Interim Action Plan is finalized, Ecology will begin work on a detailed program design for a new program for sampling and cleaning up home yards. Due to limited funding, Ecology will only address residential properties in areas expected to have the highest levels of arsenic. Public involvement for the program design will focus on these neighborhoods, once Ecology has determined them. Ecology will work with local stakeholders to address community concerns and design a program that minimizes neighborhood impacts.

Phase Two will have a separate Interim Action Plan and public review process. It will focus on broader strategies that require more research and planning. For example, Ecology plans to explore requiring soil sampling and cleanup through local development permitting processes. While Phase One focuses mainly on the highest contamination, Phase Two will look more at strategies for the whole plume area. Ecology will make the Phase Two Interim Action Plan available for public review and comment.

Ecology will share any future cleanup plans, beyond Phases One and Two, with the public when they occur. Major changes to Interim Action Plans will require additional public comment periods. The public is welcome to contact Ecology with questions and comments at any time during the Tacoma Smelter Plume cleanup.

Figure 2. Cleanup Phasing

H.3 Public Participation Activities and Responsibilities

The purpose of this Public Participation Plan is to promote public understanding and participation in cleanup activities. This section of the plan addresses how Ecology will share information and receive public comments and community input on the site activities. The following is a list of the public involvement activities that Ecology will use, their purposes, and descriptions of when and how they will be used during the Tacoma Smelter Plume cleanup.

H.3.1 Public Comment Periods

Comment periods are the main way Ecology gets feedback from the public on cleanup plans. Comment periods are at least 30 days long and are required at key points during cleanup, before final decisions are made. During a comment period, the public can comment in writing. Verbal comments are taken if a public hearing is held.

Public comment periods will be held for:

- The Phase One Interim Action Plan and State Environmental Policy Act determination;
- Yard sampling and cleanup program design;
- Phase Two Interim Action Plan; and
- Any further cleanup plans Ecology develops for the site.

Responsiveness Summary

After formal comment periods, Ecology reviews all written comments and responds to major issues in a responsiveness summary. Due to the size and complexity of the cleanup, and the large range of stakeholders involved, Ecology plans to write general responses to the major issues raised. The Responsiveness Summary will include all comments received. However, there will not necessarily be a direct response to each concern raised.

Document Revisions

Ecology will consider the need for changes or revisions to cleanup decision documents, based on input from the public. If significant changes are made, then a second comment period may be held. If no significant changes are made, then the draft document(s) will be finalized.

H.3.2 Public Meetings and Open Houses

Ecology will hold public meetings or open houses during comment periods. For the Phase One Interim Action Plan, Ecology will hold at least three meetings in different areas of the plume, to provide greater access to affected populations. At least one meeting will be held in Pierce County, one on Vashon-Maury Island, and one in mainland King County, near the communities where Ecology plans to begin soil sampling and cleanup work. Ecology may plan other meetings as time and resources allow.

Format

Public meetings or open houses are an opportunity for members of the public to speak with Ecology staff, meet other local stakeholders, and learn more about the cleanup process. The agency's typical format is to hold open house sessions for speaking one-on-one with staff and viewing posters and cleanup documents. In between open house sessions, project staff members give a presentation and answer audience questions. The public may submit their comments in writing at the meeting, or later by mail or e-mail. Sometimes technical workshops are held before the open house. These workshops give participants a chance to learn about and discuss technical issues in more depth.

Additional meetings

Ecology may also hold special community meetings before soil sampling begins in a neighborhood. These meetings will inform community members about the process, and give them a role in planning how the work is done. The goal is to minimize community and environmental impacts.

Advertisement

All public meetings will be held in accessible locations, during weekday evening hours. Workshops may be held during the late afternoon of a meeting day, or on a separate date. Meetings will be advertised through

- Direct mailings or e-mails to stakeholders, organizations, associations, and agencies.
- Postings at local libraries, schools, and other public venues.
- Newspaper display ads.
- Websites – Ecology, local agencies, organizations, and associations.
- Ecology's Site Register.

H.3.3 Information Repositories

Information repositories are places where the public may review site information, including documents that are the subject of public comment. Due to the large volume of documents and the number of libraries, Ecology will mostly only send copies of the fact sheet and ask libraries to help patrons find Ecology's website. The locations listed in bold text will receive hard copies

Seattle Public Library Southwest Branch
9010 35th Avenue SW
Seattle, WA 98126
206-684-7455

Seattle Public Library South Park Branch
8604 Eighth Ave. S
Seattle, WA 98108
206-615-1688

Seattle Public Library High Point Branch
3411 SW Raymond St.
Seattle, WA 98126
206-684-7454

Seattle Public Library West Seattle Branch
2306 42nd Ave. SW
Seattle, WA 98116
206-685-7444

Seattle Public Library Delridge Branch
5423 Delridge Way SW
Seattle, WA 98106
206-733-9125

Greenbridge Library
9720 8th Ave SW
Seattle, WA 98106
206-762-1682

White Center Library
11229 16th SW
Seattle, WA 98146
206-243-0233

Boulevard Park Library
12015 Roseberg Ave. S
Seattle, WA 98168
206-242-8662

Tukwila Library
14475 59th Ave S
Tukwila, WA 98168
206-244-5140

Burien Library
14700 Sixth Ave. SW
Burien, WA 98166
206-243-3490

Valley View Library
18750 Military Rd S
SeaTac, WA 98188
206-242-6044

Vashon Library
17210 Vashon Hwy SW
Vashon Island, WA 98070
206-463-2069

Des Moines Library
21620 11th Ave. S
Des Moines, WA 98198
206-824-6066

Woodmont Library
26809 Pacific Highway South
Des Moines, WA 98198
253-839-0121

Tacoma Public Library Swasey Branch
7001 6th Ave
Tacoma, WA 98406
253-591-5666

Tacoma Public Library South Tacoma Branch
3411 S 56th St
Tacoma, WA 98409
253-591-5666

University Place Library
7315 27th St W, Suite D
University Place, WA 98466
253-565-9447

Lakewood Library
6300 Wildaire Rd SW
Lakewood, WA 98499
253-582-6040

Federal Way 320th Branch
848 S 320th St
Federal Way, WA 98003
253-839-0257

Tacoma Public Library Kobetich Branch
212 Browns Point Blvd NE
Tacoma, WA 98422
253-591-5666

Tacoma Public Library Wheelock Branch
3722 N 26th St
Tacoma, WA 98407
253-591-5666

Tacoma Public Library Main
1102 Tacoma Ave S
Tacoma, WA 98402
253-592-5666

Tillicum Library
14916 Washington Ave SW
Lakewood, WA 98498
253-588-1014

Steilacoom Library
2950 Steilacoom Blvd
Steilacoom, WA 98388
253-588-1452

DuPont Library
1540 Wilmington Dr
Dupont, WA 98327
253-964-4003

Lacey Timberland Library
500 College St SE
Lacey, WA 98503
360-491-3860

Ecology's Southwest Regional Office is another repository:
300 Desmond Drive SE, Lacey, WA 98503
Contact Debbie Nelson for an appointment, Debbie.Nelson@ecy.wa.gov, 360-407-6365.

Site information is also on Ecology's website at
http://www.ecy.wa.gov/programs/tcp/sites_brochure/tacoma_smelter/ts_hp.htm

H.3.4 Site Register

Ecology's Toxics Cleanup Program uses its bimonthly Site Register to announce public meetings and comment periods, as well as many other activities. To receive the Site Register in electronic or hard copy format, contact Seth Preston at (360) 407-6848 or by e-mail at Seth.Preston@ecy.wa.gov. It is also available on Ecology's website: http://www.ecy.wa.gov/programs/tcp/pub_inv/pub_inv2.html.

H.3.5 Mailing List

Ecology is continually updating the mailing list for the Tacoma Smelter Plume. It includes individuals, groups, public agencies, elected officials, private businesses, and other known interested parties. The list will be maintained at Ecology's Southwest Regional Office and will be updated when individuals request to be added or removed. Please contact Hannah Aoyagi at (360) 407-6790 or by e-mail at Hannah.Aoyagi@ecy.wa.gov if you would like to be involved or have your address added to or deleted from this mailing list.

H.3.6 Fact Sheets

Ecology will mail fact sheets to people and organizations interested in the Tacoma Smelter Plume cleanup to inform them of public meetings and comment opportunities and important activities. Ecology also may mail fact sheets about cleanup progress.

H.3.7 Website

The Tacoma Smelter Plume website has a large volume of information about the site and related soil contamination issues. Resources include

- Public comment period documents.
- Brochures, guidance, and health information.
- Soil sampling and cleanup information.
- The Soil Safety Program.
- Links to local health department programs.
- Information about other area wide soil contamination issues.

Link: http://www.ecy.wa.gov/programs/tcp/sites_brochure/tacoma_smelter/ts_hp.htm

H.3.8 Newspaper Legal Ads and Display Ads

Ecology will place legal ads in the Seattle Times, Tacoma News Tribune, and Olympian to announce public comment periods and public meetings for the cleanup. Ecology may also place display ads in these newspapers and smaller community publications.

H.4 Plan Updates

Ecology will update this public participation plan as the project proceeds. If a major revision is necessary, the revised plan will be submitted to the public for comment.

H.5 Contacts

If you have questions or need more information about Tacoma Smelter Plume, please contact

Hannah Aoyagi, Public Involvement Coordinator
Washington State Department of Ecology
300 Desmond Drive
Lacey, WA 98503
Phone: (360) 407-6790
E-mail: haoy461@ecy.wa.gov

Glossary

Comment Period: A time period during which the public can review and comment on documents and proposed actions.

Contaminant: Any hazardous substance that does not occur naturally or occurs at greater than natural background levels

Information Repository: A file containing current information, technical reports, and reference documents available for public review. The information repository is usually located in a public building that is convenient for local residents such as a public school, city hall, or library.

Interim Action Plan (IAP): An Ecology document that outlines *partial* cleanup actions for a site. The plan also considers public comments and community concerns.

Model Toxics Control Act (MTCA): Legislation passed by citizens of the State of Washington through an initiative in 1988,and later amended by the legislature. It regulates the identification, investigation, and cleanup of facilities where hazardous substances have been released into the environment. It also provides for public involvement in the decision-making process. The Model Toxics Control Act is Chapter 70.105D of the Revised Code of Washington (RCW).

Model Toxics Control Act Cleanup Regulation: The regulation which provides specific details of how the Model Toxics Control Act is to be implemented. Chapter 173-340 of the Washington Administrative Code (WAC).

Public Notice: At a minimum, adequate notice mailed to all persons who have made a timely request of Ecology and to persons residing in the potentially affected vicinity of the proposed action; mailed to appropriate news media; published in the local (city and county) newspaper of largest circulation; and the opportunity for the interested persons to comment.

Public Participation Plan: A plan prepared to encourage coordinated and effective public involvement designed to the public's needs at a particular site.

Responsiveness Summary: A summary of oral and/or written public comments received by Ecology during a comment period on key documents, and Ecology's responses to those comments. The responsiveness summary is especially valuable during the Cleanup Action Plan phase at a site when it highlights community concerns.

Risk: The probability that a hazardous substance, when released into the environment, will cause an adverse effect in the exposed humans or living organisms.

State Environmental Policy Act (SEPA): A state law that directs state and local agencies to consider environmental values along with technical and economic considerations when making decisions on proposals for actions. This law is Chapter 43.21C of the Revised Code of Washington (RCW).

Appendix I
Soil Safety Program Toxicity Characteristic Leaching Procedure (TCLP) Results

Appendix H – Soil Safety Program TCLP Results

This appendix contains data collected during Ecology's Soil Safety Program. Soil samples collected from childcare plays areas are compared to their Toxicity Characteristic Leaching Procedure (TCLP) results for arsenic and lead. The first set of numbers is the result from discrete in situ soil samples taken during site characterization under the Soil Safety Program. The second set of numbers is the TCLP value, used for Waste Disposal Authorizations during the cleanup phase of the Soil Safety Program. No samples exceeded the dangerous waste threshold value of 5.0 mg/L, even though the soil levels were among the highest observed within the Tacoma Smelter Plume.

---- = not analyzed for TCLP

	Arsenic		Lead	
Facility ID	Soil value (mg/kg)	TCLP value (mg/L)	Soil value (mg/kg)	TCLP value (mg/L)
27-0023-1-04-1-4	400	0.26	64	-----
17-1286-1-6-1-4	22	-----	2000	1.5
307-3-06-1-4	117	0	80.1	0
307-3-06-2-4	54.5	0.0319	38.8	-----
307-3-07-2-4	118	0.058	157	0
307-3-08-1-4	557	0	807	0.614
307-3-08-2-4	691	0.217	1040	1.11
27-1244-1-03-1-4	33	-----	7900	0.03
27-1244-1-04-1-4	26	-----	2000	0.2
27-1244-1-05-1-4	25	-----	3100	0.56
27-1018-1-08-1-4	150	0.12	370	
27-1144-1-07-1-4	14	-----	1200	0.043
27-1033-1-01-1-4	30	-----	1300	0.68
27-1218-1-04-1-4	480	0.42	69	-----
27-1113-2-02-1-4	210	0.1	260	-----

Appendix J
Model Environmental Covenant

Model Restrictive (Environmental) Covenant

After Recording Return to:

____
Department of Ecology
[fill in regional address]

Environmental Covenant

Grantor: **[land owner]**
Grantee: State of Washington, Department of Ecology
Legal: **[fill in brief legal description]**
Tax Parcel Nos.: **[fill in]**
Cross Reference: **[if amendment, recording number of original covenant]**

Grantor, _____**[land owner]**________, hereby binds Grantor, its successors and assigns to the land use restrictions identified herein and grants such other rights under this environmental covenant (hereafter "Covenant") made this day of _____________, 200__ in favor of the State of Washington Department of Ecology (Ecology). Ecology shall have full right of enforcement of the rights conveyed under this Covenant pursuant to the Model Toxics Control Act, RCW 70.105D.030(1)(g), and the Uniform Environmental Covenants Act, 2007 Wash. Laws ch. 104, sec. 12.

This Declaration of Covenant is made pursuant to RCW 70.105D.030(1)(f) and (g) and WAC 173-340-440 by [NAME OF PROPERTY OWNER], its successors and assigns, and the State of Washington Department of Ecology, its successors and assigns (hereafter "Ecology").

A remedial action (hereafter "Remedial Action") occurred at the property that is the subject of this Covenant. The Remedial Action conducted at the property is described in the following document[s]:

[INSERT THE DATE AND TITLE FOR CLEANUP ACTION PLAN and other documents as applicable].

These documents are on file at Ecology's [Insert Office Location] Office.

+++++++Select the appropriate scenario for the property+++++++

SCENARIO 1:

This Covenant is required because the Remedial Action resulted in residual concentrations of [SPECIFICALLY LIST SUBSTANCE(S)] which exceed the Model Toxics Control Act Method [LIST APPLICABLE METHOD] Cleanup Level(s) for [SOIL, GROUNDWATER, ETC.] established under WAC 173-340-____.

++++and/or++++

SCENARIO 2:

This Restrictive Covenant is required because a conditional point of compliance has been established for [SOIL, GROUNDWATER, ETC.].SCENARIO 3:

If the Remedial Action does not fit within Scenarios 1 and/or 2 and you believe that the property still needs a Restrictive Covenant, contact the AG's office.

++

The undersigned, [NAME OF PROPERTY OWNER], is the fee owner of real property (hereafter "Property") in the County of [NAME OF COUNTY], State of Washington, that is subject to this Covenant. The Property is legally described [AS FOLLOWS: (insert legal description language)] -or- [IN ATTACHMENT A OF THIS COVENANT AND MADE A PART HEREOF BY REFERENCE (attach document containing legal description)].

[NAME OF PROPERTY OWNER] makes the following declaration as to limitations, restrictions, and uses to which the Property may be put and specifies that such declarations shall constitute covenants to run with the land, as provided by law and shall be binding on all parties and all persons claiming under them, including all current and future owners of any portion of or interest in the Property (hereafter "Owner").

Section 1. (This Section must describe with particularity the restrictions to be placed on the property.)

1. If the property was remediated to industrial soil cleanup standards, then use the following sentence: "The Property shall be used only for traditional industrial uses, as described in RCW 70.105D.020(23) and defined in and allowed under the [CITY -or- COUNTY] of [________________'s] zoning regulations codified in the [OFFICIAL NAME OF ZONING REGULATION] as of the date of this Restrictive Covenant."

2. If the groundwater contains hazardous substances above cleanup levels, then use the following sentence: "No groundwater may be taken for [LIST THE PROHIBITED USES, E.G., DOMESTIC, AGRICULTURAL, OR ANY USE] from the Property."

3. If the soil contains hazardous substances above cleanup levels, then describe prohibited activities as follows:

a. For contaminated soil under a structure use the following sentence: "A portion of the Property contains [SPECIFICALLY LIST SUBSTANCE(S)] contaminated soil located [SPECIFICALLY DESCRIBE WHERE THE SOIL IS LOCATED, I.E., UNDER THE SOUTHEAST PORTION OF BUILDING 10]. The Owner shall not alter, modify, or remove the existing structure[s] in any manner that may result in the release or exposure to the environment of that contaminated soil or create a new exposure pathway without prior written approval from Ecology."

b. Example language for contaminated soil under a cap: "Any activity on the Property that may result in the release or exposure to the environment of the contaminated soil that was contained as part of the Remedial Action, or create a new exposure pathway, is prohibited. Some examples of activities that are prohibited in the capped areas include: drilling, digging, placement of any objects or use of any equipment which deforms or stresses the surface beyond its load bearing capability, piercing the surface with a rod, spike or similar item, bulldozing or earthwork."

<u>Section 2</u>. Any activity on the Property that may interfere with the integrity of the Remedial Action and continued protection of human health and the environment is prohibited.

<u>Section 3</u>. Any activity on the Property that may result in the release or exposure to the environment of a hazardous substance that remains on the Property as part of the Remedial Action, or create a new exposure pathway, is prohibited without prior written approval from Ecology.

<u>Section 4</u>. The Owner of the property must give thirty (30) day advance written notice to Ecology of the Owner's intent to convey any interest in the Property. No conveyance of title, easement, lease, or other interest in the Property shall be consummated by the Owner without adequate and complete provision for continued monitoring, operation, and maintenance of the Remedial Action.

Section 5. The Owner must restrict leases to uses and activities consistent with the Covenant and notify all lessees of the restrictions on the use of the Property.

Section 6. The Owner must notify and obtain approval from Ecology prior to any use of the Property that is inconsistent with the terms of this Covenant. Ecology may approve any inconsistent use only after public notice and comment.

Section 7. The Owner shall allow authorized representatives of Ecology the right to enter the Property at reasonable times for the purpose of evaluating the Remedial Action; to take samples, to inspect remedial actions conducted at the property, to determine compliance with this Covenant, and to inspect records that are related to the Remedial Action.

Section 8. The Owner of the Property reserves the right under WAC 173-340-440 to record an instrument that provides that this Covenant shall no longer limit use of the Property or be of any further force or effect. However, such an instrument may be recorded only if Ecology, after public notice and opportunity for comment, concurs.

[NAME OF GRANTOR]

____
[Name of Signatory]
[Title]

Dated: __________________

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

____
[Name of Person Acknowledging Receipt]
[Title]

Dated: __________________

[INDIVIDUAL ACKNOWLEDGMENT]

STATE OF ____________________
COUNTY OF __________________

On this ______ day of __________________, 20__, I certify that ______________ personally appeared before me, and acknowledged that **he/she** is the individual described herein and who executed the within and foregoing instrument and signed the same at **his/her** free and voluntary act and deed for the uses and purposes therein mentioned.

____
Notary Public in and for the State of Washington, residing at ______________.
My appointment expires______________.

[CORPORATE ACKNOWLEDGMENT]

STATE OF ____________________
COUNTY OF __________________

On this ______ day of __________________, 20__, I certify that ______________ personally appeared before me, acknowledged that **he/she** is the ____________________ of the corporation that executed the within and foregoing instrument, and signed said instrument by free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that **he/she** was authorized to execute said instrument for said corporation.

____
Notary Public in and for the State of Washington, residing at
_______________.
My appointment expires_______________.

[REPRESENTATIVE ACKNOWLEDGEMENT]

STATE OF ____________________
COUNTY OF __________________

On this ______ day of __________________, 20__, I certify that ______________ ______ personally appeared before me, acknowledged that **he/she** signed this instrument, on oath stated that **he/she** was authorized to execute this instrument, and acknowledged it as the

___________________________ [type of authority] of ________________________ [name of party being represented] to be the free and voluntary act and deed of such party for the uses and purposes mentioned in the instrument.

____
Notary Public in and for the State of
Washington, residing at ______________.
My appointment expires ______________.

Exhibit A
Legal Description

Appendix K
Responsiveness Summary:
Response to public comments on the draft Interim Action Plan

DEPARTMENT OF
ECOLOGY
State of Washington

RESPONSIVENESS SUMMARY

Tacoma Smelter Plume
Asarco Tacoma Smelter Site
October 20 – December 20, 2011 Public Comment Period

Interim Action Plan

Prepared by
Washington State Department of Ecology
Southwest Regional Office
Toxics Cleanup Program
300 Desmond Drive
Olympia, Washington 98504-7775

June, 2012

Contacts

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Project Manager
Washington Department of Ecology
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(360) 407-6257
Marian.Abbett@ecy.wa.gov

Hannah Aoyagi
Project Planner
(360) 407-6790
Hannah.Aoyagi@ecy.wa.gov

More Information

Visit Department of Ecology's Tacoma Smelter Plume website for background on the site, links to documents, and information about the cleanup:
http://www.ecy.wa.gov/toxics/tacoma-smelter.html

Site documents are also available at:

Washington Department of Ecology
Southwest Regional Office
300 Desmond Drive SE
Lacey WA 98503
(360) 407-6243

Tacoma Public Library
Northwest Room
1102 Tacoma Ave.
Tacoma, WA 98402
(253) 591-5666

The Washington Department of Ecology (Ecology) has a list of interested residents, organizations, businesses, and agencies. To join the mailing list, please contact Hannah Aoyagi at 360-407-6790 or Hannah.Aoyagi@ecy.wa.gov.

Table of Contents

Introduction

This responsiveness summary addresses comments and questions from the October 20 – December 20, 2011 comment period on the Tacoma Smelter Plume cleanup plan. The plan covers how Ecology will use a $94 million settlement to clean up some soils, and manage risk throughout the 1,000 square mile plume. The plan has four main pieces:

1. Sample and clean up yards in the most highly contaminated areas of the plume.
2. Continue the Soil Safety Program for schools, childcares, parks, and camps.
3. Provide ongoing outreach and education.
4. Encourage cleanup during property development or redevelopment, when soils are already being disturbed.

Fifty-five individuals, organizations, and local governments commented. We also included some common questions heard during our public meetings, and from people who did not provide written comments. We did make a number of changes to the Interim Action Plan and Model Remedies Guidance. The major changes are listed in the next section "Actions Resulting from Public Comments."

Format of the Responsiveness Summary

Ecology has reviewed all comments received. Comments from different reviewers often covered the same topics. We have responded to these common concerns, as well as many other comments and questions. The contents include:

- **Summary of Public Involvement**
- **List of Commenters**
- **Acronyms and Abbreviations**
- **Responses to Common Concerns**
- **Responses to Specific Concerns**
- **Appendix A: Comment letters**

Next Steps

Now that we have finalized the Interim Action Plan, next steps include designing the yard sampling and cleanup program. We will need public input during the program design and as we develop new outreach strategies, especially for real estate agents and new homebuyers.

Actions Resulting from Public Comments

Yard Sampling and Cleanup Program

The comment period provided us with many issues we need to address while designing the yard program. We will are currently working on these issues as we make decisions about how to take soil samples and how and where to do cleanup. We will also look at ways to make yard replacements more environmentally friendly, with less stormwater runoff, and more native and drought resistant plants.

Expand the Soil Safety Program

We will identify play areas at places of worship, preschools, private community parks and community centers within the high zone. We will evaluate funding options to possibly address these play areas.

Cleanup During Development

We are no longer charging a fee for VCPs that have only Tacoma Smelter Plume contamination. We will also create materials to help smaller-scale projects decide if model remedies are appropriate. We will design a handout that includes background on the plume, a map, lab information, a summary of cleanup options, and an Ecology contact. We will distribute this to local permit offices.

Real Estate Sales

We are accelerating our work on this part of the plan. We are beginning to meet with real estate agents and planning to pilot some educational tools. One major initiative is to promote the disclosure of arsenic and lead from the Tacoma Smelter Plume.

Working with Local Governments

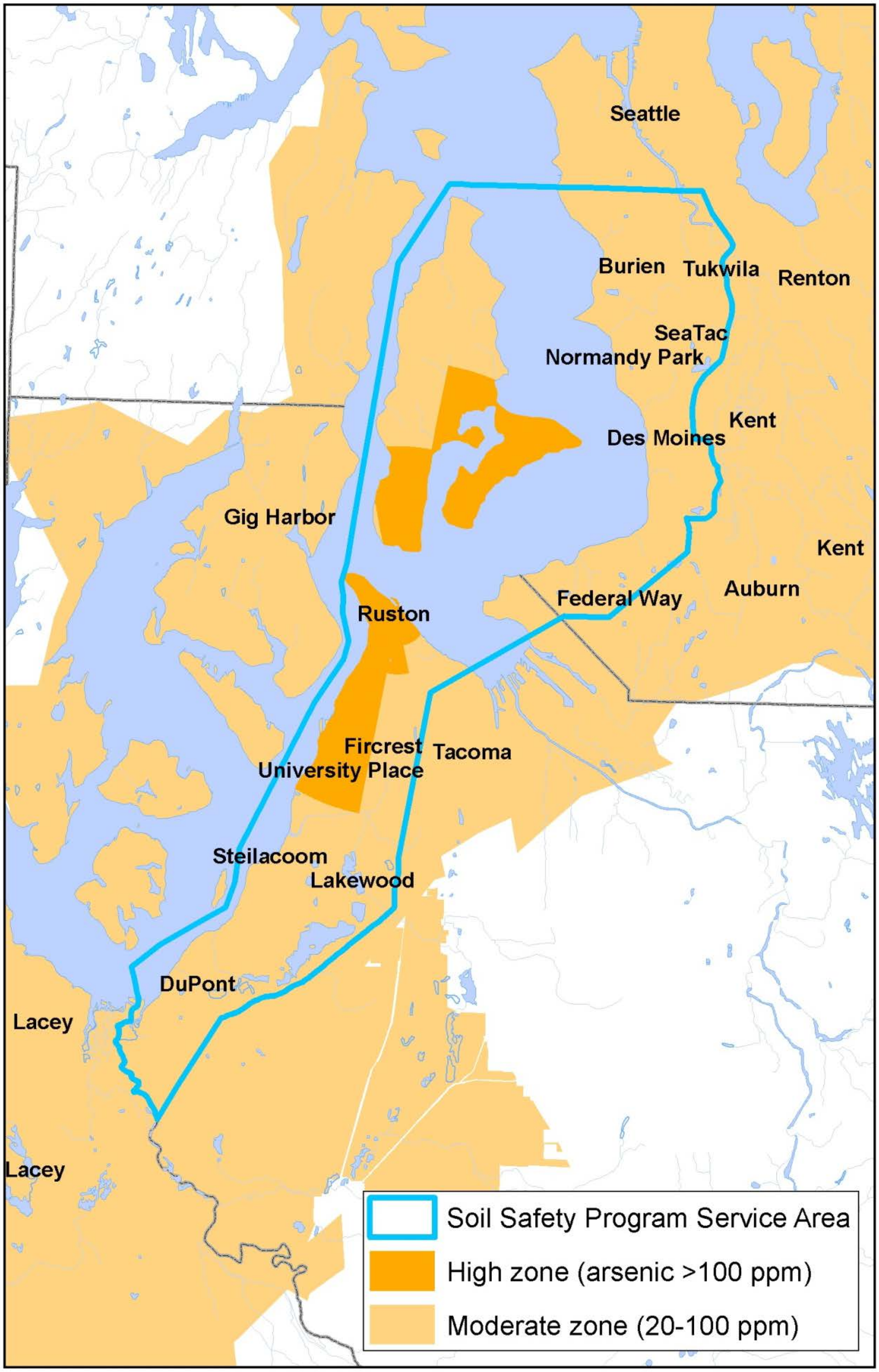
We are beginning to talk with cities about developing best management practices for soils at public works project sites within the plume.

Education and Outreach

We will coordinate with our local health department partners to try new outreach methods. In particular, we will contact some of the community organizations suggested.

State Environmental Policy Act Checklist

We will work with local waste management staff during the yard cleanup program design to better understand and reduce the impacts of soil disposal. We will also try to schedule cleanup work to avoid peak traffic hours.


Seattle
Burien
Tukwila
Renton
SeaTac
Normandy Park
Kent
Des Moines
Gig Harbor
Kent
Auburn
Federal Way
Ruston
Fircrest
Tacoma
University Place
Steilacoom
Lakewood
DuPont
Lacey
Lacey
Soil Safety Program Service Area
High zone (arsenic >100 ppm)
Moderate zone (20-100 ppm)

Summary of Public Involvement

The Model Toxics Control Act (MTCA) mandates public involvement in the site cleanup process. The cleanup plan comment period ran from October 20 to December 20, 2011. Public involvement included stakeholder briefings, fact sheets mailers and other outreach, and public meetings.

Stakeholder Briefings

In August and September of 2011, we held eight briefings for key stakeholders:

- Interested tribes
- Ruston Town Council
- Tacoma City Council
- Vashon-Maury Island Community Council
- University Place City Council
- Pierce County Cities and Towns Association
- Pierce County Council
- King County Council staff

The purpose was to give local tribes and elected officials a preview of the cleanup plan. They also provided questions and feedback on how to explain the plan to the public.

Fact Sheets and Other Outreach

Ecology advertised the comment period using the following methods:

- **Fact sheet mailer** - Mailed to residents and property owners (2,750 in King County and 6,200 in Pierce County).
- **E-mail announcement** – Sent to around 700 stakeholders.
- **News release**
- **Other** - Notices on Ecology's Public Involvement Calendar and Site Register**.** Legal ads in the Olympian, Tacoma News Tribune, and Seattle Times.
- **Website** – http://www.ecy.wa.gov/toxics/tacoma-smelter.html
- **Blogs** – Posts about the comment period and public meetings, meeting recaps, and follow-ups to questions.

Public Meetings

Ecology hosted four public open houses. Each event had open house sessions, a presentation, and question and answer session. The presentations are available at: http://www.ecy.wa.gov/programs/tcp/sites_brochure/tacoma_smelter/2011/iap.html

- November 2 in Tacoma @ Point Defiance Elementary School (~50 in attendance)
- November 9 on Vashon Island @ McMurray Middle School (~250 in attendance)
- November 16 in University Place @ Curtis High School (~35 in attendance
- December 6 in Des Moines @ Des Moines Activity Center (~20 in attendance)

List of Commenters

Date	Name	Affiliation
11-2-11	Mike Monahan	Tacoma resident
11-2-11	Marie Jurich	Tacoma resident
11-3-11	John Zinza	
11-5-11	Marshall Hampton	
11-9-11	Emma Newby	Vashon resident
11-9-11	Jonathan Katz	Morningside Farm, Vashon
11-9-11	Lynda Brothers	L Brothers Law
11-9-11	Robert Blauvelt	Vashon resident
11-11-11	Carl Sells	Vashon resident
11-12-11	Michael Meyer	Vashon resident
11-16-11	Carl Halsan	Gig Harbor resident
11-16-11	Mark Amrine	City of Lakewood
11-16-11	Todd Torset	Vashon property owner
11-16-11	Kristin Lynett	City of Tacoma Office of Sustainability
12-15-11	David Swindale	City of University Place
12-15-11	Charles Bell*	Burien resident
12-15-11	Michael Bluske*	Seattle resident
12-15-11	Kyle Cruver*	Vashon resident
12-15-11	Aura Cuevas*	Seattle resident
12-15-11	Joann Edmonds-Rodgers*	Seattle resident
12-15-11	Daniel Evans*	Tacoma resident
12-15-11	Kathleen Fellbaum*	Vashon resident
12-15-11	Michelle Gaither*	Seattle resident
12-15-11	Terri Glaberson*	Seattle resident
12-15-11	Natalie LaBerge*	Tacoma resident
12-15-11	Carole Meriam*	Vashon resident
12-15-11	Margaret Rothschild*	Vashon resident
12-15-11	Mary Schroeder*	Seattle resident
12-15-11	Jody Tapsak*	Seattle resident
12-15-11	Amy Traux*	Seattle resident
12-15-11	Laurie Tucker*	Vashon resident
12-16-11	Pamela Morrill	Camp, Dresser & McKee Inc.
12-16-11	Adele Reynolds*	Seattle resident
12-17-11	Mark Slack	Seattle resident
12-17-11	Karin Nelson*	Seattle resident
12-17-11	Amy Wolff*	Vashon resident
12-19-11	Peter Huffman	City of Tacoma, Community and Economic Development Department
12-19-11	Heather Trim	People for Puget Sound
12-19-11	Evonne Agnello	Tacoma resident
12-19-11	Rein Attemann*	Seattle resident
12-20-11	Carl Teitge	Tacoma resident
12-20-11	Todd Hunsdorfer	City of Kent
12-20-11	Deborah Johnson	City of Lakewood

12-20-11	Doug Fortner	Town of Steilacoom
12-20-11	James Perry	
12-20-11	Jessica Knickerbocker	Tacoma resident
12-20-11	Kevin Brown	King County Parks & Recreation Division
12-20-11	Pamela Badger	King County Solid Waste Division
12-20-11	Kristine Anderson and Richard Hamm	Tacoma residents
12-20-11	Leslie Ann Rose	Citizens for a Healthy Bay
12-20-11	Marilyn Dunstan	Burien resident
12-21-11	Richard Heggen*	Tacoma resident
12-22-11	Stephanie Jewett	City of Burien
12-22-11	Alixine Sasonoff*	Burien resident
12-22-11	Tacoma-Pierce County Health Department	

**Duplicate comments. Please see Charles Bell's comment letter.*

Acronyms and Abbreviations

Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
IAP	Interim Action Plan
MTCA	Model Toxics Control Act
NFA	No Further Action
ppm	Parts per million, same as milligrams per kilogram
TPCHD	Tacoma-Pierce County Health Department

Responses to Common Concerns and Questions

1. Interim Action Plan Priorities, Funding, Scope, and Timeline

The Asarco settlement belongs to the people of Washington State. This Interim Action Plan (IAP) is designed to provide the greatest possible benefit to **public health** and **environmental quality** with the funds we have. In general, we heard support for focusing resources on soil sampling and cleanup, areas of highest contamination, and places where children play.

1.1 Funding from the Asarco settlement

Although the State of Washington received $188 million total from Asarco, only $94 million is for cleaning up the Tacoma Smelter Plume. The rest will go towards the Everett smelter, mine cleanups, to reimburse the State Toxics Account, and other Asarco-related cleanup projects. The State also received funds for Natural Resource Damage Assessment. Because Asarco went into bankruptcy, we cannot recover any more money from the company.

If more funding becomes available in the future, we have ideas for more "Phase Two" projects (IAP Chapter 7).

During the public meetings, we heard a number of concerns about whether the funding would last for 10 or more years. The funds are in an interest-earning account and we will pace the cleanup in a way that limits the administrative costs. In order to spend the funds the state legislature must appropriate them to the Department of Ecology every two years (biennium). It means we cannot clean up every yard at once, but it does ensure that the money goes as far as possible.

1.2 Scope of the cleanup

Some people have stated that Ecology has a responsibility to clean up the entire plume, if we believe it does indeed pose a risk. Others question why we are including such a large area in the plan.

We must address the entire area where people could be at risk, which is why our plan covers the entire 1,000 square miles of the plume. However, the risk is far higher in the high zones (map on page 9). These are the areas that need soil cleanup. In other areas, the most effective "cleanup" method and way to manage risk is education and behavior change. For lower arsenic levels, the risks and environmental damage of soil cleanup may outweigh the benefits.

1.3 Starting cleanup soon

Many asked Ecology to get cleanup started as soon as possible. As of March 2012, we have hired a contractor and started designing the yard sampling and cleanup program. We expect to begin sampling and cleanup around the end of 2012. We also continue to clean up parks, camps, schools, and childcares through the Soil Safety Program.

2. Yard Sampling and Cleanup Program

The yard sampling and cleanup program proposal had the largest number of comments and questions. We can use many of the comments in designing the program this year.

2.1 How to prioritize sampling and cleanup

University Place and west Tacoma residents had concerns that funding would run out before the program reached them. Some suggested offering cleanup on a first-come, first-served basis. Those who sampled their own yards or had their local health department sample[1] could be cleaned up sooner. We will consider this as part of program design. However, our cost estimates for the entire project are based on being able to clean up yards neighborhood-by-neighborhood.[2]

Some suggested that Ecology do more soil sampling to help refine high zone boundaries—the area the yard program would cover. Further data would be helpful and we are now discussing where to take more samples.

One commenter supported making low-use, wooded, and undeveloped land the lowest priority for cleanup. The IAP proposes cleaning up only the high-use areas of properties that also have woods or undeveloped areas. We plan to keep this the same for the yard program design.

2.2 Suggestions for other land use types to include

Some comments suggested including private clubs and other private property as part of the yard program. We are planning to keep the yard program focused on residential properties only. However, we are exploring adding more play area types to the Soil Safety Program, including private parks, places of worship, and community centers.

The City of Tacoma asked whether Ecology could include public rights-of-way in the yard program. Currently, we are planning to only include rights-of-way that are connected to the property and that homeowners use as part of their yard. The program design will include a more specific description.

2.3 Why begin cleanup in the Ruston/North Tacoma Superfund area?

A number of people have asked why Ecology is "going back" into EPA's Superfund cleanup area, and whether this is the best use of funding. EPA has already cleaned up the worst contamination. However, EPA's action level for arsenic was 230 parts per million (ppm), which is higher than our action level of 100 ppm. Many properties where EPA did not take action (because arsenic was below 230 ppm) still have what Ecology considers unacceptably high levels of arsenic. Ecology included funding for this work as part of its settlement with Asarco and will be enhancing EPA's cleanup action.

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[1] Currently, Tacoma-Pierce County Health Department offers free home soil testing in certain areas of the plume in Pierce County.

[2] Per-yard cost of cleanup goes down when the yards are in the same neighborhood. For example, a truck can pick up soil from several yards at once and make one trip to the landfill. Equipment and workers can stay in one neighborhood at a time. The reduced travel also lessens the environmental impacts of cleanup.

2.4 Ideas for soil sampling

We received a number of specific suggestions for designing the soil sampling piece of the yard cleanup program. We appreciate the questions and comments, and will use many of them in designing the program:

- **Focus resources on sampling.** We expect to offer soil sampling for as many as 17,000 yards, but probably less than 10% will be over our action level of 100 ppm. For the yards with 20-100 ppm arsenic, soil sampling is still a great outreach tool. We can empower people to change simple behaviors to reduce soil exposure. We can also advise on ways to use landscaping to reduce exposure.
- **Use x-ray fluorescence spectroscopy (XRF) to sample soils**. We do plan to use XRF (see Technical Questions, Section II for more information).
- **Do not use an average of 100 ppm as a firm cutoff for deciding whether to clean up an area of a yard**. We agree that using 100 ppm as a firm cutoff may exclude areas that actually need cleanup. For example, we may sample and find an average of 99 ppm, but if we had sampled again, we would have found an average over 100 ppm. As the commenter suggested, we will look at using other statistics and sampling approaches that consider the variability of the data.
- **Will you sample walk-in properties on Vashon Island?** Yes, sampling equipment can easily be carried by hand.
- **Will you sample pathways to walk-in properties, even if they are county property?** We will consider this as part of the program design.
- **Will you sample steep slopes?** Slopes are prone to erosion, difficult to work on, and are not usually areas where humans are exposed to soils. We will avoid sampling or cleaning up steep slopes. However, we have not yet decided how to define "steep."
- **Why does the plan discuss both play areas and whole properties?** The Soil Safety Program cleans up play areas and is separate from the yard cleanup program. With the larger properties in the yard program, we will only clean up the "high use" areas, which include play areas.

One suggestion—to **make participation mandatory—**is not feasible. One of the largest costs of soil sampling is in contacting property owners for permission to access their yards. Trying to force people to participate could take resources away from the actual sampling and cleanup work. It might also make others less likely to participate.

In general, Ecology does not enforce against homeowners unless we feel that there is a serious threat to public health or the environment. With Tacoma Smelter Plume contamination, there is a long-term risk, but no immediate threat. Part of our cleanup plan includes finding ways to educate future homeowners and allowing them to check whether their yard was sampled.

2.5 Ideas for cleanup

- **Work block by block to minimize impacts and cost.** We do plan to work in phases, which will reduce the disruption to each neighborhood. Cleaning up several yards on one block at one time means that truck traffic and construction noise may only impact neighbors for a few weeks, depending on how many yards need cleanup.
- **Use local workers to do the cleanup work.** We will put all cleanup contracts out for bid and we encourage contractors to check our website regularly http://www.ecy.wa.gov/services/contract/contract.html. Workers will need a 40-hour hazardous materials training and a 24-hour on-the-job training. We will provide details in the bid package.
- **Provide local governments with outreach materials and funding for public notice.** Ecology will pay for any public notice related to local permit requirements for the yard cleanup. We can also supply local governments with outreach materials (such as "tip sheets"), mail information to their residents, provide presentations, and help answer questions.
- **Consult with local planning, permitting, and surface water staff on the program design.** We plan to work with local staff during both the design process and the implementation of the program.
- **What soil depth will cleanup reach?** We have not yet decided cleanup depths, but we do know it will depend on the situation. For example, if the top 18 inches of soil under a lawn has over 100 ppm arsenic, we would likely remove the entire 18 inches. Most digging won't go much deeper because contamination is mostly in the top layer of soil. Also, at that depth, the replacement soil will provide enough protection from any deeper contamination. However, sloped areas, soil around trees, and other situations may need a different approach.

2.6 Suggestions for restoring yards after cleanup

We have heard concerns about how we will restore yards after the cleanup, and whether there is any flexibility in how they are restored. We plan to at least replace topsoil, sod, landscaping, and small trees—we would not remove larger trees, but work around them instead. All restoration work will meet local landscaping and tree cover requirements.

Both city staff and residents have asked whether homeowners could opt to have more environmentally-friendly landscaping put in after the cleanup. The specific comments were to use low-impact development techniques and rain gardens, which help reduce stormwater runoff. These ideas will be considered in the program design. We will probably be able to offer different landscaping options, up to the cost of replacing the original landscaping. The homeowner would need to pay for any additional costs.

Landscaping options could include putting in drought resistant and native plants. We also hope to build local partnerships to help educate homeowners about gardening without pesticides and using less water. We will consult with the local public works departments, Tacoma-Pierce County Health Department's Natural Yard Care Program, and other local experts during the yard program design.

2.7 Addressing yards below Ecology's action level for cleanup

The Asarco settlement should cover cleanup of all yards with average arsenic over 100 parts per million (ppm). However, we expect to find many properties with arsenic between the 20 ppm state cleanup level and our action level of 100 ppm. For those yards, where people are still at risk, we plan to educate residents about healthy actions that can reduce exposure to contaminated soils.

Many commenters and public meeting participants had questions and concerns about the yards between 20 and 100 ppm:

- **Can Ecology use leftover funds to clean up these remaining yards?** Possibly. We plan to reevaluate our funding every two years, to see if we can offer cleanup for yards below 100 ppm, as well as other types of properties with high levels.
- **What if homeowners paid part of the cost based on arsenic level in their yard?** Once the yard program is up and running, we will look into whether we can reimburse homeowner cleanups in some way. Right now, we do not have a way to reimburse private cleanup costs. If we were able to provide funding, we would likely prioritize the yards with the highest arsenic levels.
- **Classifying 40 ppm arsenic as moderate is wrong.** We do not consider 40 ppm to be "safe," but it does pose less risk than 100 ppm arsenic. Residents with yards with moderate contamination will receive outreach and education about how to reduce exposure to soils. At these levels, covering bare soils and using healthy actions like taking off shoes at the door can greatly lower your risk.
- **This puts future home buyers at risk.** Part of the benefit of the yard sampling is that future homeowners can access data on the property they are buying through Ecology's public database (see next section). Ecology and local health departments can also provide outreach and education.
- **Educate people about cleaning up their own yards.** Outreach will focus on making yards safer. Simple and inexpensive landscaping and maintenance projects can reduce exposure to soils. For example, lawns are a good protective barrier, so reseed bare patches. Also, mulching around plants covers bare soil and helps keep the ground moist.
- **Can homeowners afford to do their own cleanup?** Ecology's cleanups may cost \$15,000 - \$30,000 per yard because they involve digging up and disposing of tons of highly contaminated soil. However, we do not encourage removing contaminated soil from your own yard, unless it is part of an existing project. For moderate contamination, covering contaminated soils is more cost-effective and still provides protection.

2.8 Database of yard sampling results and cleanup information

The Interim Action Plan proposes building a public database for tracking yard sampling and cleanup data. We will work with local governments, real estate agents, and the public to make sure the database is accessible and helpful.

We heard strong support, but also serious concerns about making this information public, including one suggestion for a law to protect data from public disclosure. We do not plan to pursue legislation. In fact, the database will be crucial for educating future homeowners.

Clarification: In Chapter 8.3 of the Interim Action Plan, Ecology's policy is to not list yard cleanups on the Confirmed and Suspected Contaminated Sites List (CSCSL). The CSCSL does not usually include residential properties—most of the sites are larger commercial or industrial sites. The Tacoma Smelter Plume database will include yards and child play areas, and will be for outreach rather than regulation.

3. Disposal Area for Homeowners Doing Their Own Cleanup

Several people suggested that a soil disposal "dump area" be created for property owners who need to remove soil from their yard or who want to do their own cleanup. The goal is to provide a convenient and low-cost place they can take Tacoma Smelter Plume contaminated soil. Another option suggested was to provide free local disposal containers, so home owners don't have to pay to move the soil.

Ecology is working with the Environmental Protection Agency (EPA) and the Tacoma-Pierce County Health Department on this issue. The three agencies are exploring options for a soil disposal program for north Tacoma and Ruston residents as required by EPA's Record of Decision. We could apply lessons learned from that process to the Ecology-managed yard cleanup program, which we are now designing. We could also explore a similar program for areas with moderate contamination during Phase II of the Interim Action Plan.

We had a related question about whether any areas have contamination from past hauling of contaminated dirt, sand, or gravel. Arsenic binds to soil organics, like decomposing plant matter. Therefore, we tend to not find it in sand or gravel. We are not aware of any areas contaminated by soil moved from other parts of the plume. However, it is possible. We recommend testing your soil if you are unsure. Always ask for arsenic and lead test results when you buy soil.

4. Phase Two Actions – Soil Sampling and Cleanup During Development

Chapter Seven of the Interim Action Plan outlines ideas for "Phase Two" actions. These include addressing soil contamination during development.

One long-term strategy is to encourage or require soil sampling and cleanup during development projects, including redevelopment. Ecology is not requiring local permit offices to require sampling or cleanup during development. Currently, we do not have the authority to do so and we understand that this is an added workload and cost. Any future decisions will involve local governments and will also go out for public comment. We will continue to provide technical assistance and work with permit offices on encouraging sampling and cleanup.

4.1 Soil Sampling

We heard opposition and support for requiring soil sampling. Those opposed to the sampling cited the cost. We did hear support for requiring soil sampling, citing similar testing requirements already in place. One commenter suggests using the development type and volume of soils to decide whether land needs sampling. We will continue to work with local governments and other stakeholders on whether, and how, to require soil sampling.

4.2 Cleanup

The idea of requiring cleanup raised a number of concerns about added cost for development projects and increased workload for local permit offices.

We were asked to subsidize cleanup costs if it became a requirement, especially for smaller projects, homes, and play areas. One commenter pointed out that sampling and soil handling has extra costs beyond normal project costs. We will look at costs to smaller projects—especially additions—as we plan Phase Two. Right now, we do not have a way to reimburse private cleanup costs. If we were able to provide funding, we would likely prioritize cleanup of existing residential yards.

Land owners can join Ecology's Voluntary Cleanup Program (VCP) to get technical assistance. Some have been concerned that program fees may deter land owners from joining. **In response, we are no longer charging a fee for VCPs that have only Tacoma Smelter Plume contamination.** Staff from Ecology's Northwest and Southwest Regional Offices who do these reviews will have their time covered by Tacoma Smelter Plume project.

One commenter asked about preventing fraud during cleanups, in particular ensuring that properties receiving a No Further Action (NFA) opinion actually do the cleanup. Ecology will have oversight over VCP projects. This means we will review all documentation to make sure that cleanup was done properly. If not, we can withhold the NFA. Ecology will not have oversight of independent cleanups.

4.3 Model Remedies and Cleanup Levels

The Model Remedies provide sampling and cleanup guidance for Tacoma Smelter Plume contamination. Depending on arsenic and lead levels, one may use one or more of the four cleanup options without a site-specific Feasibility Study. Cleanups done using the Model Remedies can get Ecology approval under the Voluntary Cleanup Program.

One comment was that model remedies may be appropriate for large developments, but overwhelming to smaller-scale projects. **In response, we will design a handout that includes background on the plume, a map, lab information, a summary of cleanup options, and an Ecology contact. We will distribute this to local permit offices.**

In the meantime, people can still use the Model Remedies Guidance. It was written, so that individual property owner could take their own soil samples and provide guidance about selecting a cleanup method that works for them. If a property owner has questions about Model Remedies Guidance, please contact Ecology.

The cleanup level is the threshold at which Ecology considers an area to be clean. The Model Remedies cleanup levels are 20 parts per million (ppm) for arsenic and 250 ppm for lead. One commenter asked to allow alternative "Method B" or industrial cleanup levels:

- The Method B, unrestricted use, cleanup level is 0.67 ppm—lower than the current cleanup level.
- The cleanup level for Method C, industrial use, is 88 ppm—higher and less protective than the current cleanup level.

The cleanup level of 20 ppm reflects natural background and is protective of human health and the environment.

Another commenter asked to increase the level at which Ecology can issue a No Further Action Letter. The Interim Action Plan sets the cleanup levels for the site. Cleanups must meet this cleanup level to be given a No Further Action decision by Ecology. The plan also sets remediation levels for the various model remedies. For example, mixing is only a model remedy when arsenic is below 40 ppm.

Independent cleanups may use higher remediation levels, but cannot use the Model Remedies and must do a feasibility study. The feasibility study must demonstrate that the chosen remedy meets cleanup levels of 20 ppm arsenic and 250 ppm lead at the end of remediation. To get a No Further Action decision, the Feasibility Study will need to be approved by Ecology.

4.4 Cleanup requirements for independent cleanups vs. Ecology cleanups

Ecology's yard cleanup program will meet the same cleanup levels as independent cleanups. We expect to mainly use excavation and removal, which is a permanent remedy. However, the program must balance the two goals of reducing risk for as many people as possible, and cleaning up whole properties.

5. Phase Two Actions - Addressing Contamination During Real Estate Sales

Chapter Seven of the Interim Action Plan outlines ideas for Phase Two actions. These include addressing soil contamination during property sales. The plan proposes a number of possible approaches for managing soil contamination risks through real estate sales. The approaches range from voluntary real estate agent education to requiring soil sampling before sale. We received a number of comments on the proposed ideas, and one new outreach idea.

Real estate was one of the main topics of the public meetings, follow-up questions, and comment letters. **In response, we are accelerating our work on this part of the plan. We are beginning to meet with real estate agents and planning to pilot some educational tools. One major initiative is to promote the disclosure of arsenic and lead from the Tacoma Smelter Plume.**

5.1 Impacts to Property Values

One of the biggest concerns was that the cleanup project would hurt property values. We heard questions about whether identifying a "high zone" would make homes harder to sell. What if Ecology found arsenic just below the action level of 100 parts per million (ppm) and wasn't able to clean it up?

We urge home owners in the high zone to participate in the free yard cleanup program. Even if we do not clean up your yard, you will still know what's in your soil and how to reduce your exposure. The same types of simple landscaping projects that improve property values can also cover contaminated soil. Examples include reseeding bare patches in your lawn or adding beauty bark to your landscaping.

Home buyers should consider soil contamination as one of many factors in purchasing a home. In fact, many areas of the country have soil contamination issues—here, we have public awareness, free home soil testing for certain areas, and outreach programs. Ecology and Pierce County health departments can help home buyers find out if a yard has been cleaned up, and if not, how to reduce exposure to soil.

5.2 Disclosure

We heard a great deal of support for including arsenic and lead from the Tacoma Smelter Plume in Form 17. Form 17 is a property disclosure form all sellers must fill out. Currently, it does not mention arsenic and lead, or the Tacoma Smelter Plume. Suggestions include adding arsenic and lead (from any source) to Form 17, or creating a handout about the Tacoma Smelter Plume. We are working on the handout idea first, and exploring how to change the form itself.

5.3 Education for Real Estate Agents, Sellers, and Buyers

Commenters and public meeting attendees were generally supportive of educating real estate agents. Ecology plans to reach out to real estate agencies and organizations throughout the plume area, beginning with the most contaminated areas. We can offer presentations, brochures, maps, and other educational tools. We are also looking for input and other ideas for addressing soil contamination through real estate sales.

One commenter suggested working with local Chambers of Commerce to provide brochures for relocation packages for new homeowners. We will consider this as an outreach tool, especially in the high zone of the plume.

5.4 Requiring Soil Sampling Before Sale

Written and verbal comments both supported and opposed requiring soil sampling before a property is sold. Such a requirement would likely take changing state law, which could be difficult. We plan to evaluate this as part of Phase Two and address it in the future.

Some suggested that the cost of sampling would place an unfair burden on sellers. Currently, the Tacoma-Pierce County Health Department offers free home soil testing as an outreach tool. Ecology plans to start a similar program for parts of King County. If sampling became a requirement, there could be a way to assist homeowners with the cost.

5.5 Use of Maps and Databases in Real Estate Transactions

Several commenters had ideas for how to share soil contamination data with the public. For example, use county geographic information systems (GIS) to make arsenic and lead data available online. The plan is to offer local governments and their customers access to Ecology's database of sampling and cleanup information.

Over the past six months, we heard many comments about the Tacoma Smelter Plume map. Some feel that the arsenic level color coding targets certain areas of the plume. They also would like to see the data points used to create the map. Some voiced concern that some areas did not have enough soil samples to accurately determine the zones.

A new, improved map will be ready around the end of 2012. It will use more sampling data and show the probability of an area having a certain level of arsenic. Ecology will also look at areas where more sampling will better inform the map. The current map shows an upper estimate of arsenic levels. While this may appear alarming, we feel it is important to let people know how high levels *could* be in their area.

For a simpler map, the Soil Safety Program Service Area map (map on page 9) shows the area Ecology and health departments are most concerned about. Within this boundary, there is a higher likelihood that yards could have arsenic over cleanup level of 20 ppm. This is also where we focus more of our outreach programs.

6. Phase Two Actions – Streamlining Cleanup

Chapter Seven of the Interim Action Plan outlines ideas for "Phase Two" actions. These include streamlining the cleanup process by providing local technical assistance and certifying consultants to do soil sampling and cleanup. We received one comment noting that consultants did not need a special certification, as they should be able to use model remedies. Over the next year or two, we will gather feedback on the model remedies to see if training is needed.

7. Working With Other Government Agencies

Chapter Seven of the Interim Action Plan outlines ideas for "Phase Two" actions. These include working with other agencies to address contamination during development and redevelopment projects on their lands. We received comments from local governments and other stakeholders throughout the plume:

- **Do not shift the cost of soil safety to the local level through unfunded mandates.** This comment also relates to Section 4.2 and cleanup during development. We can lessen the costs by continuing free technical assistance to local governments. For example, Ecology is providing technical assistance to property owners about how to sample their soil. We review soil sampling results and provide recommendations to the local governments.
- **Settlement funds going to governments should not be used for cleanup of public properties.** The concern is that this will draw money away from residential and play area cleanups. Under the current plan, Ecology does not plan to pay for cleanup of public properties except for the existing child play areas.
- **Ecology should help cities and towns develop best management practices (BMPs) and specs for their capital improvement projects.** Ecology will work with any jurisdiction wanting to incorporate soil safety into public works projects.
- **The creation of a "hazard zone" may deter development and redevelopment.** We understand the concern with the term "hazard zone." Local governments will help shape any future map overlays, including how we present it to the public.
- **However, there is still a need to institutionalize soil information and provide overlays for local planning.** Local governments and the public will have access to Ecology's database of soil sampling and cleanup data starting later in the summer of 2012. This database is searchable by address and has mapping functions. We hope that local governments will incorporate the soil mapping function into their local GIS systems.

8. Education and Outreach

We heard many good ideas for expanding our outreach efforts, and will consider them all.

8.1 Places where children play

Ecology and local health departments do provide outreach to schools, childcares, park districts, YMCAs, and Boys & Girls Clubs, especially those participating in the Soil Safety Program.

8.2 Ethnically-diverse and non-English populations

Reaching ethnic and non-English-speaking communities is an important part of our outreach programs. The health departments have targeted eight of the most common languages spoken in Pierce and King Counties besides English. They have also come up with culturally-sensitive ways of reaching people.

Pierce County has a special outreach program for the Slavic community, designed based on feedback from surveys and focus groups. Information about gardening was very important, since so many families use community gardens. The outreach message about taking off shoes was less important, as most families reported that it was already a common practice. As suggested, we will also contact the Korean Women's Association.

King County has done radio and newspaper advertising in Spanish, Korean, Vietnamese, and Cantonese, and has some materials available in Amharic, Cambodian, and Somali. They have also worked with community groups to provide outreach at fairs, festivals, and meetings.

8.3 Places to give out information

One new idea could reach a very large number of households—sending information in utility bill or property tax statement inserts. Some suggested giving out information through churches, charity organizations, homeowner's associations, garden stores, doctor's offices, and pharmacies.

We have already tried some of these ideas. For example, Thurston County stocks home and garden stores with brochures, and King County has provided outreach through doctors. We have had positive feedback, especially from parents with young children, who learned about the issue from their doctors. In the future, we will try doing outreach through these other avenues.

8.4 Groups and industries to include or partner with

We heard suggestions to work on outreach with garden clubs, Master Builder groups, Chambers of Commerce, FutureWise, businesses, contractors, real estate agents, and developers. Some of these groups have been involved in Tacoma Smelter Plume outreach and we hope to build more relationships in the future.

Next steps include outreach to builders and developers about the Tacoma Smelter Plume Model Remedies and voluntary cleanup. See Section 5 for more about our plans with the real estate industry.

8.5 Start a stakeholder advisory group

Ecology, the Tacoma-Pierce County Health Department, and EPA are planning to reconvene a Ruston and North Tacoma area advisory group. The purpose is to help plan outreach for residents living in the Superfund cleanup area—the one square mile closest to the former smelter. We also plan to have focus groups during the yard cleanup program design (later in 2012). Some longer-term advisory groups may arise out of the focus group process.

8.6 Measuring the success of outreach

Ecology measures the success of outreach through the number of people reached and surveys on awareness and behavior change. Every three months we look at how many people we are reaching through our different methods. This includes broad-based outreach like television ads and mailings, and personal interactions like home soil testing visits or classroom presentations.

Tacoma-Pierce County Health Department and Public Health—Seattle & King County have done surveys in different communities within the plume. These surveys ask about awareness of the issue, how people find information, and whether they have changed their behaviors, like taking off shoes or vacuuming more. We will continue to do these surveys to look at trends over time.

9. Health Risks

Many people asked questions about the health risks from arsenic and lead, and whether our cleanup levels and action levels were protective enough or too protective.

9.1 Eating food grown in contaminated soil

Most plants, with the exception of leafy greens, take up very little arsenic and lead into their edible parts. The main concern is accidentally eating contaminated dust or dirt stuck to the outside of the vegetables, fruits, nuts, and berries. We recommend washing produce well before eating. Use a scrub brush to remove dirt from root vegetables, in particular.

We also recommend gardening in raised beds. Make sure the soil you bring in is not contaminated--ask your soil supplier if they test for arsenic and lead. Also, make sure that you are not using wood treated with arsenic (known as CCA wood).

9.2 Action levels, cleanup levels, and risk to human health

Ecology set an action level of 100 parts per million (ppm) for arsenic for yard cleanups. Arsenic over 100 ppm in residential yards poses an unacceptable risk and needs cleanup. We estimate that being exposed to 100 ppm arsenic in soils may increase cancer risk by as much as **150 cases in one million people**.

Our cleanup level is 20 ppm for arsenic. This means anywhere we do cleanup, the levels must get below 20 ppm. The additional cancer risk at **20 ppm is 30 in one million**. For more about how we set the action level and cleanup level, including for lead, please see our fact sheet at: http://www.ecy.wa.gov/biblio/1109095.html.

One commenter suggested that a better understanding of the risks at lower levels of arsenic might help Ecology get more compensation. The $94 million in funding we have is from a bankruptcy settlement, so we have no way of getting more compensation. However, our agency is always looking at new science to help inform our cleanup work.

9.3 Linking Tacoma Smelter Plume contamination to health effects

A common question was whether Ecology could do a study to "prove" a link between Tacoma Smelter Plume contamination and health effects in the local population. It was also suggested that we look beyond cancer outcomes and study heart disease and diabetes, which are also linked to arsenic exposure.

Regardless of what health studies show, Ecology has a legal obligation to protect the public. In the Tacoma Smelter Plume the risks may be small relative to our ability to measure them in health studies. However, the risks are large enough to be of concern in terms of public health goals and state cleanup law. The risks may also be unacceptable for many people.

We know that even low doses of arsenic and lead are toxic to humans. We also know that children are at greater risk. Studies of communities living near smelters and other sources of metals, especially lead, show a link between soil contamination and human exposure. Therefore, we can assume that Tacoma Smelter Plume contamination poses a threat to human health.

Several health studies looked at health outcomes in parts of the Tacoma Smelter Plume. However, they were unable to determine whether or not smelter contamination contributed to health problems in people who lived in the area. The main reasons[3] are:

- **Health studies are often not good at measuring small effects.** In many cases, health studies are not good at measuring the effects of environmental contamination. They may be able to find large increases in illness, but are often unable to detect the smaller increases that risk assessments predict will occur from the contamination.

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[3] A 2001 study by Public Health – Seattle & King County discusses some of these issues in more detail: "Review of Available Data on Types of Cancer Related to Arsenic Exposure: Vashon-Maury Island, Washington State and Washington State Counties 1980-1998."
http://www.kingcounty.gov/healthservices/health/news/2001/~/media/health/publichealth/documents/toxic/vmicancerreport.ashx

The comparison of cancer rates among Vashon-Maury Island (VMI), King County, and Washington State is summarized on page 2: "When comparing rates, no statistically significant differences were found between VMI and the state as a whole or King County."

The report went on to discuss limitations of the study (page 3, emphasis added):

> However, limitations in the study datasets--especially the small number of health events on VMI and the lack of information on detailed exposure to arsenic--limit the conclusions that can be drawn about excess risk. In general, the smaller the number of deaths or cases involved in the comparison areas, the larger the observed differences need to be to rule out random variation as a cause of the difference. In addition, the lack of detailed exposure information means that true "exposed" and "unexposed" populations cannot be assembled for comparison. ***Thus, although this analysis probably rules out a very large increase in cancer risk to the population of VMI, the study is not sensitive enough to detect a smaller increase in risk.***

- **Past exposures can be especially hard to estimate.** In contaminated areas, studies look at groups of people to see whether exposure to contamination has caused more illness. A study's ability to determine this depends how well people's exposure has been measured and how carefully their illnesses have been diagnosed and counted. The less accurate the measurement, the harder it is to show a connection. It is also more likely that no connection will be found, even if one really exists.
- **Health effects can take decades to show up.** Cancers caused by arsenic don't normally show up until 30 to 40 years after exposure has begun. If we find a cancer by arsenic today, the exposure may have started more than 30 years ago.
- **People moving in and out of an area make it hard to see an effect.** Many people living in the area 30 years ago have moved away, so a study would not be able count any of their contaminant-related cancers. Many new people have moved into the area during the past 30 years. It is too soon for them to have observable cancers caused by the contamination. Therefore, it is very hard for a health study to show arsenic-related health effects.
- **Arsenic-related health effects have many possible causes.** Illnesses linked to arsenic, such as cancer and heart disease, can be caused by many things not related to the contamination. These include diet, smoking, and exposure to other chemicals. A health study must rule out the effects of these factors. Otherwise, you cannot tell how much arsenic contributed to the illnesses.

9.4 Concern about illnesses in a neighborhood

We heard from several people concerned about possible disease or cancer clusters in their neighborhoods. They asked if there could be a link to soil arsenic and lead, and if the Washington Department of Health (DOH) could do a study.

We discussed some of problems with doing a health study in the last response. A good health study would likely be expensive, intrusive, and take many years in order to provide answers. DOH would need to find many people who had lived in the area at least 30 years ago. They would need to allow researchers to assess their diets, lifestyles, and environmental exposures to many chemicals, including Tacoma Smelter Plume arsenic and lead, throughout their lives. Even then, the results might not be conclusive.

For more information about community health studies, please visit:
http://communityhealthstudies.org/

9.5 Should I get tested for arsenic and lead?

Many health agencies recommend blood lead testing for children, since there are many sources of exposure, regardless of where they live. Elevated test results let families know to check the child's environment for possible sources of exposure, including soil. Adults can also have a blood lead test. Your doctor can provide more information about how to get tested. They can also help you to interpret the results using national guidelines.

Health agencies do not typically recommend arsenic testing. First, the results vary greatly depending on how recently you were exposed to arsenic. Certain foods, like rice and fish, can increase your arsenic levels for a short time and make it difficult to interpret the test results. Second, there are no clear guidelines for what a “normal” arsenic level is, and what level is a health concern.

If you have arsenic test results and need help understanding them, please contact Jim White at the Washington Department of Health, (360) 236-3192 or Jim.W.White@doh.wa.gov.

9.6 What is the risk to pets?

Arsenic poses a larger risk to humans than most animals, including dogs and cats. However, pets can bring contaminated soil into the home on their fur and paws. We recommend regularly bathing outdoor pets and wiping their paws before coming inside. Vacuuming regularly and damp dusting helps reduce any contamination that does make it inside the home.

Responses to Technical Comments

10. Model Remedies and Guidance

Commenters suggested some changes to the Model Remedies and offered edits to make the guidance clearer. They also had advice on how to encourage people to use the model remedies. We made some change to the Model Remedies and we incorporated many of the clarification edits in the final version of the guidance (noted below). We are also working on outreach materials for local planning offices, to help property owners decide if they should use the model remedies.

10.1 Major edits to the Model Remedies in Chapter 11

Ecology received more than 20 comments asking about using x-ray fluorescence spectroscopy (XRF) for soil sampling. XRF is a device that can provide quick test results in the field. Some samples still need to be sent to a lab for comparison, but most of the sampling can be done on site. The Model Remedies now allow the use of EPA Method 6200 for XRF.

We are removing “institutional controls only” from the Model Remedies. We had hoped to provide guidance on how to determine whether habitat should be left in place with institutional controls. In some cases, there is more value in preserving a natural area, than in destroying habitat just to clean up the soil. Unfortunately, we do not have this guidance yet. Therefore, projects must do a separate disproportionate cost analysis to get Ecology approval to leave contamination in place.

10.2 Major edits to the Model Remedies Guidance

Forest duff can sometimes have high levels of arsenic and lead. These materials should not be mulched or reused. Instead, they should go to a landfill along with any contaminated soils. As a result, we added guidance on forest duff sampling, which is very similar to soil sampling.

Several commenters made the point that mixing may be the best cleanup option in areas where soil is expensive to remove or bring in. For example, Vashon Island has the added cost of ferry transport. For soils with less than 40 parts per million arsenic, where soil transport is difficult or expensive, one should consider mixing as a remedy. The benefits, in some cases, may outweigh the cost of mixing machinery, labor, and extra soil sampling.

10.3 Edits not made

Comments suggested sampling the top two inches of soil to get a better idea of the highest levels of arsenic and lead, and because people are most likely to be exposed to the top layer. We opted to keep the first sampling interval at six inches for two reasons:

1. Most areas have some disturbance of the soil surface, which means that contamination is likely deeper than the top two inches.

2. Cleanup decisions still require data at least down to 12 inches. Requiring a two inch deep sample would add to the cost and time, without providing much additional data to help in planning cleanup.

There was also a request to require 6-12 inch samples at every tenth sample location. The guidance requires a 6-12 inch sample at every fourth location. With every tenth location, many decision units would have only one depth sample. This makes it harder to find out if there is contamination in the 6-12 inch range.

10.4 Cleanups must get local government permits

Independent cleanup projects must get all applicable local permits. The guidance does not specify these requirements because the Tacoma Smelter Plume covers so many jurisdictions. **We noted the need for local permits in the guidance disclaimer, the introduction, and the "Planning for Cleanup" chapter.**

Cleanup done by Ecology or under Ecology's formal cleanup program only need to meet the substantive requirements of local permits.

10.5 Maintaining institutional controls

One commenter had concerns about long-term protectiveness where land use may change over time. The two non-permanent model remedies—capping and consolidation and capping—require institutional controls.

For Ecology-managed cleanups, we plan to mostly use permanent remedies. For the yards we cap, we will provide homeowners with binders that explain where the cap is and how to maintain it. As part of our periodic review process, at least every five years, we will check on many of these yards to make sure the cap is in good shape. Future owners will be able to find this information through a public database.

For cleanups needing formal Ecology approval, we require an environmental covenant to enforce the institutional controls. Any change in land use that affects the remedy will require Ecology approval. For independent cleanups, Ecology has no way to enforce institutional controls.

10.6 Open space

As noted in 10.2, we are removing "institutional controls only" from the Model Remedies for now. Within the next year, we hope to have guidance for dealing with open space. In the meantime, land owners are encouraged to enter the Voluntary Cleanup Program for technical assistance. This program is free for sites with only Tacoma Smelter Plume contamination.

10.7 Cap thickness

The Model Remedies require a thicker cap when arsenic and lead levels are higher. The purpose is to provide extra protection in case a land owner neglects to maintain the cap. This is important where contamination poses a greater risk to human health.

10.8 Phytoremediation

Around 2005-2007, Ecology did a pilot study on whether Chinese brake ferns could clean up Tacoma Smelter Plume contamination. Although the ferns do take up arsenic and other metals, they do not grow well in this climate. Also, the ferns themselves become hazardous waste. Arsenic levels in the fronds were high enough to seriously harm a child if they accidentally ate one.

11. Evaluation of Cleanup Options

We received one letter with several comments and questions about the way we selected the overall cleanup approach. We have addressed them below. For more detail, please see the November 12th letter from Michael Meyer.

11.1 Do not use No Action as a baseline for comparing remedies

Mr. Meyer is correct that Ecology should not use No Action for a baseline. We should use the most permanent remedy that is practicable. WAC 173-340-350(8)(c)(ii)(A). We deleted this reference because we used the "Preferred Option"--Alternative B-Phased Prioritized Action—as the baseline. We can use a No Action alternative for comparison—this is often done at other cleanup sites—but it cannot be the baseline alternative.

Alternative C- All Properties Sampled and Remediated could be seen as the most permanent remedy. However, we do not have to use it as the baseline because it is not practicable.

11.2 Why did Ecology assume there is not enough funding to clean up the whole plume?

Mr. Meyer is correct that Ecology did not document the cost to clean up the entire plume through a disproportionate cost analysis. To clean up the whole plume may cost billions of dollars. There are potentially over 700,000 properties impacted by the Tacoma Smelter Plume. At an average of $30,000 to cleanup a standard lot, this translates into $20 billion. Clearly this is disproportionate.

11.3 Model Remedies Feasibility Study Disproportionate Cost Analysis is not rigorous enough.

The purpose of the Feasibility Study for the model remedies was to develop several model remedy options for property cleanup, depending on the circumstances. We compared costs among alternatives to demonstrate relative costs (Appendix C, Table 6-1). A disproportionate cost analysis is not needed because Ecology is not recommending that only one remedy be used.

11.4 Selection of Remediation Levels

For a quantitative evaluation of remediation levels see the Appendix D: Cleanup Levels, Action Levels and Human Health Risk.

12. Waste Disposal

Tacoma-Pierce County Health Department suggested an edit to Section 9.3.4 Solid and Hazardous Waste Management. **In response, we are updating this section to note other landfill types that may be able to accept contaminated soils.**

13. State Environmental Policy Act (SEPA) Checklist

Clarification: This SEPA checklist covers most Interim Action Plan activities, including Ecology's proposed yard cleanups. Certain Soil Safety Program cleanups, especially larger park projects, may still require SEPAs as part of local permitting requirement. Independent cleanups and Voluntary Cleanup Program projects must still meet any applicable SEPA requirements.

Ecology received comments on three topics:

1. **Soil volume going through transfer stations.** While landfills may be able to handle the volume of soils, transfer stations may not be able to. **We will work with local waste management staff during the yard cleanup program design to better understand and reduce the impacts of soil disposal.**

2. **Reducing the impacts of truck traffic.** As requested, **we will try to schedule cleanup work to avoid peak traffic hours.** This is especially important for trucks carrying soil to and from the site, and for ferry travel.

3. **Impacts to recreational uses.** Commenters noted that widespread use of institutional controls could restrict recreational uses. As stated in the SEPA Checklist, we do not expect the proposal to displace recreational uses. For those park and camp play areas in the Soil Safety Program, the cleanup work only temporarily limits access. Institutional controls like signage are encouraged, and mainly consist of signage, not fencing.

14. Health and Safety Requirements

Commenters asked Ecology to clarify several issues related to health and safety regulations. What are the requirements when hiring subcontractors for cleanup or any other site work involving soil excavation by yard maintenance, construction, or utility workers? Also, do landscape maintenance workers need to be HAZWOPER trained and is that really practical?

Washington State Department of Labor and Industries laws and regulations govern health and safety at worksites. Employers must ensure workers' safety. The Inorganic Arsenic Rule (Chapter 296-848 WAC) governs work within the Tacoma Smelter Plume and other areas with soil arsenic contamination.

Ecology will continue to refer to Labor and Industries worker safety regulations and guidance for area-wide soil contamination. We will work with Labor and Industries to answer these questions and possibly create guidance for employers. The goal is for employers to inform subcontractors and workers about health and safety measures related to Tacoma Smelter Plume contamination.

Appendix A: Comment Letters

Tacoma Smelter Plume
Public Comment Form

DEPARTMENT OF ECOLOGY
State of Washington

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NAME: MIKE MONAHAN

ADDRESS: 6102 N PARK AV

CITY: TACOMA ZIP: 98407

COMMENTS

(Please use back side of this form if you need more room)

Is it possible to provide access to a "dump area" for folks who are cleaning up their contaminated yards on their own (ie - a place that does not cost a lot of $$ to get rid of the "dirty" dirt)

Thanks,

M

Tacoma Smelter Plume
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NAME: Marie H. Jurich (Mrs. George M.)

ADDRESS: 7231 S. 15th St.

CITY: Tacoma, WA ZIP: 98465-1501

COMMENTS

(Please use back side of this form if you need more room)

We had our soil tested & found we had a level of 218 of arsenic & 360 of lead (11 times the minimum) (18 times the minimum) design into your could you testing program a way towards remediate the soil in ~~home~~ first with very high content & not just area by area?

Our house is a 3-bedroom rambler & would be ideal for a young family (if the soil is remediated.)

— Marie H. Jurich

→

Our home is behind the gymnasium of St. Charles Borromeo school. Is our dust blowing into their property?

From: John Zinza
Date: November 3, 2011
To: Cynthia Walker
Subject: Comments, Draft Interim Action Plan

John is currently on Tacoma Smelter Plume staff

Plan Key Comments Areas:
Should we encourage or require sampling and cleanup during development?

Comment: I believe there should be a sampling requirement during development. The requirement to sample could be determined via a criteria based matrix that covered information about type of development, volume of soils to be removed, etc.

My rational for requiring sampling is based on protecting the worker, and taking appropriate dust control measures. I don't believe that just informing the worker of the hazards of arsenic is enough. Sampling results will provide the developer and the worker with the basis to take appropriate personal protection actions as necessary. The details of this requirement could be worked out by implementing a pilot program with state agencies that have construction projects within the Tacoma Smelter Plume. This same rational applies to dust control. Sample results can be the basis for determining the extent and degree of dust control and monitoring above and beyond BMPs for erosion and sediment control.

How can we help educate home buyers?

Property disclosure: The property disclosure form you referred to is impressive since it covers just about everything a potential property owner should know. I recently filled the form out and can recall the environmental section with the yes or no or I don't know responses. It really left me with an impression to make sure I disclosed everything I knew. Potential home buyers need to be able to make informed decisions about a property purchase. This is one tool to make it happen.

County Parcel Systems: GIS parcel information systems such as the King County Parcel Viewer Interactive Property Research Tool are incredible tools in researching a property. The tool let's you zoom into a parcel and you can obtain a property report, including searches and reports on King County Department of Development and Environmental Services permits and activities. The King County Department of Assessments has a place for Environmental information in the parcel data base. Since there is a place for environmental information there is a responsibility to populate it correctly. This could be done through a permit process.

Chamber of Commerce: One of the challenges will be to educate people that are contemplating moving to the area. A great place to receive information on an area is through the local Chamber of Commerce who commonly offer a relocation package. A relocation package could have an informative brochure about the arsenic dangers in the area and what is being done about the problem. It will be important to put a positive view on the brochure about the historical background on the smelter and what it meant to the area and to the nation. The brochure could also provide web addresses for additional information including how to research a property prior to renting or purchase.

From: Marshall Hampton
Date: November 5, 2011
To: Cynthia Walker
Subject: Cleanup

Can we include a removal by homeowner option where the homeowner removes the contaminated soil by themselves or a homeowner paid contractor, places it in a container provided by the program and is hulled off to a disposal site by the program, at no additional cost to the homeowner?

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NAME: Emma Newby

ADDRESS: 13617 SW 235 th St.

CITY: Vashon ZIP: 98070

need email - renewby@centurytel.net

COMMENTS

(Please use back side of this form if you need more room)

If I want to do a voluntary clean-up, I need to sample my soil, so where can I send it and what the cost?
(I am not in the high toxicity)

Good idea to oblige Real Estate to declare contamination!

Help + education from Garden Club

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NAME: JONATHAN KATZ - REP. FOR MORNINGSIDE FARM ON VASHON.

ADDRESS: 5391 PAR FORE DRIVE SE

CITY: PORT ORCHARD ZIP: 98367

COMMENTS

(Please use back side of this form if you need more room)

IF WE VOLUNTARILY DO ALL RESEARCH REQUIRED + SAMPLING, CAN'T WE GET PRIORITY ON THE HELP WITH ACTUAL CLEAN-UP.? IF WE SPEND THE RESEARCH + SAMPLING MONEY WE SEEMS IF WE SHOULD RECEIVE HELP. ESPECIALLY IF WE RUN A CAMP WITH SMALL CHILDREN.

From: Lynda Brothers
Date: November 10, 2011
To: Cynthia Walker
Subject: Comment on smelter

I found the on line interactive map to be inadequate as was the entire web site. This so-called plume is spread all over the PR pieces and internet yet by the Department's own comments it is based on very few sample locations. Nonetheless those locations are not shown clearly anywhere. In fact, more than just inadequate communication, I think the map and web site borders on irresponsible! Ecology has put out a plume map without showing precisely where you have samples; and as such the map can easily impact property values and/or real estate transactions. And it can do so irrationally and without sufficient basis. This is really a waste of resources. Please provide quality, meaningful work not some watered down pablum aimed at a sixth grader.

Secondly, I'm not impressed that Ecology calls this public comment on a "clean up plan" – I could not find any meaningful "cleanup." This is comment on a Public relations campaign which as stated above is based on completely insufficient data is some areas. All in all, I think the Department should be doing a more comprehensive and precise job rather than spending time and money on a PR piece that fails to provide necessary information for a reader to evaluate the work being considered.

Thanks.

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NAME: ROBERT BLAUVELT

ADDRESS: 21524 TRAMP HARBOR RD

CITY: VASHON ZIP: 98070

COMMENTS

(Please use back side of this form if you need more room)

THANK YOU FOR ALL YOUR GOOD INFORMATION -

2 COMMENTS -

I FEEL THAT WITH YOUR VERY LIMITED RESOURCES YOUR FOCUS SHOULD BE DIRECTED TOWARDS =

- SAMPLING SOILS, TO GET A MORE DETAILED PICTURE OF THE ACTUAL EXTENT OF THE CONTAMINATION.
- A HEALTH SURVEY
- EDUCATION
- ~~HELP (PROPERTY~~

From: Carl Sells
Date: November 11, 2011
To: Cynthia Walker
Subject: Asarco Cleanup

The state required remediation above 20 PPM is going to impact almost every property on the island. Long term implications that individual property owners will be responsible for remediation that is not covered by the Asarco funds, which only kick in at 100 PPM, is going to kill our property values. Most property owners will not have the resources to do the remediation. No one will want to buy property on the island. No lender will want to finance on the island. No company will want to expose their employees to the pollution by locating here and no one will want to raise their children here. The state is going to create a wasteland.

Yesterday I met with the major real estate brokers on the island and gave them a copy of the map you provided of the "high arsenic" portion of our island. We discussed the short and long term implications of the project and the impact on the market in general. It may be a good time for you to do a follow-up with all of the island real estate professionals. I'm sure you will get a good turnout. I'm sorry to say that the response was very negative on the projected impact on our market. I also met with the director of the Chamber of Commerce and the major supplier for island contractors. The response there was the same.

In the past couple of years the island has lost two major employers, K-2 and SBC. That resulted in the direct loss of more than a thousand jobs and the loss of possibly three hundred more ancillary jobs. This project has the potential of creating many jobs for island contractors and personnel. King County has just presented a plan that limits the maintenance of our roads and may leave us with mostly gravel. But, I see this as an island killer.

I hope that I am seeing this incorrectly. Perhaps you are aware of other views that are not so pessimistic and have a ray of hope. I and other islanders need to understand that the island will not become uninhabitable. Can you give us a glimmer of hope?

From: Michael Meyer
Date: November 12, 2011
To: Cynthia Walker
Subject: Comment on smelter

Thank you for the opportunity to comment on the Draft Interim Cleanup Action Plan for the Tacoma Smelter Plume. I appreciate that Ecology has taken the lead on addressing the worst of the contamination from this site, rather than using enforcement authority to require property owners to perform cleanups. After an initial read of the plan, it appears that Ecology's approach is reasonable. However, I am concerned that Ecology's evaluation of remediation levels and alternatives for the cleanup appears to be based primarily on narrative descriptions of what seems "reasonable." For example, I don't see a quantitative evaluation that supports the selection of the remediation levels for the Interim Action. Just the fact that the RLs are nice round numbers ("100 ppm" for arsenic) suggests that some qualitative assessment was performed, or that the numbers were based on "gut feel." This doesn't seem sufficiently rigorous for such an important and large site.

Regarding the alternatives evaluated, in section 1.5, first bullet, Ecology states that the No Action alternative was used as a baseline for comparing other options. This concerns me, and undermines the credibility of the conclusions in the Interim Action Plan. The feasibility study process under MTCA does not utilize the concept of the "No Action" alternative as a baseline for comparison to other alternatives. Instead, the No Action alternative is used under CERCLA. MTCA is more conservative and requires (WAC 173-340-360[3][e][ii][B]) that "the most practicable permanent solution evaluated in the feasibility study shall be the baseline cleanup action alternative against which cleanup action alternatives are compared." All other alternatives are then compared against the baseline alternative. If an alternative is selected that is less permanent than the baseline alternative, the disproportionate cost analysis process under MTCA must be used to show that the incremental costs of the baseline alternative "exceed the incremental degree of benefits achieved by the alternative." The FS for the model remedies in Appendix C uses a brief narrative to serve as the disproportionate cost analysis. This narrative is not quantitative, and is not rigorous enough to meet the MTCA standards. The IA Plan should strictly adhere to MTCA so that it is credible and defensible, and we can be reasonably certain that the best decisions are being made.

Section 2.7 - Ecology asserts that there are not enough settlements funds to clean up the whole plume. What is the basis for this assertion? A disproportionate cost analysis is required to establish this. Even though this sounds plausible, some quantitative backup is required. I don't see any cost estimate for performing complete cleanup for use in comparisons to other alternatives.

Section 6.1.3, "In many cases, grading, digging, and construction will lead to soil cleanup." This implies that Ecology will not require any special handling or disposal of soil on properties within the TSP. Is this correct? Or will development of undeveloped land now require the developer to precharacterize soil at the site and potentially use special handling and disposal techniques for soil at addtitional cost? Will Ecology provide assistance to developers in this regard? Phase II plans appear to lean towards requiring cleanup during development, but don't discuss soil handling and disposal and confirmation, just pre-construction sampling.

Section 6.2.3 - Ecology's "decision unit" process relies on the existing land use pattern at each property. How will land use or engineering controls be used to ensure that exposures do not increase as land use patterns on individual properties change over time (e.g., homeowner construction of new play area within a previously forested portion of a property)?

Section 6.4.3 and 6.4.5 - Under capping scenarios, how will Ecology maintain and inspect institutional controls (i.e., "confimational monitoring" under section 11.4.2) that ensure the cap remains in place and effect in perpetuity on thousands of individual properties? It appears that Ecology is leaving this up to the property owner, but doesn't Ecology have an on-going obligation to maintain and inspect ICs if they are a key cleanup action component? Thank you.

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NAME: CARL HALSAN

ADDRESS: PO BOX 1447

CITY: GIG HARBOR ZIP: 98335

COMMENTS

(Please use back side of this form if you need more room)

I'M WORKING ON A VACANT SINGLE FAMILY LOT WHERE I'M PROPOSING A FILL & GRADE PROJECT TO BRING THE SITE UP TO STREET LEVEL IN PREPARATION FOR A NEW SFR. IF THE CITY REQUIRES US TO CLEAN THE SOILS SHOULDN'T WE BE ABLE TO BE REIMBURSED? ARE WE PENALIZED FOR NOT HAVING A HOME ON THE SITE NOW? IF WE BUILD A HOUSE W/O GRADING OR FILLING, THEN TEST THE SOILS, ~~[illegible]~~ THE CLEANUP WOULD BE PAID FOR. IS THAT THE GAME WE'RE FORCED TO PLAY?

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NAME: Marc Amrine

ADDRESS: City of Lakewood

CITY: ______ ZIP: ______

COMMENTS

(Please use back side of this form if you need more room)

You probably should contact the following agencies:

1) Pierce Co Master Builders Assoc (MBA)
   Shawn Hoey and Tiffany Spier
2) Snohomish / King County Master Builders Assoc.
3) Real Estate Industry
4) All Chambers of Commerce
5) Future Wise
6) School Districts (Private & Public)

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NAME: TODD TORSET

ADDRESS: 21720 NE 136th Pl

CITY: Woodinville, WA ZIP: 98077

COMMENTS

(Please use back side of this form if you need more room)

I own a walk-in cabin we use a lot on Vashon (27903 SW Sommerhust Walk Vashon, WA 98070). My question is how will a site like this be handled since it is a walk-in (park in parking lot and walk down to house). Our particular lot does have a road on the plot map which has never been developed so there is potential to get access. The other question regarding our site it is sloped so I'm curious how steep a slope can be and still be cleaned up. More on back

- I'm also curious if accessed value of home will be effected by being in the high zone. I had no idea of this issue when I purchased this property 4 years ago.

- Also the path we and our neigbors walk in on is county property. Will this be covered by the clean up?

From: Kristin Lynett
Date: November 16, 2011
To: Cynthia Walker
Subject: Tacoma Clean up Comments

I would like to see that beneficial surface water techniques are incorporated into the restoration of cleaned up properties. Instead of replacing with grass or other low infiltration vegetation, residents should be encouraged to build rain gardens or other native vegetation.

As heavy equipment would already be on site excavating the contaminated soil, the cost of digging a rain garden would be greatly reduced.

I would encourage Ecology to be flexible in defining “replacement”, and allow for more beneficial restoration techniques and costs. I would encourage Ecology to work with the City’s Surfacewater Division to educate residents on programs and techniques and opportunities to lower their stormwater rates.

Thanks for the opportunity to comment.
Kristi Lynett

Sustainability Manager
Office of Sustainability
City of Tacoma
kristin.lynett@cityoftacoma.org
(253) 591-5571
www.cityoftacoma.org/sustainability

University Place
WASHINGTON

December 15, 2011

Cynthia Walker
Project Manager
Toxics Cleanup Program, SWRO
P.O. Box 47775
Olympia, WA 98504-7775

RE: Draft Interim Action Plan – Tacoma Smelter Plume

Dear Ms. Walker:

The City of University Place has reviewed the Draft Interim Action Plan for the Tacoma Smelter Plume and has the following questions and comments:

1. It is our understanding that the State of Washington received $188 million in the Asarco Settlement of which $111 million was to address the smelter plume. In the Executive Summary of the Draft Interim Action Plan for the Tacoma Smelter Plume and elsewhere in the document, it states the amount of money set aside to address the smelter plume is $94 million. Where is the $17 million difference being allocated?

2. During the Phase One Yard Sampling and Cleanup Program funds should be made available to local government to provide additional public notice. Notice at the local level includes the City newsletter, City Website, UPTV and other means of public notification. Direct mailing and/or going door to door should be considered in areas of high contamination (100 ppm Arsenic).

3. Section 6.1 indicates that Ecology would take action in order of geographic proximity to the former Asarco Smelter (Ruston/ North Tacoma Study Area). However, it is our understanding that soil sampling has shown that proximity to the Asarco Smelter is not the only factor that determines where higher levels of contamination are likely to occur. Wind direction and topography are also factors that need to be considered. Rather than taking action in order of geographic proximity to the former Asarco Smelter, Ecology should allow any property owner in the High Arsenic zone to take advantage of the program on a first come, first served basis. Is there a possibility that funds would run out before properties in University Place could take advantage of the program?

4. Ecology does not propose to sample or cleanup non-residential properties even within the Arsenic high zone. However, there may be uses inside this area including private clubs (Tacoma Rifle and Revolver Club) where large numbers of people gather and recreate. If it is the intent to cleanup sites with the highest level of contamination where people tend to gather such as parks and camps, then Ecology may want to consider funding sampling and cleanup of these private or commercial types of land uses.

5. According to the Draft Action Plan when a property is tested and the results indicate moderate contamination a record will be created indicating the results and the status of the cleanup. Property owners may be reluctant to have their property tested if there is a chance they would be responsible for cleanup costs needed to obtain a No Further Action determination from Ecology. Creating a record indicating contamination of a property that would be publically available and may adversely affect the value of the property is an action most property owners would avoid.

To overcome this obstacle to testing Ecology may want to consider one or more of the following actions:

a. Paying for all or a portion of cleanup of all properties where testing indicates action is needed, including those properties with moderate contamination.

b. Tiering the amount of financial assistance to the level of contamination. For example, on properties where the average arsenic is 100 ppm or more Arsenic, Ecology would pay for 100% of the cleanup cost. On properties with an average arsenic up to 80 ppm. Arsenic, Ecology would pay for 80% of the cleanup cost.

c. Increase the level of contamination at which Ecology issues a No Further Action determination.

d. Pay for cleanup of properties on a first come, first served basis regardless of level of contamination.

e. Pass legislation protecting testing results from public disclosure.

6. Table 6.2 indicates a number of parcels in four jurisdictions but does not indicate the significance of these parcels. Are these the estimated number of parcels in the Arsenic high zone?

7. Regarding Sections 6.4.3 and 6.4.4, the City's municipal code includes landscaping and significant tree preservation requirements. Prior to any cleanup action, Ecology, the landowner and/or the contractor should contact the City to determine what landscaping is required and which if any significant trees can be removed.

8. Phase Two proposes to require public agencies, private developers and private property owners to cleanup sites contaminated by others, effectively transferring the liability for the contamination. The contamination caused by others now becomes the responsibility of the property owner without the benefit of settlement funds. While we can't comment for other public agencies, the City of University Place and many of its residents will be unable to afford cleanup costs without significant financial assistance!

9. Instituting sampling and cleanup outreach, review, requirement, monitoring and enforcement at the local level requires time and resources from local government. Currently, local government is only allowed to recover costs associated with permit review and issuance. All other costs including customer service, outreach and enforcement must be borne by the City's General Fund. One hundred percent grants should be available to affected cities to pay for the costs of instituting the action plan at the local level. Mandating local government to designate a hazard zone, require sampling and cleanup and enforcement would place a huge burden on local governments already strapped for funds.

10. Section 7.3 indicates the voluntary cleanup program would be fee-based. Property owners would need to pay to obtain a No Further Action determination. Fees for this determination may deter some property owners.

11. Section 7.4.1 proposes to require local governments to conduct sampling and clean up on facilities managed by local government when soil is moved. Local governments construct and maintain numerous public facilities including roads and utility systems. Requiring cleanup in conjunction with public construction and maintenance projects could make them cost prohibitive and significantly affects the ability to provide facilities and services to a growing population. The benefits of cleanup must be weighed against the benefits of providing public facilities and services in a cost effective and timely manner.

12. Section 8.5 Enforcement states that Ecology will not enforce against residential land owners in the Tacoma Smelter Plume. However, the Draft Interim Plan includes proposals to mandate local government to require sampling and cleanup in conjunction with development projects. If both are true, Ecology would in effect be transferring enforcement responsibility to local government without the benefit of funding. Local government would also take the brunt of any citizen discontent.

13. Is the public record of sampled properties included in Chapter 6 the same record listed in Chapter 8.3?

14. Chapter 11. How would Ecology prevent fraud in cases where a property owner requests a No Further Action determination of a property in the moderate zone where sampling is performed by the property owner?

Thank you for the opportunity to comment on the Draft Interim Action Plan – Tacoma Smelter Plume. Should you have any questions regarding our comments or questions please do not hesitate to contact me at (253) 460-2519 or at DSwindale@cityofup.com.

Sincerely,

David Swindale, AICP
Director, Planning and Development Services

Copy: Exec

From: Charles Bell
Date: December 15, 2011
To: Cynthia Walker
Subject: Comment on Asarco Smelter Draft Interim Action Plan

Dear Ms. Walker,

Thank you for undertaking action to develop an interim cleanup plan for the Asarco Smelter in Tacoma. The sampling and cleanup should occur quickly (it is significantly overdue) and should be done using neighborhood teams with XRF scanners (cost effective mobile devices that give results on the spot) and urge Ecology to:

- Stop the delay. The settlement agreement was made in 2009. The residents should not have to wait more than another year to have their yards sampled.

- Be cost effective and swift sampling. Create neighborhood teams with the Health Departments of King and Pierce County to sample efficiently with XRF scanners.

- Be cost effective and swift remediation. On a neighborhood scale, bring in clean topsoil for affected properties and so the cleanups block by block in order to minimize cost and disturbance to the residents.

Thank you for this opportunity to comment.

[This comment was submitted by 21 other commenters.]

14432 SE Eastgate Way, Suite 100
Bellevue, Washington 98007
tel: 425 519-8300
fax: 425 746-0197

December 16, 2011

Ms. Cynthia Walker
Washington Department of Ecology
Toxics Cleanup Program
P.O. Box 4775
Olympia, Washington

VIA email: Cynthia.Walker@ecy.wa.gov

Subject: Comments
Draft Interim Action Plan for the
Tacoma Smelter Plume

Dear Ms. Walker:

This letter presents Camp Dresser and McKee Inc.'s (CDM) comments on the proposed Draft Interim Action Plan for the Tacoma Smelter Plume. CDM's comments are attached to this letter. General comments are presented first, followed by specific comments.

Thank you for the opportunity to review and comment upon the proposed plan.

Very truly yours,

Pamela J. Morrill, LHG
Senior Project Manager
Camp Dresser & McKee Inc.

Attachment

General Comments

Alternative Cleanup Methods

CDM recognizes the need to have a simplified approach for conducting site remediation on relatively routine sites. However, guidance often becomes prescriptive and CDM is concerned that the document does not discuss other options under MTCA that may be appropriate for some sites. For example, the model remedy is not practical for large open space properties (i.e., forest land and fields). Development of site-specific risk-based remediation levels based on the land use would be practical, appropriate and protective for large open space areas where human exposure is minimal.

Organic Surface Layer

CDM notes that the guidance document specifies removing organic detritus (i.e., grass, leaves, sticks, forest duff) before collecting surface soil samples. While this is an appropriate approach for urban and other areas where this cover of detritus is recent, it is not necessarily appropriate for sampling conducted in natural areas. Because the metals were an airborne deposition any surface that has been undisturbed during and after the Tacoma Smelter fallout could be contaminated. Thus, forest duff in forest land is impacted by arsenic and lead. CDM has sampled forest duff within the Tacoma Smelter Plume and confirmed this. Arsenic concentrations in forest duff tend to be similar to the surface soil and lead concentrations tend to be similar or higher. Lead, being a cation, tends to adsorb preferentially to the organic matter.

Health and Safety

The document overlooks the practical and potential legal implications of applying the Inorganic Arsenic Rule to work that involves exposure to soils in the Tacoma Smelter Plume and other areas with soil arsenic contamination. The Inorganic Arsenic Rule infers that anyone that may have any exposure to soils within the impacted area must follow the Rule. This Rule seemingly applies to everyone living and working within the Tacoma Smelter Plume fallout area including not only remediation contractors, but also such personnel as yard maintenance laborers, construction workers, and utility workers.

Specific Comments

1) <u>Page 22 – Section 2.4.2 Extended Footprint Study</u>

The fourth paragraph, last sentence reads “Depth profiles show higher levels of arsenic and lead in the top two inches of soil than in the 2-6 inch range.” This would generally be the case for undisturbed soils. However, this begs the question, why is Ecology specifying a 0-6 inch depth interval for site characterization and confirmation analyses? The 0-6 inch sample interval is appropriate when sampling disturbed areas (i.e., areas that have undergone some form of soil mixing). However, for soils in areas that that have been relatively undisturbed over time, such as forests, the 0-2 inch interval would show the greatest concentrations. Since the majority of exposure by children and adults alike will occur from exposed surface soil the 0-2 inch interval should be equally appropriate for both disturbed and undisturbed soils.

2) Page 39 – Section 4.3.3 Consistent with Public Concerns

The last paragraph, second sentence states that "Right now, local planning offices must decide whether to require soil sampling and cleanup as part of the development process." CDM does not believe that local planning departments are currently equipped to make such decisions. Ecology should expect to assist local planning departments in developing an implementation plan.

3) Page 40 –Section 4.3.4 Considerations Based on SEPA Evaluation

The first bullet states that traffic impacts can be lessened by "planning truck routes to reduce miles driven, informing neighbors, and avoiding using large trucks on small streets." These measures are obvious – contractors will most likely implement all of these measures to the extent possible in order to maximize profitability (i.e., no one would use a longer route unless the shorter route had such a high volume of traffic and/or stop lights that it made the shorter route ultimately less economical). A more meaningful suggestion would be to consider altering work hours to avoid peak traffic periods. Also, remedial activities that involve soil disposal on Vashon and Maury Islands will involve utilizing the ferry transportation system. The SEPA should consider alternatives to lessen the impacts on the ferry system for remedial actions conducted on the islands.

The second bullet states that a "manageable volume of soil will go to local landfills because the program will run ten years or longer." This statement should probably be modified to state "local and regional landfill" as most of the soil will likely be trucked to local transfer stations where it will then be railroaded over to eastern Washington. Also, CDM questions the practicality of this statement. While the regional landfills should be able to handle the volume of soil, typically the pinch point occurs at the transfer stations. Very often soil excavation and disposal jobs are held up because the transfer station cannot keep up with the incoming soil volume, whether as a result of weather related or other railroad shut downs, or because of incoming soil volume being greater than the station's handling capacity.

4) Page 43 – Section 5.1 Introduction to the Four Main Phase One Actions

The word "and" is a typo and should be removed from this sentence.

CDM

5) Page 60 – Table 7.1 Phase Two – Proposed Actions by Land use and Estimated Contamination

Under the land use category of "property development with a focus on residential", land within the High Zone average arsenic concentrations will be evaluated at least every two years for funding to address contamination. Properties in the Moderate Zone could be cleaned up at the agency's expense, but based on how it is worded, the High Zone properties will be given the higher priority for funding. Similar to Comment #2, some type of reporting requirement should be instituted as a part of the development or purchase and sale process. Ecology should assist in developing such reporting requirements.

6) Page 63 – Section 7.3 Phase Two Scoping: Streamlined Approaches for Approving Cleanup Actions

The last bullet states that Ecology may "Certify contractors and consultants to do soil sampling and cleanup that meets Tacoma Smelter Plume Model Remedies guidelines." Alternatively, CDM recommends that Ecology develops guidelines that a landowner can use in making informed decisions on hiring consultants and contractors and perhaps a roster of consultants who perform this type of work. Any competent contractor and environmental consultant should be able to implement a TSP model remedy cleanup without having to obtain a special certification.

7) Page 73 Section 9.3.6 Health and Safety

This document is unclear regarding the average landowner's requirements regarding compliance with health and safety regulations. The Inorganic Arsenic Rule does not provide clear direction in this regard. This section should describe the landowner's obligation when hiring subcontractors to conduct remedial actions, as well as any site work that involves moving arsenic contaminated soil, such as for landscaping or site grading.

8) Page 84 Section 11.5 1. Characterization Sampling

Sample Depth: – Again, please define the logic of sampling the 0-6 inch interval for characterization sampling as opposed to a shallower (i.e., 0-2 inch) interval.

Sampling Protocol: – The last sentence specifies clearing grass, leaves, or other debris from the ground surface prior to sampling. CDM agrees that it is necessary to remove recently deposited organics (i.e., leaves, beauty bark), grass, and other debris (i.e., rocks). However, the sampling protocol completely leaves out one appropriate media for sampling, which is forest duff. Considering that the arsenic and lead exist because of airborne deposition and many forested areas have not been disturbed during much or all of the period of the Asarco fallout, the forest duff, and in particular the lower layers of the forest duff, contain arsenic and lead concentrations similar to surface soils. Lead in particular preferentially partitions to organics. CDM has verified the presence of arsenic and lead in the duff in older undisturbed forests within the Tacoma Smelter Plume.

9) Page 86 Section 11.5.3 Stockpile Sampling

Suggest changing "stockpile sampling is required to "stockpile sampling may be required" . Stockpile sampling is not necessarily required for the excavation with offsite disposal if the site characterization sampling was sufficient for the waste profiling and acceptance by the landfill. Also, stockpile sampling should not necessarily be required for consolidation and capping if site characterization data were sufficient to profile the material.

10) Page 88 Table 11.5 Summary of Model Remedy Options and Considerations

The way that the mixing action is presented "Mix the top 6-12" contaminated soils with imported or deeper, clean soil," indicates that the soil mixing can occur at depths greater than 12". For example, the 0- 12 inch interval could be mixed with the 12-18" soil interval. Is this the intention?

What is the logic in requiring a thicker cap when arsenic and lead concentrations are greater. All caps should be constructed and maintained such that they are competent regardless of the arsenic/lead concentrations. Because risk is a function of both concentration and exposure, if the arsenic/lead contaminated soil becomes exposed there will not be a control over the exposure.

11) Page 89 – Section 11.6.1 Capping In Place

See the prior comment. A cap should be designed with the expected level of use in mind (i.e., high/low traffic and traffic type – foot, motorized, etc), not on the concentration of arsenic.

12) Page 92 – Section 11.6.5, Institutional Controls Only, last paragraph

Bark will break down and will not hold up under heavy use. Practically speaking, only heavily used walking paths/trails should need to be covered with a physical barrier. A risk-based approach should be one option for large open space areas with miles of trails and relatively infrequent use.

13) Page 93- Section 11.8 Model Remedies Best Management Practices

This seems to imply that routine site workers, such as the average landscape maintenance worker, will need to be HAZWOPER trained. This is impractical, not implementable, and a huge financial burden for companies and homeowners. CDM suggests that the implications of this section be reviewed by legal counsel.

14) References

Please check the links. The one for the Science Advisory Board, 2006 does not work.

Appendix B - Tacoma Smelter Plume Model Remedies Guidance

15) Page 8 – Decision Units, Second Paragraph

The document indicates that one could "cap a community green belt." This doesn't make sense if the purpose of the green belt is to leave an area natural – capping would destroy the native environment.

16) Page 10 – Sample Depths, first bullet

See Comment 1 regarding the sample interval.

Refer to comment #8. Removal of the organic layer over the surface of the soil does not always make sense. It makes sense if the surface layer is gravel, grass, or organic matter in disturbed areas, such as planter beds. It does not make sense if it is the organic layer is relatively undisturbed forest duff. Sampling this material has proven that it contains arsenic and lead at levels similar to soil.

17) Page 12, Soil sampling steps

#5 – Regardless of the depth interval is to be sampled, it should be specified that an even amount of soil should be collected across that depth interval. Too frequently samples are collected from a cone shaped hole, which will bias the data higher. A hand auger works well.

#7 Do not overlook the need to wash the soil mixing bowl. "Safely dispose of the dirty water" is not adequate guidance.

18) Page 17, Excavation and Disposal Process

#2 Prevent contaminated soils and dust from escaping the site -Soil and dust do not "escape. "

Whenever possible, a better alternative to wheel washing is to avoid having trucks drive onto contaminated areas.

19) Page 19, Worksheet – Planning for Excavation and Removal

Item 7 – Soil disposal is typically by the ton, not the cubic yard.

Item 9 – Equipment costs, confirmation sampling and testing of clean imported fill are not included in this tally.

20) Page 22 – XRF Note

The XRF should be allowed for compliance sampling if conducted in accordance with EPA Method 6200. The XRF is proven to produce valid data that is correlative with laboratory data, particularly if the data take into an account an appropriate adjustment factor.

21) Page 24 - B. Mixing with deeper soils (undisturbed areas)

The guidance is silent on how the forest duff, which contains lead and arsenic is to be dealt with. Also, implementing soil mixing on large expanses of forests and other undeveloped lands is not only infeasible, but will cause greater harm than benefit. As an example, consider the practicality of attempting to conduct soil mixing around tree roots and blow downs (trees, branches and other large detritus), as well as the resulting annihilation of the understory on forested lands.

22) Page 26 – Chapter Five: Capping in Place

Last paragraph that starts with "Important" – Ecology notes a preference for excavation and disposal during residential development. Consider a "green remediation" alternative, which would be soil mixing. Development possibly presents an excellent opportunity for soil mixing. Typically, soil that is excavated from the areas of foundations is much deeper than the depth of contamination. These soils could be mixed with the top soils, likely achieving the <20 ppm cleanup level for arsenic.

23) Page 27 – Soil Caps

There are some words missing from this paragraph.

24) Page 27 – Hard Caps

It is not practical to lay a hard cap over a surface soil as the organic layer will need to be stripped of prior to laying the hard cap. Otherwise, the hard cap (e.g., driveway) will settle, crack, and eventually fail.

25) Page 31 Process for consolidation and capping

#7 - Soils do not "escape" during transport. An alternative word might be "spilled."

26) Page 32 Worksheet: Planning for Consolidation and Capping

#3 b – Suggest two separate lines, one for soil fill and a second for other types of fill (i.e., beauty bark/gravel

27) Page 36 – Human Costs, Loss of human use

An alternative to fencing off a large, natural environment or developing expensive remediated trail systems is implementation of a risk assessment. The public's use of these areas is typically infrequent, of relatively short duration, and non-invasive. Thus, the exposure, and therefore the risk of adverse human health effects is generally low. Ecology should consider allowing site-specific risk assessments for such areas.

28) Page 39 - Sampling Process

#6 – See comment #17

29) Page 43 - Sampling Process

#3 - Note that the soil aliquots should be of approximately equal volume when collecting the composite sample.

Appendix C - Golder Associates Feasibility Study

30) Section 3.2 Remediation Levels

Golder noted that concentrations of 100 mg/kg for arsenic and 500 mg/kg for lead would not pose a threat to groundwater. This is inconsistent with the reference (SAB, 2006) and this Draft Interim Action Plan, which state that arsenic concentrations of up to 200 mg/kg and lead concentrations up to 1,000 mg/kg are protective of groundwater.

Appendix E: SEPA Checklist

31) General

Is this SEPA checklist intended to cover only Ecology conducted cleanups, or is it intended to also cover cleanups conducted by the public. If it is the latter, then the SEPA should have greater consideration of the additional remedial actions completed by the public and the implementation of remedial actions by the public.

32) Page 15, #12 - Recreation

Recreational uses will be highly impacted if this interim remedial action plan mandates institutional controls (i.e., fencing off) or remediation of miles of trails (unaffordable) on large expanses of natural open space properties.

From: Mark Slack
Date: December 17, 2011
To: Cynthia Walker
Subject: Tacoma Smelter Plume

Re: Public Comment

The work being done is essential and this comment is not a complaint.

An unfortunate consequence of good public education is an adverse impact on property values for many homeowners. To recover those values, a prudent homeowner will want to participate in the Soil Sampling and Cleanup Program. For qualified parcels (>100 ppm), determining the implementation priority will be difficult. From the Open House event on Vashon (November 9th), I gleaned that the current thinking was to start remediation in SW Tacoma and proceed north -- indicating that Vashon property owners may not see relief for many years.

When you establish prioritization guidelines, please provide an appeal mechanism for any homeowner who has intention to sell. Specifically, if I want to sell my property that lies within the highest arsenic zone, I'd like to be able to request expedited sampling, and if that sampling confirms contamination in excess of the threshold, I don't want to have to wait years for remediation.

To ensure that such provisions are not abused, monetary claw-back provisions could be defined in the event the homeowner does not sell within a specified period of time, say three years. Alternately, a steep Priority Adjustment Fee could deter abuse and have the added benefit of making sparse funds go further.

City of Tacoma
Community and Economic Development Department

December 19, 2011

Ms. Cynthia Walker
Southwest Regional Office, Toxics Cleanup Program
Department of Ecology
PO Box 47775
Olympia, WA 98504-7775

RE: City of Tacoma comments regarding the *Draft Interim Action Plan for the Tacoma Smelter Plume* (October, 2011)

Dear Ms. Walker:

Thank you for the opportunity to comment on the above-noted Action Plan. We appreciate the work that your staff and the Department of Ecology (Ecology) have done to pursue a settlement and funding for removal of toxic soils in our community. Thank you also for communicating with staff and the City Council regarding the Action Plan. We have coordinated among staff to offer the following comments and suggestions.

Background: City of Tacoma *Comprehensive Plan*

As a GMA-planning City, Tacoma uses its *Comprehensive Plan* goals and policies to guide the development of regulatory codes, and to provide a framework for decision-making.

As you are aware, the City of Tacoma has adopted *Comprehensive Plan* policies to pursue partnerships and collaboration with other governmental agencies to prevent or eliminate environmental contamination. We have been using these policies for at least the last five years to support use of SEPA Substantive Authority to require cleanup as mitigation for new development projects. We intend to continue that cooperation as the Action Plan is put into place.

In addition, the City has also adopted *Comprehensive Plan* policies consistent with Pierce County's County-Wide Planning Policies which place a strong emphasis on infill development. For Tacoma, this means that we intend to accommodate additional population through additional dwelling units on under-developed lots, and, more so, through new development on undeveloped lots throughout the City. The overwhelming majority of these properties are small, fitting within a range of 2-8 residential lots.

The Environmental Policy Element of the *Comprehensive Plan* emphasizes environmental quality, including water quality, with a strong preference for Low Impact Development techniques to manage surface water runoff.

Finally, the City has adopted an Urban Forest Policy Element which has as its goal establishing and protecting a citywide tree canopy of at least thirty percent. The City intends to lead by example, increasing the canopy coverage on public lands and forming partnerships with property owners to plant trees. Overall emphasis is placed upon tree cover in residential and open space areas.

Comments and Recommendations: Phase I

1. The City has been using SEPA Substantive Authority to implement the recommendations of Ecology regarding voluntary cleanup at the time of site development. The area affected by the Asarco plume is nearly one-half the City. Because of concerns about adequate traffic study and mitigation, the City's SEPA threshold for residential development has been set at 4 units – thus meaning that very small developments may be required to complete a cleanup at their site. In other jurisdictions a development as large as 20 units may be beneath the SEPA threshold. While the City agrees that sites of all sizes should be cleaned up to protect human health, it also recognizes that the cost burden can be overwhelming, thus creating a disincentive for infill development.
    - Ecology should consider providing cleanup services or funds to new developments beneath a certain size threshold. In the alternative, consider cost-sharing with new development, perhaps on a sliding scale based upon the size of the development and/or anticipated costs of cleanup.
    - A similar consideration might be made for small non-residential development, e.g., day care facilities or churches, which may not have the resources to adequately address soil contamination.
2. The City will coordinate with Ecology when conducting public works projects in areas of high potential contamination. Ecology should continue to provide technical assistance to City staff to develop BMPs for public works projects, and we would encourage the following:
    - Develop standardized specification language and SEPA language for City Capital Improvement projects within City Right-of-Way, detailing the Phase 1 and Phase 2 minimum soil testing requirements, minimum disposal requirements, and minimum soil handling requirements relative to the specific concentration areas as noted on the draft Ecology ASARCO Clean-Up Plan.
    - Develop standardized Best Management Practices (BMPs) that can be associated to the specific concentration areas as noted on the draft Ecology ASARCO Clean-Up-Plan. The BMPs would be utilized on the majority of City infrastructure projects.
3. Please note that independent cleanups are not exempt from City of Tacoma permitting requirements, and property owners should be advised of this. Independent cleanups involving 50 cubic yards or more of grading activity would require a grading permit from the City at a cost of approximately $300 or more. Independent cleanups shall comply with all applicable requirements contained in the City of Tacoma Surface Water Management Manual, Tacoma Municipal Code 12.08 and the Public Works Design Manual in effect at time of construction permitting. The Interim Action Plan does not vest independent cleanup projects for surface water requirements.
4. As the residential cleanup plan is further refined, ensure that there is equity in application of cleanup standards for independent cleanups. Simply put, it makes sense, when working with a private developer on voluntary cleanup, Ecology asks the question "What would we require of ourselves if we were the ones completing the cleanup?" and apply those standards for the developer. For instance if Ecology determines that it will not clean up an undeveloped portion of a large residential lot, such as a forested hillside, it should not

require a developer to clean a similar portion of its site – even if that site may be accessible to future residents. Education about reducing exposure can be provided in that case.

5. As the detailed yard sampling and cleanup program is developed, continue to consult with local planning, permitting, and surface water staff for review. Of special concern are compliance with the City's Surface Water Management Manual, the Public Works Design Manual, and other local codes and policies. Compliance with local codes is important in all jurisdictions.
6. The detailed yard sampling and cleanup program shall include Best Management Practices (BMPs) to prevent construction activities from adversely impacting downstream resources and on-site stormwater flows. Identify methods for implementing BMPs both with Ecology contracts and when working with homeowners who will be completing their own cleanups. All projects shall comply with Minimum Requirement #2 of the Surface Water Management Manual and other applicable City codes and requirements.
7. When restoring yards, consider using Low Impact Development (LID) techniques to improve stormwater conditions. Ecology may want to consider offering the option of cost-sharing with the property owner to implement the LID. Stormwater improvements shall meet the requirements of the City's Surface Water Management Manual, the Public Works Design Manual, and other local codes and policies.
8. In most areas of the City, property owners are responsible for maintaining the area between their property line and the roadway. This area includes the planting strip, sidewalk, parking strip, etc., and is commonly used as part of the residential yard (frequently for gardens). If a residential property is cleaned up, this area should be included in the work despite being within the right-of-way.
9. Ensure that any trees which are removed as part of a cleanup action are replaced with equivalent species, or a species which will have an equal or larger crown width. Consider working with property owners (with cost-sharing) to increase the yard area used for tree growth – again, working with City staff expertise for residential trees. When restoring or improving yards, work with land owners to ensure survival of landscaping. It is especially important that work around mature trees within their drip-line (known as the critical root zone) is limited, or preferably, avoided entirely. Additionally, work in areas with known pathogens (e.g., root rot) and susceptible mature trees should be avoided.
10. As the residential cleanup program is implemented, please work with City staff to maintain records of cleaned/tested areas using GIS systems.
11. Please consider adding publicly-owned land to the testing and cleanup program. Prioritize soil testing and soil removal and disposal funding for public right-of-way and capital projects which improve public streets, planting strips, medians, and landscaping abutting public streets and sidewalks; and for projects which improve public lands and facilities. In addition, make funding available for open space and other public vacant and improved lands programmed for community recreational purposes e.g., community gardens, parks, etc. Work with City staff to establish reasonable best practices for capping contaminated soil on public and private lands and in right-of-way. Work with solid waste purveyors to ensure efficient soil disposal processes, which facilitate reasonable soil disposal costs for public and private projects.

Comments and Recommendations: Phase II

1. Thank you for providing the model remedies guidance. It is helpful in developing internal practices for City projects and in educating our staff and residents.
2. We have heard concerns from property owners regarding sites which are tested but which are not cleaned up under Ecology's program (sites which exceed 20 ppm arsenic threshold but less than 100 ppm). The concern is that once a property is "tagged" as having contaminated soil, it will decrease in property value or be unsellable or undevelopable. Prior to implementing any disclosure/reporting standards for real estate transactions, ensure that appropriate educational materials are available so prospective buyers are fully aware of the implications of and safety practices for elevated arsenic levels. We would encourage further study of ways to provide financial assistance (partial payment, low-cost financing) for property owners completing private cleanups.
3. Continue to work with planning, permitting, public works, and intergovernmental staff from all cities as code requirements for cleanup are developed. The City of Tacoma is – in policy and practice – strongly supportive of its single-family housing stock and emphasizes ease in permitting and review for single-family homeowners. Single family homes are the majority of our land use, and a large proportion of our permit applications. Any requirements for cleanup associated with residential building permits (such as garages or retaining walls) must carefully balance cost and effort of cleanup with the benefits of improvements to residential properties. While, again, we agree that all properties should be cleaned up, there is concern with the costs associated.
4. Continue to work with city staff to provide informational materials to residential property owners. The City of Tacoma provides several "tip sheets" regarding different development projects which could be easily adapted to include information on soils and soil safety.

Again, thank you for all of your work with what is a broad and difficult topic. We appreciate your communication with staff as well as the technical assistance you have provided, and we look forward to a continued partnership. If you have any questions or if you need any assistance from our staff, please contact Shirley Schultz in Building and Land Use Services at 253-591-5121, or Calvin Taylor in Environmental Services at 253-593-7711 who can coordinate any necessary response.

Sincerely,

Peter Huffman
Assistant Director

cc: Rey Arellano, Interim City Manager
Ryan Petty, Community and Economic Dev. Director
Dick McKinley, Public Works Director
Geoff Smyth, Environmental Services, Science and Engineering
Jeffrey Jenkins, Facilities Management
Kurtis Kingsolver, Public Works Interim Assistant Director

PEOPLE FOR PUGET SOUND

pugetsound.org

December 19, 2011

Cynthia Walker, Project Manager
Toxics Cleanup Program, SWRO
PO Box 47775
Olympia, WA 98504-7775
Via email: Cynthia.Walker@ecy.wa.gov

RE: Draft Interim Action Plan for the Tacoma Smelter Plume

Dear Cynthia,

Thank you for the opportunity to provide comments on the *Draft Interim Action Plan for the Tacoma Smelter Plume* dated October 2011, and associated documents.

People for Puget Sound is a nonprofit, citizens' organization whose mission is to protect and restore the health of Puget Sound and the Northwest Straits.

Background

The Asarco Smelter operated in Tacoma for almost 100 years producing copper. Unfortunately, the air plume of contamination from this facility deposited arsenic, cadmium and lead in a large area (over 1000 square miles) with levels above cleanup targets in areas from Thurston County, to Vashon Island, to the Magnolia neighborhood in Seattle and east of I-5 in King County. It is the largest contamination area in the state. The 1 square mile area right around the smelter site is a Superfund site (designated in 1983) and has been largely cleaned up by USEPA.

In the larger plume footprint, Ecology has sampled the yards of 1000 daycares and schools in the broader plume area and has cleaned up 100 of those. Across the footprint of the plume, the contamination is quite variable – some parcels will have high levels and adjacent parcels will not, depending on wind patterns, slope and amount of land disturbance. This is why it is important to sample residential yards.

As noted in the plan, these chemical are toxic and persistent. Arsenic contributes to cardiovascular disease, diabetes, and certain cancers. Lead can cause developmental delays and behavioral problems in children. It is imperative that these chemicals get cleaned up.

Ecology is using a 2009 $94 million settlement from Asarco to conduct sampling in residential yards, implement remediation and conduct education and outreach. Ecology believes that the plume is too large to clean up every property with this amount of funding, so they are doing partial cleanup (i.e., an "interim action").

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People For Puget Sound supports a thorough cleanup of the contaminated area. We recommend the most permanent remedy (removal of soil and replacement with clean soil for ALL contaminated parcels) because this is protective of human and wildlife health and in the long-run it is most cost effective to do the job right at the beginning than to come back again and again to do more cleanups. If Ecology cannot clean up all of the parcels with the given amount of funding, then a prioritized and cost-effective approach is 2nd best.

Our comments follow:

1. **Stop the delay.** The settlement agreement was made in 2009. It is great that Ecology is creating this interim cleanup plan, but People For Puget Sound thinks that the sampling and cleanup should occur quickly (it is significantly overdue). The residents should not have to wait another year to have their yards sampled. It should not take a year to get the sampling started.

2. **Quick and comprehensive sampling**. Sampling should be done using neighborhood teams with XRF scanners (cost effective mobile devices that give results on the spot). Specifically we recommend that Ecology create neighborhood teams with the Health Departments of King and Pierce and Thurston Counties to sample efficiently with XRF scanners. These teams can provide immediate feedback to parcel owners and can effectively work block-by-block for maximum speed and cost-savings.

3. **Cost effective and swift remediation**. On a neighborhood scale, bring in clean topsoil for affected properties and so the cleanups block-by-block in order to minimize cost and disturbance to the residents.

4. **Improve the cleanup target.** Ecology has determined a cleanup target for yards for arsenic at 20 parts per million (ppm) and lead at 250 ppm and is only planning to clean up yards at an even higher target level (average arsenic over 100 ppm or single arsenic sample over 200 ppm average lead above 500 ppm or single lead sample above 1000 ppm). Unfortunately, these levels are above the state's human health standards. We recommend that the sampling (above) be conducted swiftly and in a cost-effective manner so that the $94 million go further – get the cleanups done for the existing cleanup target levels, and then use remaining funds to cleanup properties that are below the cleanup targets but above human health standards.

Thank you for your consideration. You can reach me at (206) 382-7007 (X172) or htrim@pugetsound.org.

Sincerely,

Heather

Heather Trim
Director of Policy

From: Evonne Agnello
Date: December 21, 2011
To: Cynthia Walker
Subject: Asarco cleanup needed in my yard

Re: Input sought on Asarco Cleanup

As the attached 3 pages show *[not included in this Responsiveness Summary]*, the soil in yard was tested by the Pierce County Health Department in 2003 and shown to have 48.4 ppm arsenic in my back yard, which is wooded and next to the 4th hole on the Highlands Golf Course and 29.1 ppm arsenic in my front yard.

While my back yard arsenic is more than twice the state background level for arsenic of 20 ppm, I see from the map in the Tacoma Weekly that anything less than 100 is considered moderate. I think that's wrong.

There are children in my neighborhood and they play in this contaminated area. There are also, of course, hundreds of people of all ages who golf in this area and shuffle through my trees looking for golf balls.

It seems if Asarco is to take full responsibility for correcting the horrendous environmental wrath it's plant has wrought on Puget Sound -- and there is no reason why it should not -- then I ask that my yard, both front and back be properly cleaned at their expense.

Thank you.

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December 20, 2011

Department of Ecology
Cynthia Walker
PO Box 4775
Olympia WA 98504-7775
Cynthia.Walker@ecy.wa.gov

Re: Department of Ecology Tacoma Smelter Plume Clean Up Plan Public Comment

Dear Dept. of Ecology:

I have read much of the information that has been published in the local newspapers, published by DOE and I attended the DOE meeting at Curtis High School in November, 2011, which discussed DOE's arsenic and lead standards.

DOE has already been imposing in Tacoma in 2011 through SEPA its new arsenic and lead standards on citizens who did not cause the pollution. The property owners in Tacoma that have had to comply with the new DOE standards have already faced enormous economic hardship. The DOE has not offered to use its clean-up funds to offset these private owner mitigation expenses. The new DOE standards applied to the entire plume area could be devastating to all property owners, residential, business, municipal and charitable. This can happen whenever DOE decides it will impose its will on property not covered now by SEPA reviews.

The DOE experience in Tacoma in 2011 has shown that the impact of the new standards and DOE regulation is economically harsh. The Asarco and the EPA funded mitigation in the Tacoma Smelter Plume area did not cost the property owner any money and did not threaten their property use or values. This has dramatically changed. DOE regulation is excessively expensive, unfunded to the property owners and creates a toxic label on 1,000 square miles of property.

It is time for the DOE to provide the citizens in the Tacoma Smelter Plume area the hash facts of their new economic reality. It is time for the DOE to announce that all previous mitigation is being superseded by the DOE. DOE needs to tell property owners that relied on EPA Super Fund mitigation that it no longer matters. There is a new regulator, DOE, with new rules. It is time for the DOE to publish that the funds available to DOE will not fund all of the mitigation at the levels DOE has set. If there is not a likelihood of future mitigation funding DOE should state that. If DOE now considers all of the property in the plume area toxic it should announce that to the public.

Has DOE done any cost analysis, or SEPA, of the economic impact that the imposition of the new standards, clean up and testing plans will have? If not, is DOE planning on doing this cost analysis? Shouldn't DOE perform this economic impact analysis and a SEPA itself before proceeding forward with these new standards, any sampling and any clean up?

Does DOE have any specific scientific evidence of past health problems caused to residents by arsenic or lead in the plume area to justify the dramatic change from the Environmental Protection Agency standards for arsenic and lead? If there is additional scientific evidence is it only laboratory work or educated guess work? Is there any scientific study specific to the current residents who have lived and used their property in the plume area which has already been cleaned up to the EPA standard? What is the likelihood that a fully landscaped residence with less than 230 ppm arsenic in the yard will somehow cause a person to get cancer or any of the other of the diseases DOE has listed? Where are the scientific studies specific to the generations of residents who have lived under the plume and used their yards and breathed the arsenic and lead as it was dropping on them (at a time the toxins were well above current the EPA 230 ppm standard)?

DOE has recognized in its literature that many of the <u>health problems that can be caused by arsenic are not in fact expected to be caused by arsenic but will be due to other factors such as diet, genes, life style, pre-existing illness, and other chemicals.</u> The DOE recognizes at the same time arsenic can increase the risk of developing these illnesses and feels it is <u>likely</u> (but not proven) to contribute to <u>some</u> of the cases. The DOE also recognizes that most arsenic only stays in the body a short period of time. The number of potential health risks for cancer listed by DOE in its literature as 1 in 1,000,000, 30 in 1,000,000 or 1 in 2,000 do not seem to be relevant or related to any study (especially of the use of this plume area) and are only guesses.

Has DOE attempted to quantify the specific health benefits to the residents of the plume area vs. the dramatic economic hardship that the new DOE regulations will bring?

EPA is currently winding down the yard clean up to the 1993 EPA 230 ppm standard. Does DOE know the cost of Super Fund mitigation? Shouldn't these costs be disclosed to the public to help it understand the potential cost of the DOE program which appears will greatly exceed the EPA mitigation?

In 1993 the United States Environmental Protection Agency set up a 950 acre Super Fund site for the area surrounding the Asarco Smelter. EPA set the maximum safe level of arsenic in the soil at <u>230 parts per million and lead at a maximum of 500 parts per million</u>. These were the acceptable limits. <u>EPA literature indicates it has been cleaning up property that had levels that only could have potentially caused health problems.</u> There has never been a statement that the existing levels of arsenic or lead were causing health problems or have now caused health problems. What has changed?

Many of the properties in this plume area were sampled and cleaned up to these maximum EPA standards. Many sites were sampled and very minimal areas on them were cleaned. There were many other sites that were sampled but not clean up. By new DOE standards all of these properties are now contaminated. How does DOE justify this wasted effort?

What new information caused DOE in 2003 to declare that there are now 1,000 square miles of Asarco contamination not 1.5 square miles? This is an increase of 660 times. This includes 7,000 developed lots and 2,000 undeveloped lots.

DOE is also setting new standards for mitigation for arsenic of 20 ppm and 250 ppm for lead. <u>The new standard for arsenic is approximately 12 times greater than the EPA safe standards of 230 ppm and 500 ppm</u>. What specifically is this change based upon? The new DOE standard is barely above 7 ppm which is the approximate amount of arsenic naturally occurring in soils.

The DOE received $188 million in the bankruptcy settlement with Asarco. One-half of this, $94 million, is apparently dedicated to the Tacoma Asarco clean up. The other $94 million is apparently dedicated to Everett and other sites. Of the $94 million only $64 million is slated for clean up.

From the recent DOE experience in Tacoma with SEPA projects the amount of $64 million is dramatically inadequate to cover the true cost of mitigation.

There are three sites in the Tacoma Plume area that have recently come under DOE's SEPA jurisdiction. I do not have all of the specifics of these sites but do have some knowledge. Rabbi Zellerman came to the DOE meeting in University Place. He had a SEPA required DOE mitigation on an approximate 7,000 square foot residential site to build a religious building. The cost of the remediation was over $19,000. The cost of soil removal for dump fees alone was $28 per ton. The Highland Golf Course requested a preliminary plat for 8 lots and came under SEPA. DOE is requiring removal of arsenic and lead to 20 ppm and 250 ppm. The lots are about 6,000 square feet. DOE wants the each site totally decontaminated. A 6,000 square foot lot has 6,000 cubic feet of soil in 1 foot of depth. Divided by 27 is a cubic yard. Removing 1 foot of soil on a 6,000 square foot lot equals approximately 222 yards. 222 yards times 1.3 (to quantify tons) equals approximately 290 tons. The dump fee of $28 per ton equals $8,000 per foot of soil removed. This is without the cost of permits, scientific studies, dust containment, loading, trucking, return of soil, testing of returned soil, compaction and other related costs which add at least another $8,000 per foot of depth removed. If two feet of soil need to be removed that is approximately $32,000 per building lot. The soils must be removed rather than mixed, partially removed or buried. There is really no way to know how deep the soil removal will be before a DOE letter of "NO Further Action" is granted. Sales of the golf course lots are almost impossible because DOE may well require the digging to start and not stop until 20 ppm is reached. No one wants that risk. A commercial project at 37th and Vassault required SEPA DOE approval. The rumor is that this was done at a cost of around $300,000. DOE allowed capping because it was a commercial project. Capping is much cheaper.

The decontamination cost on these three sites, a total of approximately 10 acres, could easily exceed $500,000. This is about 0.0000156 of the 1,000 square miles but almost 130th of the total DOE clean-up budget of $64,000,000.

DOE wants to come up with a plan in early 2012 for decontamination of sites expanding out from the smelter. All sites exceeding 20 ppm will not be decontaminated. The sites with less than 100 ppm will not be touched. Sites above 100 ppm will be decontaminated to a 20 ppm and 250 ppm standard. This is the same as the SEPA sites.

Why would a site with 101 ppm be decontaminated to 20 ppm when a site next door may be at 99 ppm but not decontaminated at all? Will the 99 ppm property be devalued? Is it labeled toxic? Will the bank finance it?

Does DOE have a maximum depth to which it will remove contaminated soil? What if the depth turns out to be 5 feet to get to 20 ppm? Most residents will never dig to 5 feet or even 1 foot depth on their property in a lifetime. If done it would likely be a short term exposure. Is there a more rational way to look at risk? If at a 1-foot depth the soil is at 50 ppm is this not safe? Where is the science to say 50 ppm is a serious health risk?

Will all property be identified by DOE as toxic if it exceeds 20 ppm? If it is identified as toxic what is the affect? Can a house be sold? Can it be sold without the new owner tacking on toxic liability? Can it be occupied? Can it be bank financed? If the houses can't be financed there will be no purchases. The prices of property will dramatically drop. There will be huge suffering not just site specific but community wide. What happens to state, city, school district and other entities' tax revenues?

Apparently, the DOE plans to begin clean up in 2013. This plan will continue for 10 years. What happens to the houses that are not slated to be cleaned up until years 2 to 10? Do they get a toxic label? Will the banks finance a toxic property that will only be cleaned up in the future if the DOE still has money available? State budgets are not reliable now. DOE only has $94,000,000. DOE has not presented a plan of where the extra clean-up money will come from.

Why does DOE take any of this money for administration?

If clean up is really necessary, since there is money in the bank now, why spread the mitigation over 10 years when the costs will escalate? More property can be decontaminated when the costs are less. Put construction trades to work now.

The DOE is offering sampling and wants voluntary clean up at the property owner's expense. There are no funds to pay for this clean up. After the sampling will DOE label a site above 20 ppm toxic? Can a home owner afford a $30,000 clean up?

At this time I do not think that DOE has any good numbers on what a site will take to decontaminate arsenic to 20 ppm. I believe that the 2011 SEPA sites required more than 2 feet of soil removal. I have reviewed several properties in the plume area. At 12-18 inches of depth of soil after the EPA decontamination, the tested arsenic levels were from 99 ppm to 156 ppm with a mean of 108. DOE does not know how deep a 20+ ppm decontamination must go? The EPA only went a few inches in most cases.

If an occupied site exceeds more that 12 inches of soil removal there are very expensive problems to resolve that magnify with each additional inch of depth. When are the building foundations, rock walls, trees, shrubs, sidewalks, curbs, roads and the neighboring properties undermined? What is the real cost on an occupied site? Has DOE at this time sampled several sites in the plume area and received bids for the removal to 20 ppm and the restoration of the site?

What happens to the properties that are skipped over because they are a distance from the Asarco smelter but over 20 ppm? Are they listed as contaminated?

Has DOE considered what happens to whole communities if they are labeled toxic and there are not enough funds to complete a clean up? Does a community recover from this? Is the DOE considering this in setting clean-up ppm levels?

Very Truly Yours,

Carl D. Teitge

From: Todd Hunsdorfer
Date: December 20, 2011
To: Cynthia Walker
Subject: Tacoma Smelter Plume Draft Interim Action Plan Comments_City of Kent

RE: Tacoma Smelter Plume Draft Interim Action Plan Comments

Dear Ms. Walker,

The city of Kent appreciates the opportunity to comment on the Tacoma Smelter Plume Interim Action Plan (IAP), and is looking forward to continued dialogue about the cleanup.

In response to this iteration of the IAP the city of Kent has the following comments:

- The City feels it is inappropriate to require private landowners to clean up properties contaminated by Asarco. Chapter 6 places the burden on private residential property owners to clean up properties that fall into the moderate category, which includes sites that exceed state cleanup standards for arsenic.

- The City agrees that when the land use is designated as "Property development with a focus on residential" (Table 7.1), cleanup should be *encouraged*. However, the City feels strongly that, where cleanup will be required, funding should be provided by the Department of Ecology to do the required cleanup. Private property owners should not be required to clean up contamination caused by Asarco.

- In Section 7.4.1, titled "Proposed Actions for Properties Managed by Other Agencies" Ecology proposes a set of actions for working with other agencies, one of which includes requiring, through state law, soil sampling and cleanup for projects involving soil moving at facilities managed by state agencies and local governments. The city of Kent is concerned with the administrative burden and cost of requiring soil sampling and cleanup in these instances.

The city of Kent is anticipating and would like to participate in an additional comment period for Phase II of the IAP, once the public and neighboring jurisdictions have had an opportunity to express their initial concerns.

The city is thankful for your consideration of these comments. For any additional clarification on these comments please contact Todd Hunsdorfer, Environmental Conservation Technician, at (253) 856-5537, or thunsdorfer@kentwa.gov.

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Environmental Engineering | Public Works Department
220 Fourth Avenue South, Kent, WA 98032
Phone **253-856-5537** | Cell **253-740-0224**
thunsdorfer@KentWA.gov
www.KentWA.gov

From: Deborah Johnson
Date: December 20, 2011
To: Cynthia Walker
Subject: Comment letter - Draft Interim Action Plan for the Tacoma Smelter Plume

Dear Ms. Walker:

This e-mail constitutes the City of Lakewood's comments on the proposed Interim Action Plan for the Tacoma Smelter [Asarco] Plume.

Our comments focus on the Phase Two Actions delineated in Chapter 7. Generally, we believe these actions shift responsibility and cost associated with plume cleanup to the local level and to individual developers.
We note from the explanatory language in Section 7.1 that additional input will be requested on these proposed actions in or around 2014. In terms of the bulleted issues upon which you are seeking specific feedback, we do not believe the Phase Two actions are feasible. The City of Lakewood does not currently have funding, work programming, or expertise to undertake such a regulatory program, nor are we likely to begin such a program in the foreseeable future. As currently framed, the proposed actions constitute an unfunded mandate upon local governments.

Economic development is the Lakewood City Council's top priority. We are concerned that the creation of a hazard zone as proposed will not only affect property values for existing land uses, but could also act as a deterrent to new development or redevelopment. As one of the designated regional centers under the Puget Sound Regional Council's VISION 2040 plan, Lakewood is expected to add significant new growth, not just in terms of population but also jobs. The City's comprehensive plan under the state Growth Management Act is largely predicated on redevelopment and infill, which could be negatively influenced not just by the mere presence of a hazard zone, but also the prospect of cleanup costs associated with land development in the city. The proposal to require seller sampling of soils could also negatively impact real estate values and dampen investor interest in property acquisition. As a whole, these proposed regulatory actions further press on a real estate and development industry that is already significant hampered by the current economy and could significantly deter investment in our community.

The requested feedback points also ask whether "local governments have legal issues with the actions." At this time, the City of Lakewood has not undertaken specific legal review of this proposal; however, we are obviously concerned about costs associated with environmental cleanup caused by a land use that is not even located within our city being passed on to us. Further, we would point out that the contamination actually occurred prior to the City's incorporation, which further obfuscates any responsibility the City may or may not have in terms of cleanup. We reserve the right to engage legal review and/or undertake legal action at a later date as the plume plan becomes more fully formed and is forwarded for additional review and comment.

Thank you for considering our comments. Please place me on the mailing list for any subsequent notices related to the plume plan. If you have any questions or need additional information, please contact me at 253.983.7770 or e-mail <djohnson@cityoflakewood.us>.

Deborah Johnson
Senior Planner
Lakewood Community Development Dept.
6000 Main Street SW
Lakewood, WA 98499-5027
Voice: 253.983.7770
Fax: 253.512.2268

From: Doug Fortner
Date: December 20, 2011
To: Cynthia Walker
Subject: Tacoma Smelter Plume

Re: Tacoma Smelter Plume – Draft Interim Action Plan

Dear Ms Walker:

Thank you for the opportunity to comment on the proposed Tacoma Smelter Plume Draft Interim Action Plan.

The Town's primary concern is that the Department's actions not increase the Town's costs. The Town does not have the resources, either financially or in personnel, to absorb additional unfunded mandates from the State. The suggestion that local governments create a Tacoma Smelter Plume "hazard zone" raises the concern that the State is attempting to shift the cost of cleanup to the local level. More information on this idea is needed before the Town can provide a detailed critique.

The Town has been reluctant to require contractors to expend additional resources on testing soils without explicit authority or direction from the State. The proposals for the State to require soil sampling and cleanup for all grading permits within the region, develop a General Construction Permit and revise the SEPA checklist to include questions about soil contamination would give the Town the unquestioned ability to require sampling.

The Town looks forward to providing more comments as the Department refines the Interim Plan.

Regards,

Doug Fortner
Town Planner, Town of Steilacoom

From: James Perry
Date: December 20, 2011
To: Cynthia Walker
Subject: Tacoma Smelter comments

Ms Walker,

I was very disappointed I was unable to attend your November meeting on Vashon Island. I've owned a home and resided in Burton since about 1974. I live on the bluff above the Burton beach, facing Tacoma. I gardened both vegetables and flowers in the native soil until the early 1990's. I became concerned and switched to container gardening with store-bought soil. I have many fruit and nut trees on my 3/4 acre lot. Are the fruits and nuts safe to eat? We always wash off any edibles the slugs, birds, and other critters may have peed on. Are vegetables grown in native soil safe to eat? We understand that native soil has to be washed off our bodies and clothing.

I would be willing to let the EPA clean up the higher use areas of my yard. I think current residences should have priority for testing and clean-up over undeveloped property. Development on Vashon is now zoned. Development in the highly contaminated area is severely restricted due to access to existing potable water.

Whole property clean-up versus high-use areas: Low use areas with ornamental trees should be a lower priority. Residential properties, especially large acreage, that have undeveloped woodlands should be very low priority. Undeveloped property should have the lowest priority, especially if water availability or zoning would limit development.

Where to start: Start with the most highly contaminated areas. Start from the smelter site and work outward. Test areas generally known to be contaminated as you outward.

Your Power Point doesn't go into detail how site clean-ups are to be done. When you excavate, do you replace any of the lost topsoil? Nobody wants a yard like a strip mine pit or trees and a house setting on little mounds of dirt. Who would do the replacement "gardening"? How would small and dwarf trees be dealt with? Do we existing shrubs get replanted. How deep could the moderately contaminated soil go? Could we vegetable garden in the native or replacement soil after mitigation?

What will the role be of phytoremediation? How can we get Chinese Brake Ferns? Do they actually work at removing the evil chemicals?

Education: I think anybody who's lived in the contaminated areas of Vashon and Maury Islands and Tacoma for a significant time are moderately well informed. You cover hygeine and dust control issues, but gloss over gardening and food crop issues. People who are moving into the zone or developing property, should have obligatory education by realtors. The real estate disclosure form should be changed to include lead and arsenic contamination.

The main emphasis should be on cleaning up existing play areas and residences. Sites that are proposed to be developed in the "plume area" should have to have a soil test just like they have to get a percolation test. Change the state law to require soil sampling prior to sale in known contaminated areas.

Your free soil sampling should be expanded to residences in the highly contaminated zone. It would expand your database and help clarify the extent of contamination and how much work needs to be done.

I recently retired. I've had skin cancer, high blood pressure, and am pre-diabetic, so please hurry up!

Thank you,

From: Jessica Knickerbocker
Date: December 20, 2011
To: Cynthia Walker
Subject: Interim Action Plan comments

Good Evening Cynthia,

Thank you for the opportunity to comment on the plan. I have a number of question, concerns, comments and suggestions. Please bare with me this plan could have a negative impact on my family, my 2 year old daughter, and my largest investment, my home. On the other hand I also see this plan with some significant improvements could greatly improve nearly 1/2 of Tacoma.

To begin with I am very disappointed in the way that Ecology is approaching this cleanup. I challenge you and your staff to take a step back and take another good look at the big picture. The very first sentence regarding the plan overview states. "The plume is too large to clean up all soils. " Right there it appears that you have already given up. And maybe this sentence is true, but this should not be the very first sentence without any justification for this conclusion. How has Ecology determined that this area is too large? It is also stated that "If you live inside this area you could be at risk. Arsenic and lead are toxic." And goes on to explain risks to Children. If people living in these areas are truly as risk then no matter how far the risk extends Ecology has a responsibility to find a way to clean it up to an acceptable level. I would also like to point out that at the Public meeting I attended on this plan both the Health Department and Ecology stated that there is "no statistical evidence that supports that people living in these areas are at any additional risk than those living in Cincinnati OH" or anywhere else in the world. The message needs to be clear, fair and consistent.
To answer your specific questions:

Should Ecology spend the settlement mainly on soil sampling and cleanup (page 1 figure)?

Yes! However, it was stated at the public meeting that if your yard is to be cleaned up then your landscaping would be replaced in kind or better than what is there today. I do not agree with this approach, Ecology should focus the money on the *cleanup* and stabilization of each yard. Fancy, expensive landscaping should be the responsibility of the homeowner. Now I do think that Ecology should offer enhanced landscaping options so yards could be restored to what they were. From a constructibility standpoint it only makes sense for this to be done with the cleanup. Ecology could credit to the homeowner for the cost of the sod not needed. This option would extend to the homeowner the benefit of expected cheaper bid prices. I also think Ecology should offer homeowners the option to have their yards to be landscaped with a sustainable landscaping to improve stormwater and reduce water consumption. Again at the cost to the homeowner. It would be a shame to not at least make this education available when yards are already tore up.

Should we focus on yards in the most contaminated zone (page 3) and play areas? Yes, of course. Sites that may cause recontamination to other sites should also be evaluated and stabilized.

How can we improve our outreach and reach people in the less contaminated areas? 1. If you want to test and find the most contaminated sites you should not threaten to educate potential home buyers. If you are going to test all sites and then put big red arrows pointing to contaminated sites on Govme and not clean them up to the 20 ppm, then I do not know why anyone would allow you on their property. 2. You should attend Tacoma neighborhood council meetings and also outreach to existing HOAs, churches, philanthropic organizations, and schools. All of my neighbors and the Chair of West End Neighborhood Council (West End is entirely within the "high" zone) had no idea about this plan. 3. Have you considered a stakeholder advisory group? Property owners, businesses, contractors, real estate agents, developers.... 4. You also need to educate folks about how they could clean up their own yards. Available contractors, permit requirements, disposal requirements and options.

Should we encourage or require sampling and cleanup during development? Absolutely, this is the best time to do it. Development and Redevelopment if they are disturbing the soil. Plus, these sites during construction are recontaminating the rest of our yards. Requiring sites to be brought up to code is standard across many industries, building code, traffic mitigation, stormwater impacts, etc.

How can we help educate homebuyers? If you do not clean up to the state clean up levels then you need to be very clear what the risks are to homebuyers. You can't publicly state that their is no statistical evidence to support a risk, but then turn around and tell potential buyers not to buy here. Hands down I would not have bought my house in Tacoma. That being said as an environmental engineer with a decent amount of working knowledge of the Smelter Plume and it's risk I am not concerned for my families health. My fear is never being able to sell my house! Do you want to turn 1/2 of Tacoma into a park or something with no people living here? Please evaluate the risks of these properties and then put yourselves in the shoes of these homeowners and potential home buyers. I will write every elected official that represents me to stop this if you proceed along these line. I will also put my house up for sale.

What other ideas should we look at for Phase Two? You need to offer a mechanism to facilitate all of the properties testing over the state levels to be cleaned up! Provide a program where homeowners in the 21-100 range could pay a portion to have their yard cleaned up at a reduced rate. Money is a big deal especially now. But in addition to this burden who has the time or experience to find an experienced contractor at a decent price? And lets say I wanted to do it myself. The public meeting I went to the message was that we were to take the dirt to the Tacoma Landfill in bags? Really? Contractors can take it to the landfill for free right now with the capping that is going on. Ecology needs to partner with the City of Tacoma, I think this could also extend Ecology dollars.

You also need to provide financing for homeowners to pay these costs over time. No interest loans? You have 10 years to spend the money so you could use the money to offer financing. Tacoma also has an Local Improvement District program, which I realized is geared toward the public ROW. But could it be extended to these private yards? This is a financing tool which is added on to people's taxes. Could legislation be passed to allow this? Seems like a good enough reason to me.

Conclusion

Thank you in advance for your consideration. Ecology has a great opportunity to have a positive impact on a large number of residents in the South Sound. Please let me know if you have any questions? I would be happy to help in anyway that I can.

Thank you,

King County

Parks and Recreation Division

Department of Natural Resources and Parks

King Street Center, KSC-NR-0700
201 South Jackson Street
Seattle, WA 98104-3855

206.296.8687 Fax 206.296.8686
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December 20, 2011

Cynthia Walker
Tacoma Smelter Plume Project Manager
Washington State Department of Ecology
PO Box 47600
Olympia, WA 98504-7600

Ms. Walker:

Thank you for the opportunity to comment on the Washington State Department of Ecology's Public Review Draft of the Interim Action Plan for the Tacoma Smelter Plume (October 2011). We are sending this letter to document submittal of our comments to you via email today as requested in your public comment instructions.

The King County Parks and Recreation Division of the Department and Natural Resources Department, owns and manages many different kinds of park sites within the TSP area, including developed parks with recreation facilities, passive recreation sites with open space areas and natural areas managed for habitat conservation. In addition, our future plans include acquiring more natural areas and open space lands within the Tacoma Smelter Plume area and in and developing passive recreation amenities on some of those sites, especially on Vashon and Maury Islands. Therefore, the Interim Action Plan contains very significant guidance that affects both the present and future management of our park lands.

If you have any questions about our comments, please contact Connie Blumen, Natural Resource Lands Program Manager, at connie.blumen@kingcounty.gov, by phone at 206-263-6371 or by mail at the address listed on this letterhead.

Sincerely,

Kevin Brown

cc: Connie Blumen, Natural Resource Lands Program Manager, Parks and Recreation Division, Department of Natural Resources and Parks (DNRP)
Jim Neely, Program Manager IV, Solid Waste Division, DNRP
Jim Chan, Director, Building Services Division, Department of Development and Environmental Services

1202M

King County Department of Natural Resources and Parks

Parks and Recreation Division

Comments on the Asarco Tacoma Smelter Plume: Draft Interim Action Plan for the Tacoma Smelter Plume; Washington Department of Ecology; October 2011

General Comments on the Draft Interim Action Plan, Focus Areas

Phase One

We generally agree with the four major proposed actions for Phase One—offering free yard cleanups, continuing the Soil Safety Program, providing outreach/education and offering technical assistance. King County Parks has, and will continue to benefit from the sampling and clean up of play areas within our park system. In addition, we have worked with Ecology to develop soil safety message signage and obtain informational brochures to provide park users. We look forward to working with Ecology on more opportunities to provide public education via our park interpretive kiosks, brochures, planning meetings and volunteer stewardship events.

Phase Two

Because numerous King County park sites are located within the Tacoma Smelter Plume (TSP) area and King County is proposing to acquire new lands and develop existing parks within this area, we are very interested in learning more about Ecology's plans to address contaminated soils during site development and real estate sales. We understand those proposals will be addressed in Phase Two of the Interim Action n Plan. Those proposed actions will affect how we plan for and manage our existing lands as well as our proposed acquisition strategies.

The plan also identifies that Phase Two may include developing ways to streamline approaches for Ecology determinations and approvals of cleanup actions. We welcome the opportunity to be involved further in those discussions. We feel that efforts to decrease the time and costs associated with the process could allow us more resources to complete cleanup activities. We would encourage any streamlining to take into consideration the need to retain opportunities for public participation.

Other potential Phase Two focus areas identified in the plan are evaluating properties managed or regulated by government agencies and identifying if there is adequate funding to address properties not included in Phase One. While we support the goal to continue with cleanups, we are concerned about the availability of sufficient resources (budget and staff) to carry out this work. In addition, we would like Ecology to consider the use of settlement funds to support public land acquisitions and cleanup of highly contaminated land for conservation and restoration purposes. .

General Comment on Cleanup of Parks and Camps

King County owns and manages many different kinds of park sites within the TSP area, including developed parks with active recreation facilities, passive recreation sites with open space areas and natural area for habitat preservation. The Interim Action Plan uses the terms "parks", "natural areas" and "open space lands" throughout the document and appendices. It would be helpful to have definitions for these terms to be certain all land management agencies are interpreting the use of germs correctly and to help clarify Ecology's proposals for these lands.

The plan is not always clear on the extent of cleanup recommended for parks and camps. For example in the Executive Summary and on page 15 of the Interim Action Plan (IAP), it appears clear that the application of the Model Remedies at parks and camps is focused on the play areas within these properties. For example, page 15, item 2 states: "Continue the Soil Safety Program for *play areas* (emphasis added) at licensed childcares, schools, parks, camps, and multi-family public housing. However, on page 32, Table 3.2, pages 45, 52, 59, and 60) the entire property appears to be included under both Phase 1 and 2 actions.

King County recommends that the Phase 1 and 2 actions within parks and camps be limited to the areas identified in the Feasibility Study (page 19, Appendix C). These include areas of parks and camps that are either 1) highly developed or 2) include high use trails through nature areas. This classification would cover areas that could frequently expose humans to arsenic and lead, such as play areas, ball fields, camp sites, and picnic areas.

Page 11 – Section 1.1: Purpose of the Interim Action Plan is to Manage Risk and Do Cleanup (Scope)

The summary of the scope does not include cleanup actions at existing parks, camps and open space, while these activities are addressed under the plan. "Controlling significant exposure to arsenic and lead in existing parks, camps and open space" should be included in this summary.

Page 12, – Section 1.2, The Interim Action Plan Only Applies to the Tacoma Smelter Plume; and Page 13 – Section 1.3.2, Item 2: Alternative Cleanup Approaches (Use of Other Approaches)

Section 1.2 states "This plan selects action levels, cleanup levels, and cleanup methods based on the unique nature of the contamination"; Section 1.3.2 states that "Land owners may use the TSP Model Remedies to clean up their own properties." The Model Remedies focus on the protection of young children at residential properties and play areas, and as such may not be entirely applicable to other types of land uses, such as open space. Applicability of other cleanup approaches should be recognized, such as those identified in site-specific remedial investigations and feasibility studies, or application of industrial use cleanup levels, where appropriate.

Page 65 – Section 7.5 (Typo)

"This will help Ecology decide if it is practical to clean up play just high use areas or the whole property." This should read- This will help Ecology decide if it is practical to clean up just high use play areas or the whole property.

Page 30 – Table 3-1: Soil Safety Action Levels (Use of Other Action Levels)

The table lists Soil Safety Program Action Levels, which are based on Method A cleanup levels. A footnote should be added noting that other cleanup levels may be appropriate based on site specific remedial investigations and feasibility studies, should the landowner elect to use this approach. As discussed in comment 2, landowners should have the option of applying Modified Method B or industrial cleanup levels, as permitted under MTCA.

Page 83 – 11.5.1 Characterization Sampling (Samples at Depth)

Collecting 6-12 inch depth samples at 25% of surface sample locations is unnecessary in decision units that have not experienced significant disturbances to the soil profile. A provision should be added that allows for lower percentage of samples from 6 to 12 inches within decision units where there is no indication of historical disturbance of the soil profile. For example, 10% would likely be sufficient, with a set minimum number of samples to establish some degree of confidence on the mean (e.g., 8 sample minimum).

Page 83-84 – 11.5.1 Characterization Sampling and 11.5.2 Compliance Sampling (Analytical Method)

Use of field portable XRF should be allowed, provided that it complies with EPA Method 6200. This method includes development of a site-specific calibration curve based on a set number of laboratory-analyzed duplicates, along with other quality assurance provisions.

Page 84-85 – 11.5.2 Compliance Sampling (Approach)

"Further excavation or mixing will require a second round of sampling." Recommend that a caveat be added that allows for the sampling area to be limited to the area within the decision unit requiring additional remediation. For example if one acre of a 20 acre decision unit requires further remediation only the one acre area needs to be resampled, not the entire 20 acres.

Page 88 – Table 11.5 Summary of Model Remedy Options and Considerations (Mixing)

The remedy options table lists mixing as an alternative when arsenic concentrations are less than 40ppm. This is inconsistent with the Science Advisory Board reference (SAB, 2006) which states that arsenic concentrations of up to 200 mg/kg and lead concentrations up to 1,000 mg/kg are protective of groundwater. In addition, under Chapter 5 of the Model Remedies (page 26) excavation is listed as the preferred cleanup option. We recommend that the preference for excavation and landfill disposal be reevaluated in light of the environmental benefits associated with soil mixing. Like excavation, soil mixing provides a 'permanent' solution, and there is the added benefit of not needing to excavate and transport soils to a landfill. This alternative appears to have less environmental impact than excavation/disposal and is less costly, particularly when applied to the Maury Island/Vashon area, where soils must be barged or shipped via ferry to the mainland.

Page 88 – Table 11.5 Summary of Model Remedy Options and Considerations; and Page 90, Section 11.6.2 Capping In Place (Caps)

The reasoning for requiring a 12-inch cap with higher arsenic/lead concentrations is not apparent. Caps should be constructed and maintained to prevent exposure regardless of the arsenic/lead concentrations. In addition, construction of a 12-inch cap is often not feasible without excavating, which would defeat the purpose. Consideration should also be given to allowing use of gravel caps. A properly designed gravel cap may provide better long-term protection than a soil and landscape material cap, depending on the type of use (e.g., trails).

Page 88 – Table 11.5 Summary of Model Remedy Options and Considerations (Institutional Controls)

Under institutional controls, the specified action is "restrict access with fencing, signage and other measures." This implies that fencing is a required element in institutional controls. As noted on page 34 of the Model Remedies Guidance, fencing may not be practical on public access properties such as parks. Recommend that this be reworded to say "restrict access with measures such as fencing and signage."

Page 92 – Section 11.6.5 Institutional Controls Only (Institutional Controls)

Paving walking paths with bark is not very cost effective as it rapidly deteriorates and is more subject to disturbance than is gravel. Suggest that the plan not recommend use of bark as a control on trails. Conversely, as discussed above, gravel caps should be considered as a Model Remedy versus only as an institutional control only. As noted in Section 11.6.2 (page 90) any type of capping in place is a non-permanent remedy.

Page 93 – 11.8 Model Remedies Best Management Practices (HAZWOPPER)

It would be helpful if the Department of Labor and Industries addressed specifically the type(s) of workers covered under the HAZWOPER standard in the TSP area. Developing safety plans, conducting monitoring, and providing 24-hours of training for workers who will likely only be exposed to minimal skin contact hazards, such as landscape maintenance employees, does not seem warranted.

Appendix B - Tacoma Smelter Plume Model Remedies Guidance

Page 8 – Decision Units and Page 9, Figure 1 (Capping Green Belt)

Capping a community green belt would likely destroy the native environment. A more realistic example should be used, such as capping trails within a community green belt.

Page 8 – Decision Units, Second Paragraph and Page 9, Figure 1 (Forested Land)

The figure states 'Cleanup required' for forested land >20 ppm. It is likely that a disproportionate analysis for most forested areas would indicate that cleanup is not required; recommend rewording to 'Cleanup actions' or similar.

Page 10 – Sample Depths (Samples at Depth)

See comment above regarding number of samples needed at deeper levels.

Page 15 – Table 2 Model Remedy Options (Mixing)

See comment above regarding mixing.

Page 22 – XRF (Analytical Method)

See comment above regarding use of XRF

Appendix E, SEPA, Mitigated DNS, Page 15, #12 - Recreation

We disagree with the checklist conclusion that the proposal will not displace any recreational uses. Those uses could be significantly affected if institutional controls, such as fencing, are mandated or remediation of trails on natural areas and open space lands are required. Public funding for cleanup of recreational areas is extremely limited. Therefore, shutting down trails and recreational areas may occur as a result of cleanup mandates until such funding becomes available.

From: Pamela Badger
Date: December 20, 2011
To: Cynthia Walker
Subject: Ecology News Release: Plan focuses on cleaning up properties within Tacoma Smelter Plume

Thank you for the opportunity to review and comment on the draft cleanup plan for the Tacoma Smelter Plume. The King County Solid Waste Division has the following comments:

King County Code Title 10.08.020.C specifies that solid waste generated in King County must be disposed in a facility designated by King County.

> **10.08.020 System of disposal.**
> A. Under the authority provided by the King County Charter and RCW 36.58.040, a system is hereby established for disposal of all solid waste either generated, collected or disposed, in unincorporated King County. Additionally, this system shall include all solid waste either generated or collected, or both, in any other jurisdictions with which a solid waste interlocal agreement exists.
> B. It is unlawful for any person to dispose of county solid waste except at solid waste facilities and in a manner authorized under this title.
> C. Unless specifically authorized by a King County ordinance, it is unlawful for any person to deliver any county solid waste to a place other than a disposal facility designated by the county to receive the particular waste.
> D. It is unlawful for any person to deliver county solid waste other than unauthorized waste as determined by the division director to any facility for final disposal other than the county-designated disposal facility, unless the division director has provided prior written authorization for the disposal for public health, safety, welfare or planning purposes and the disposal is consistent with the adopted King County comprehensive solid waste management plan.

The contaminated soil described in the Draft Cleanup Plan will be considered "Special Waste" as defined by King County. If the facility designated by King County is a King County owned facility, this material must go through our Waste Clearance Process. Contaminated soil must receive a clearance from the Department of Health – Seattle and King County (SKCDPH). To obtain a clearance application to submit to SKCDPH, use the following link:

http://your.kingcounty.gov/solidwaste/facilities/documents/Waste_characterization-form.pdf

The Division encourages Ecology to promote the use of soil mixing as a remediation measure, to the maximum extent feasible and as described. This cleanup method minimizes generation of solid waste and supports waste minimization goals of Ecology and the Division. This alternative is particularly applicable to Vashon/Maury Island given the need for shipping soils via ferry.

If you have any questions or comments, please do not hesitate to contact me.

Pamela Badger
King County Solid Waste Division
Environmental Programs Managing Supervisor
pamela.badger@kingcounty.gov
(206) 296-8441   fax (206) 296-8431

From: Kristine Anderson and Richard Hamm
Date: December 20, 2011
To: Cynthia Walker
Subject: Tacoma Smelter Plume Cleanup Plan Comments

Ms Walker,

My husband and I bought our home and have lived in the High Arsenic zone since 1986. We were made aware of potential contamination in the soil when representatives of the EPA knocked on our door about 1991, when our son was around one. We determined from that visit that we could no longer allow him to play in the dirt and worried that the pears from a tree in our yard were safe for him to eat until we had our soil (and canned pears) tested. We continue to feel restricted from full use of our property as we would like to because of the high arsenic and lead levels that have been found in the testing of our yard samples. Although our son is 22 now and lives most of the year away from home, but we would still like the ability to safely garden in the back yard, maybe raise a few chickens and be able to landscape our hilly front yard.

In the past we had a couple inches of soil over the back yard removed and hauled to a dumpsite at the Asarco property at our own expense. The site has been closed so this option is no longer available; we would need to haul it to the Tacoma landfill; or to Graham when the Tacoma landfill is closed. The expense of safe and proper disposal has prohibited us from removing contaminated dirt. Although neighbors adjacent our property have had soil in their yards replaced we found out that our yard was ineligible for cleanup because we had taken our backyard dirt to the Asarco dump site.

Currently, we would like replace dirt in the front yard - ideally replaced by others, as has been done for our neighbors. If that is not available for our property in the near future, we at least would like to have access to a site that is closer to dispose of the Asarco-contaminated soil at no cost.

I think that it would be worth considering in the Cleanup Plan to provide several locations convenient to residences located in the High and Moderate Arsenic zones where contaminated soil could be dumped at no cost to these homeowners. From there, the State could contract to haul it more efficiently for proper disposal. This would encourage sampling and help facilitate cleanup on a broader scale which will be good for our neighborhood development in the future.

I do believe that Ecology should spend the settlement money mainly on soil sampling and cleanup, focusing on yards in the most contaminated zone and play areas.

Thank you for this opportunity to comment.

CITIZENS FOR A HEALTHY BAY

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December 20, 2011

Ms. Cynthia Walker, Project Manager
Washington State Dept. of Ecology
Toxics Cleanup Program, SWRO
PO Box 47775
Olympia, WA 98504-7775
E-mail: Cynthia.Walker@ecy.wa.gov

Re: Draft Interim Action Plan for the Tacoma Smelter Plume

Dear Ms. Walker:

The purpose of this letter is to convey comments by Citizens for a Healthy Bay (CHB) in response to the Draft Interim Action Plan for the Tacoma Smelter Plume (the Plan).

In general, CHB supports the preferred action alternative selected by Ecology that gives priority and emphasis to cleaning up soils in play areas at schools, child care centers, parks, camps, and multi-family public housing and residential yards in the worst areas of the plume. Ecology estimates that there are 20,000 parcels located in the high risk area of the Tacoma Smelter Plume that, under the draft interim action plan, must be addressed with funding from the $94 million Asarco Settlement – or $4,700 per parcel. CHB recognizes that places tremendous constraints on Ecology's ability to cleanup and manage the 1,000 mi^2 Tacoma Smelter Plume area. As such, long term and integrated outreach and public awareness are important components of the action plan. CHB encourages Ecology to create working partnerships with non-traditional community resources including schools, churches, homeowner associations and other community centers.

CHB's comments are consistent with the spirit and intent of Chapter 70.105D RCW, *Hazardous Waste Cleanup–Model Toxics Control Act*, and Chapter 173-340 WAC, *Model Toxics Control Act Cleanup Regulation*. The Model Toxics Control Action contains policies that state, in part, each person has a fundamental and inalienable right to a healthful environment and it is essential that sites be cleaned up well and that cleanup standards and cleanup actions be established that protect human health and the environment.

CHB is a community based, non-profit environmental organization representing the community stakeholders in the Commencement Bay Nearshore/Tideflats Superfund problem area and Tacoma as well as south central Puget Sound and the Puyallup River Watershed. Our membership includes citizens and other stakeholders located in the Tacoma Smelter Plume problem areas which are directly impacted by contaminated soils.

Thank you for your consideration of our remarks and for including them into the site administrative record.

Sincerely:

Leslie Ann Rose
Senior Policy Analyst

Draft Interim Action Plan for the Tacoma Smelter Plume
Comments by Citizens for a Healthy Bay

December 20, 2011
Ms. Cynthia Walker, Project Manager

Comment 1: The State's MTCA cleanup level is 20 ppm but the cleanup action level is 100 ppm. The inconsistency between the two levels is confusing to the general public whose sole concern is to whether their property's soils are safe or unsafe. The document needs to clarify the human health risk for soils greater than 20 ppm but less than 100 ppm and Ecology's basis for selecting a cleanup action level greater than the State's MTCA cleanup level.

Comment 2: The cleanup action level is 100 ppm but the results of sample analysis are subject to some uncertainty. The cleanup action level under the plan should be restated as + or – the 95% upper confidence level of the sampling and analysis results.

Comment 3: What is the depth of compliance for the Ruston/North Tacoma Soils Study Area and Vashon Island properties? The point of compliance for the Tacoma Smelter Plume is stated as being a maximum of 15 feet below ground surface which is reasonable for undeveloped properties but not practical for homes or other developed properties. The final plan must specify the maximum depth to which Ecology will excavate and replace residential soils exceeding 100 ppm arsenic.

Comment 4: What measures will Ecology use to measure the success of outreach and education activities under the Phase One interim action? The draft report concludes that existing outreach tools have been successful as up to 50 percent of people surveyed by the Tacoma-Pierce County Health Department reported seeing a television ad about the Tacoma Smelter Plume. What methods did Ecology use to establish that raising the public's awareness to the problem resulted in changes to behavior and/or that people living within impacted communities are incorporating recommended *healthy habits* into their daily lives?

Comment 5: What outreach tools are being used to raise awareness within ethnic and cultural communities, especially those for whom English is a second language? Identify and partner with established groups such as the Korean Women's Association that are already serving these populations to develop and disseminate outreach and education information appropriate for each community.

Comment 6: To improve outreach to those living is the less contaminated areas as well as those moving into these areas; Ecology should work with local entities to develop and distribute inserts that can be included into utility bills, property tax statements, etc. Identify existing community resources such as neighborhood councils, community groups, organizations, homeowner associations, civic groups, garden clubs, community gardens, environmental organizations, etc. to expand Ecology's outreach and education efforts. Ecology may wish to evaluate non-traditional outreach resources such as home and garden stores, physicians' offices, pharmacies, even veterinary offices. Park districts, schools, Boys and Girls Clubs, YMCAs, etc. located within the problem area are excellent places from which to disseminate outreach materials.

Comment 7: Ecology should convene a Regional Citizens Advisory Committee to assist with development and delivery strategies for outreach and education as well as other problem area issues and public concerns.

Comment 8: Consistent with the spirit and intent of Chapter 70.105D RCW and Chapter 173-340 WAC, Ecology must **require**, not merely encourage, soil sampling and cleanup during property development or redevelopment within both the high and moderate risk areas. This is especially true for sites developed for residential uses, child care areas, play areas, etc. Soil sampling, analysis and cleanup are also important to protect on-site worker health and safety, both during site development and future maintenance and operations activities such as utility workers.

Comment 9: As a prospective purchaser, homebuyers have a reasonable expectation that they will be fully informed about the property, including any environmental concerns. Furthermore, such disclosure needs to be made early. It is imperative that real estate disclosure form 17 include arsenic and lead contamination from the Tacoma Smelter Plume and that soil sampling be **required** prior to the sale of property located within the footprint of the plume. CHB receives approximately 1 call a month from someone concerned about the safety of their home. In general, the callers are people who recently purchased a home within the problem area but were not made aware of the potential risks from soils contaminated by lead and arsenic and did not know about the Tacoma Smelter Plume soil contamination area. CHB assists callers by providing the background and context of the potential problem, advising them of actions taken to date as well as planned future actions and providing them with contacts and informational resources – information that ideally should have been provided to them as part of the real estate transaction.

Comment 10: Buying a home is one of the most significant decisions and often the largest investment that people make. The first, best source of information for a prospective purchaser is their real estate agent or agency. By working with real estate agencies and professional organizations, Ecology can develop educational and informational tools to help agents know the risks from contaminated soils and work with prospective sellers and purchasers to determine the status of the property in question. Agencies must be accountable to ensure that agents make full disclosure to prospective buyers.

Comment 11: To the greatest extent possible, Ecology's Soil Safety and Soil Cleanup Programs should be institutionalized to insure that human health for those living, working and playing within the footprint of the problem area continue to be protected in perpetuity. Overlays added to municipal planning databases are an excellent long-term tool and Ecology must work with local entities to implement overlays to be used for planning, land use and permitting activities. The City of Tacoma designed and applied just such an overlay after the Superfund cleanup action in the Thea Foss Waterway which affords a quick and easy notification to permit administrators and others when a land use or shoreline permit is submitted for approval. CHB continues to work with the City of Tacoma and all other stakeholders to encourage development of an expanded overlay that captures all known sites of potential contamination.

Comment 12: The final draft plan must specify that lump-sum payouts from settlement funds to local, county or state governmental entities will not be made for cleanup of public properties regardless of the current or future use especially in any instance where properties known to be contaminated were purchased after the date of the settlement. Governmental entities strapped by budget considerations may consider settlement funds as source of funding for popular projects. Settlement funds must be carefully managed to provide sufficient funding for cleanup of play areas and residential properties as well as community outreach and education efforts. Lump sum payments to governmental entities or others would disproportionally target discreet sites within the expanded plume area at the expense of play areas and residential properties.

From: Marilyn Dunstan
Date: December 20, 2011
To: Cynthia Walker
Subject: Tacoma Smelter Plume

The health risks for lower arsenic dose ranges need to be better understood in order to obtain the greater amount of compensation for damages needed resulting from the Tacoma Smelter Plume emissions. Costs associated with externalities such as air toxics from production need to be determined so that those impacted are recompensed and so that product pricing appropriate reflects these externalities. If product pricing does not include the cost of externalities such as air pollution, these products are underpriced and over utililized unless abatement measures are taken.

A population study of arsenic exposure for the greater plume area versus area health experience would go a long way in helping to outline some of the costs associated with the Tacoma Smelter Plume emissions. It could very well establish higher settlement costs which could go to compensated the effected public.   Going beyond cancers to such illnesses as heart disease and diabetes and getting some measure of added risk versus exposure would help. Testing should be mandatory; this is the only way that a significant amount of credible data could be compiled to support a full scale study. Government-paid technicians should collect soil samples; the idea of residents doing this and mailing in potentially hazardous material does not make sense to me. However, the cooperation of the affected public would need to be won; politically anything else would not fly.

The public can be informed by maps showing the dispersal of the plume. However, I would like to know if any contaminated dirt, sand and gravel was hauled from heavily contaminated areas (e.g. Tacoma, Maury Island) to other areas that show on the maps as not having as significant a contamination. The hauling of contaminated dirt, sand and/or gravel via trucks or barges has the potential to create islands of hot spots throughout the area. The Tacoma Smelter has a long history. If such movement of contaminated product was done, residents need to know about it.

Additional funds could be obtained from ASARCO though settlement, or perhaps a tax on copper containing products could help provide funds.

Thanks

From: Stephanie Jewett
Date: December 22, 2011
To: Cynthia Walker
Subject: Tacoma Smelter Plume Cleanup Plan

Cynthia: As promised *[see following e-mail from December 20, 2011]*, a couple more comments in response to the suggested reading guide questions for Planning and Permit Offices –

Chapter 11 and Appendix B (model remedies):

1) **Would you use the guidance? Why or why not?**
   The majority of the time the City of Burien's development review process starts at the counter. Developers, real estate agents, builders and property owners come to our front counter asking questions about the city's development regulations and review processes as they apply to a particular site. This is the best opportunity for our planning staff to provide information about the Tacoma Smelter Plume and help facilitate cleanup. While I would consider providing the draft model remedies Appendix B to professional developers pursuing larger scale developments like subdivisions, multi-family housing, commercial or institutional uses, this document would likely be too technical and overwhelming to present to those interested in smaller scale projects, like a single-family home owner who is looking into expanding their home.

   A better tool for our planning staff for this type of contact would be a simple one to two page handout from Ecology that includes –

   - What is the Tacoma Smelter Plume
   - A map of arsenic levels specific to our jurisdiction
   - Info about how to sample your soil and select an analytical lab
   - One or two paragraphs explaining effective cleanup options (excavation and removal, mixing, capping in place and consolidation and capping).
   - Who to contact at Ecology for more information
   - Web site link to the Model Remedies Guidance

2) **Should Ecology focus most of its resources on cleaning up yards and play areas, rather than new developments?**

The City of Burien is primarily built out so new development mainly consists of redevelopment of existing developed property. Also, given the current economic climate, the City is not experiencing much new development relative to previous years. Given these two factors I would expect that focusing resources on financially helping property owners clean up yards and play areas would result in a greater area being cleaned up rather than waiting for new development. Also, any required additional development costs (such as sampling and removal/capping) would likely be seen as an obstacle to new development in the current economic climate.

Thank you for the opportunity to comment and feel free to contact me if you have any follow-up questions,

Stephanie Jewett, AICP
Planner
City of Burien
206-439-3152
Email: stephaniej@burienwa.gov
Web: www.burienwa.gov

From: Stephanie Jewett
Date: December 20, 2011
To: Cynthia Walker
Subject: Tacoma Smelter Plume Cleanup Plan

Cynthia:

Thank you for the opportunity to review and comment on the Tacoma Smelter Plume Cleanup Plan. While the Tacoma Smelter Plume Model Remedies Guidance document provides resources for sampling (like selecting a lab and working with a consultant), providing free soil sampling/analysis to potential developers within the Tacoma Smelter Plume would be an additional resource that would go a long way in helping the City facilitate sampling, education and potentially clean-up during the development review process. Besides this one initial comment, the City of Burien would like to continue to work with Elizabeth Weldin as Ecology develops the soil sampling and cleanup guidance document and provide input about how we can best work with the Department of Ecology on this issue.

Thank you,

Stephanie Jewett, AICP
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206-439-3152
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Draft Interim Action Plan Comments

From

The Tacoma-Pierce County Health Department

December 14, 2011

Revised December 22, 2011

<u>Chapter 5 – Phase One Actions</u>

5.1, Page 43

Opening sentence: "Ecology and chose a phased approach to addressing the Tacoma Smelter Plume (Chapter 4)."

Consider re-writing sentence as; Ecology has chosen a phased approach to addressing the Tacoma Smelter Plume (Chapter 4).

5.2, Page 44

Second point – "…multi-family housing," should read multi-family housing play areas,…

5.5, Page 46

May consider adding a point to proposed actions that state, Ecology will provide any revised maps showing contamination zones based upon new data sets.

Also may consider including the Local Health Jurisdiction (LHJ) as an agency able to offer outreach and education to local planning departments.

6.1, Page 49

Second paragraph, Map Zone – Consider placing a disclaimer in this paragraph, explaining that the Map Zones may change due to the on-going work of Dr. Goovaerts.

6.1, Page 49 continued

Fourth paragraph, consider addressing properties that are found to have high levels of arsenic and/or lead through the Tacoma-Pierce County Health Department's (TPCHD) Residential Soil Testing Program. Citizens that already know that they have high elevations requested that they be included in the first phase of Ecology's Clean-up Program. This should not just be for home owners who take their own soils in for testing. Details of this can be spelled out in the sampling design plan, but at least mention that TPCHD and Ecology can work together towards helping this small set of property owners.

Fifth paragraph, consider revising land use order to read:

1. Existing private multi-family housing in the Ruston/North Tacoma, or Asarco Study Area.
2. Existing single-family homes in the Ruston/North Tacoma, or Asarco Study Area.
3. Existing private multi-family housing outside of the Asarco Study Area, but within Ecology's mapped high zone.
4. Existing single family homes outside of the Asarco Study Area, but within Ecology's mapped high zone.

6.1, Page 50, Table 6.2

Bottom of page, star comment states, "*Ecology will see if arsenic contamination over 100 ppm remains on properties." May consider clarification to why Ecology would leave known elevations on ones property, i.e., elevations at 12 inches depths, etc….

6.1.3, Page 52

Top of page, should clarify that clean-up are for areas with <u>an average</u> of arsenic over 20 ppm or lead over 250 ppm.

6.3.1, Page 53

Bottom of page, include the EPA Database as a reference source.

6.4.4, Page 56

Top of page, Sampling – Consider utilizing environmental health staff from local health agency(s). When multiple sites are being remediated within a county, local personnel are available to assist.

6.4.5, Page 57

Top of page, Ecology may want to consider having their working partners assist in the evaluation of the effectiveness of institutional controls, i.e. review the draft report.

7.1, Table 7.1, Page 60

Second row of Table 7.1 – "Explore requiring sampling and cleanup prior to sale." Expound on the term 'Explore…" Consider listing out steps to how this will be conducted, i.e. Attorney General's review, sensing degree of political will to support, and public comments. Emphasize that this is merely a proposal.

9.3.4, Page 73

Top of page, first paragraph, specify permitted landfill types. Soils can go to MSWLF and potentially some limited purpose landfills. Only some, not all, landfills are permitted under the Subtitle D Law 94-580. Washington Administrative Code (WAC) 350 and 351 captures landfills that serve MW and specific waste streams. Using the, Subtitle D landfill, term is too generic. The Toxic Cleanup Program may consider consulting with Ecology's Solid Waste Staff to ensure policy properly adheres to both state and federal codes.

1.2, Page 12

Paragraph at top of page; explain that if arsenic is found to be low, and lead is elevated, Ecology will still take cleanup actions.

2.2.2, Page 20

Last paragraph on page, include that the TPCHD also participates in fairs and festivals such as Home Shows and Health fairs.