Implementation of Chapter 70.140 RCW – Area-wide Soil Contamination

Soil Safety Program – Tacoma Smelter Plume

A Report to the Legislature

Toxics Cleanup Program
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Table of Contents

List of Tables

List of Figures

List of Appendices

Executive Summary

Washington State Legislature Engrossed Second Substitute House Bill 1605 was approved by the Governor on May 6, 2005. This bill added a new chapter to Title 70 of the Revised Code of Washington (RCW) – Chapter 70.140– Area-wide soil contamination. The law directs the Washington Department of Ecology (Ecology), in cooperation with the Department of Social and Health Services, the Department of Health, the Office of the Superintendent of Public Instruction, and local health departments, to assist schools and childcares west of the crest of the Cascade mountains to reduce the potential for children's exposure to area-wide soil contamination.

The law requires Ecology to:

1. Identify schools and childcares that are located within the central Puget Sound smelter plume (Tacoma Smelter Plume) based on available information.
2. Conduct qualitative evaluations to determine the potential for children's exposure to area-wide soil contamination.
3. Conduct soil sampling by December 31, 2009, if the qualitative evaluation determines that children may be routinely exposed to area-wide soil contamination at a property.
4. Notify schools and childcares regarding the test results and the steps necessary for implementing best management practices, if soil sample results confirm the presence of area-wide soil contamination.
5. Recognize schools and childcares that successfully implement best management practices with a voluntary certification letter.
6. Develop best management practice guidelines for schools and childcares with area-wide soil contamination.
7. Develop a grant program to assist schools and childcares with implementing best management practices.
8. Evaluate actions to reduce child exposure to contaminated soils and submit progress reports to the governor and to the appropriate committees of the legislature by December 31, 2006, and December 31, 2008.

In addition, the law requires schools and childcares to work with Ecology to provide site access for soil sampling. If schools or childcares with contaminated soil do not implement best management practices within six months of receiving written notification of test results, they must notify parents and guardians of the results in writing.

To implement the law, Ecology, Public Health – Seattle & King County, and the Tacoma-Pierce County Health Department (the agencies) designed the Soil Safety Program. The agencies set a goal to create a positive, incentive-based program – a program that meets the requirements of the law while conveying an overall positive message to the school and childcare communities. The agencies based their approach to implementing the law and designing the Soil Safety Program on input from school and childcare stakeholders, and state agencies with responsibility for child health and safety. The final design document was published in April 2006.

Based on the strong advice of school and childcare stakeholders and state agency partners, Ecology is providing the Soil Safety Program free to schools and childcares. Soil testing is paid for through grants to the local health departments, who are conducting the qualitative evaluations and soil sampling. Ecology generally manages all the design issues and labor costs for implementing best management practices (termed soil safety actions) for schools and childcares with arsenic or lead levels above the Model Toxics Control Act (MTCA) cleanup standards (20 mg/kg for arsenic, and 250 mg/kg for lead). There is also an option for public schools to manage the work themselves through an interagency agreement. The agencies selected this approach in order to: 1) reduce the paperwork that would be required of a grant program; 2) speed up getting actions in place; and 3) encourage voluntary participation in the program.

The agencies identified a Soil Safety Program service area. The Tacoma Smelter Plume is more than 1000 square miles and funding is not currently available to identify and assess every school and childcare within the plume. For this reason, the agencies identified a focused service area

for the Soil Safety Program of about 315 square miles. This focused service area encompasses the highest concentrations found which are closest to the former smelter site. Ecology is providing technical assistance to schools and childcares outside of the service area, including sampling and best management practice guidance documents. Ecology, with the county health departments will re-evaluate the Soil Safety Program service area boundary at the end of 2008.

Under grants from Ecology, the local health departments in King and Pierce counties are conducting the qualitative evaluations and soil sampling of the schools and childcares within the service area. Qualitative evaluations and soil sampling are sequenced as 1) public schools, 2) private schools, 3) childcares – starting in communities closest to the smelter where there is an increased potential for higher levels of contamination, then moving outward. Many of the public schools were tested in earlier studies, and so the school districts are aware of the soil contamination. It was assumed that this level of awareness would facilitate outreach to public schools, allowing for quick sampling at the remaining public schools. Outreach to childcares will take more time, so sampling at childcares will start later. All of the soil collection and lab analysis are covered under the grant from Ecology making the sampling free for the schools and childcares.

For the schools and childcares with soil contamination above MTCA cleanup standards, Ecology is meeting with the facility representative to discuss the sampling results and actions needed to reduce exposure. Ecology has developed best management practice guidelines, termed "soil safety actions." The range of soil safety actions developed reflects concentration, extent, and location of contamination, and the nature and frequency of child use of the area. Ecology is using these soil safety actions to help put together a soil safety action plan for each school or childcare. The schools and childcares will need to follow these guidelines for reducing exposure to contaminated soils.

The table summarizes activities completed as of September 30, 2006.

Legislative Directive	**Status**	**Comment**
Identify Schools and Childcares in Central Puget Sound Smelter Plume	Identified 208 schools and 587 childcares in the Soil Safety Program service area	Task completed. Childcare list will be updated with new childcares as they become licensed through 2008.
Conduct Qualitative Evaluations	Completed at 137 schools and 124 childcares	Based on evaluations, some facilities do not require sampling, generally because the play area is paved.
Conduct Soil Sampling	Completed at 120 schools and 114 childcares	Soil sampling conducted concurrent with evaluations.
Notify Schools and Childcares of Sampling Results	All sampled facilities were notified of results	Of facilities sampled, 26 schools & 23 childcares need soil safety actions.
Recognize Schools and Childcares	All facilities not requiring soil safety actions have received a certificate for participating in the program	When soil safety actions are complete at the facilities requiring soil safety actions, a certificate of completion will be sent.
Develop Best Management Practice Guidelines	Completed	Published "Soil Safety Guidance" for small and large properties where children play, January 2007
Develop Grant Program	Completed	Grants provided to local health department for evaluations and sampling. Ecology will contract the implementation of soil safety actions. Public schools can manage soil safety actions under interagency agreements.
Evaluation of Actions and Submit Report to Legislature	Ongoing	

Significant time was spent designing the program and coordinating closely with stakeholders. The program design was finalized in April 2006, and actual field work began at that time. The King County portion of the service area is very large with nearly 500 schools and childcares to sample. The vast area coupled with only one sampling team has slowed the health department's progress in conducting qualitative evaluations and sampling. Ecology and Public Health – Seattle & King County are discussing adding more sampling staff to the 2007-2009 grant.

By the end of 2006, the Tacoma-Pierce County Health Department will have completed evaluation and sampling of public and private schools. Public Health – Seattle & King County will have completed evaluation and sampling of public schools. In 2007, the health departments will address private schools, followed by childcares.

In 2007, Ecology will continue to implement soil safety action plans at schools and childcares requiring action. Ecology anticipates a productive year with the completion of soil safety action plans at public schools, private schools, and many childcares.

In addition to activities in the Tacoma Smelter Plume, Ecology has undertaken sampling and remediation at schools in central Washington impacted by lead-arsenate pesticides. Cleanup activities were implemented at eight schools during the summer of 2006. Four schools were located in Wenatchee. Additionally, Ecology selected North Omak Elementary (Okanogan county), Brewster High School (Okanogan county), Manson Elementary (Chelan county), and Naches Intermediate (Yakima county). All eight schools have been successfully remediated, and levels of lead and/or arsenic are below MTCA cleanup standards.

1.0 Introduction

1.1 Purpose of the Report

This report provides a summary of accomplishments by the Washington State Department of Ecology (Ecology) and its partnering agencies in implementing the requirements of Chapter 70.140 Revised Code of Washington (RCW) – Area-wide Soil Contamination (Appendix A). The agencies developed a program to implement the law called the Soil Safety Program. This report also provides a summary of accomplishments in soil remediation at schools in central Washington.

1.2 Area-wide Soil Contamination

Soils in large parts of Washington State contain elevated levels of arsenic and lead caused by past releases from metal smelters and historical application of agricultural pesticides. This low- to moderate- level soil contamination, dispersed over large geographic areas, is referred to as area-wide soil contamination.

As Washington's population grows, many areas with elevated levels of arsenic and lead continue to be developed into residential neighborhoods, schools, childcares, and parks. These development activities raise a variety of health, environmental, and marketplace concerns, and create pressures for cleanup.

In early 2000, the Washington State Departments of Agriculture, Ecology, Health, and Community, Trade & Economic Development decided that effective, long-term solutions to area-wide soil contamination problems would require looking beyond traditional cleanup processes and agency boundaries. In 2001, the Washington Legislature appropriated $1.2 million to form and support a stakeholder Task Force to consider these issues. The agencies chartered a 17-member Task Force to offer advice about a state-wide strategy to respond to area-wide arsenic and lead soil contamination in Washington State. The Task Force submitted their recommendations to the agencies in June 2003.

Based on these recommendations, Ecology has worked with other state and local agencies to develop and implement strategies for addressing area-wide soil contamination. These strategies focus on:

- Reducing exposures, especially to young children, at schools and childcares.
- Improving public awareness of area-wide soil contamination concerns and solutions.
- Integrating means of addressing area-wide soil contamination with local land use planning and permitting processes.
- Exploring other (local and state) institutional changes to improve responses to area-wide soil contamination problems.

Ecology's efforts are currently focused on areas with the highest potential for elevated arsenic and lead (e.g., King, Pierce, Thurston, Chelan, Douglas, Okanogan, Yakima, and Spokane counties) and properties where young children are likely to be present on a regular basis (e.g., schools, childcares, residential neighborhoods, and parks). Area-wide activities in King, Pierce, and Thurston counties are captured under the Tacoma Smelter Plume project (Section 1.3). Area-wide activities in Chelan, Douglas, Okanogan, Yakima, and Spokane counties include soil sampling and remediation at public schools (Section 5.0).

1.3 Tacoma Smelter Plume

The Tacoma Smelter Plume is an example of a very large area-wide contamination site. Air emissions from the former Asarco Ruston Smelter impacted over 1000 square miles of primarily urbanized land in portions of King, Pierce, Kitsap, and Thurston Counties. See Figure 1. The plume impacted tens of thousands of residential, commercial, and industrial properties, leaving behind elevated arsenic and lead in the surface soils. The sheer size of the impacted area and

the number of diverse communities within the impacted area, calls for a unique approach to cleanup.

Ecology's management plan for the Tacoma Smelter Plume identifies 3 objectives:

1. **Improve Public Awareness** and understanding of soil contamination and protective measures to reduce risk from exposure.
2. **Characterize Soil And Implement Protective Measures** - collect and evaluate information to support decisions on implementing measures to reduce risk from exposure to arsenic and lead in soil.
3. **Improve Institutional Capabilities** for responding to arsenic and lead in soil.

To meet these objectives, Ecology is partnering with Public Health – Seattle & King County, the Tacoma - Pierce County Health Department, and the Thurston County Health & Social Services Department. Under Ecology grants, the local health departments are working to improve public awareness with education and outreach to local communities – in particular schools, childcares, and households with small children. The health departments help characterize soil by conducting soil sampling as part of the Soil Safety Program. Ecology is working with other local governments (e.g., planning departments) to improve institutional capabilities – that is to find ways to address arsenic and lead pollution as part of day-to-day business.

1.4 Chapter 70.140 Revised Code of Washington

Between 2000 and 2005, the health departments in King and Pierce counties sampled soils in areas where children play at schools, childcares, parks and camps. Participation in these child-use area studies was voluntary. Most public schools and parks participated in the studies, but fewer than half of the childcares contacted participated in the studies.

In 2005, the Legislature determined that it was in the public's best interest to enhance the efforts of state and local agencies. The Legislature passed a law (RCW 70.140) to keep children safe from soil contaminated by the Tacoma Smelter Plume. The law directs Ecology to assist schools and childcares in reducing children's exposure to smelter arsenic and lead. The law requires Ecology to:

1. Identify schools and childcares that are located within the central Puget Sound smelter plume (Tacoma Smelter Plume) based on available information.
2. Conduct qualitative evaluations to determine the potential for children's exposure to area-wide soil contamination.
3. Conduct soil sampling by December 31, 2009, if the qualitative evaluation determines that children may be routinely exposed to area-wide soil contamination at a property.
4. Notify schools and childcares regarding the test results and the steps necessary for implementing best management practices, if soil sample results confirm the presence of area-wide soil contamination.
5. Recognize schools and childcares that successfully implement best management practices with a voluntary certification letter.
6. Develop best management practice guidelines for schools and childcares with area-wide soil contamination.
7. Develop a grant program to assist schools and childcares with implementing best management practices.
8. Evaluate actions to reduce child exposure to contaminated soils and submit progress reports to the governor and to the appropriate committees of the legislature by December 31, 2006, and December 31, 2008.

In addition, the law requires schools and childcares to work with Ecology to provide site access for soil sampling. If schools or childcares with contaminated soil do not implement best management practices within six months of receiving written notification of test results, they must notify parents and guardians of the results in writing.

As part of Ecology's partnership with the local health departments, Public Health – Seattle & King

County, the Tacoma-Pierce County Health Department, and the Thurston County Health & Social Services Department are helping to implement this law. The program is titled the "**Soil Safety Program**." Ecology provided grants to the health departments to conduct activities related to the Tacoma Smelter Plume, including soil sampling at the childcares and schools, and providing education and outreach as part of the Soil Safety Program.

2.0 Development of the Soil Safety Program

2.1 Process Used to Design the Soil Safety Program

Ecology, Public Health – Seattle & King County, and the Tacoma-Pierce County Health Department designed the Soil Safety Program to implement Chapter 70.140 RCW. The agencies set a goal to create a positive, incentive-based program – a program that meets the requirements of the law while conveying an overall positive message to the school and childcare communities. The agencies based their approach to implementing the law and the resulting Soil Safety Program on input from school and childcare stakeholders, and state agencies with responsibility for child health and safety. The Department of Social and Health Services, Department of Health, Office of the Superintendent of Public Instruction, public and private schools, childcare advocacy groups and support organizations, childcare provider unions, and individual childcare providers provided input to the design of the Soil Safety Program.

Ecology solicited input from stakeholders through four meetings. Ecology convened two meetings of stakeholders in November and December 2005 to review soil contamination guidance materials for both statewide distribution and the Tacoma Smelter Plume. Based on these meetings, Ecology determined there was a high level of stakeholder interest in the Soil Safety Program design, and periodically convening an ad hoc stakeholders' review group would be advantageous for designing and implementing a program that met the audiences' needs. Ecology also determined that they should develop materials specific for the Soil Safety Program – separate from statewide materials. Ecology convened a communication strategy team meeting on March 8, 2006 and another stakeholders' meeting on March 29, 2006 to get feedback on the draft program design and materials, including a general communication approach. The input received at these four meetings greatly influenced the program's design. The final design document was published in April 2006.

2.2 Key Elements of the Soil Safety Program

The goal of the Soil Safety Program is to implement Chapter 70.140 RCW by identifying play areas at schools and childcares in the Tacoma Smelter Plume with elevated arsenic and lead in soil, and assisting these schools and childcares in reducing the potential for children's exposure to the soil pollution. The Soil Safety Program design implements the law through several implementation steps. Each requirement of the law is addressed as follows:

1. *<u>Identify schools and childcares</u> that are located within the central Puget Sound smelter plume (Tacoma Smelter Plume) based on available information.*

   The agencies identified a Soil Safety Program service area. The Tacoma Smelter Plume is more than 1000 square miles and funding is not currently available to identify and assess every school and childcare within the plume. For this reason, the agencies identified a focused service area for the Soil Safety Program of about 315 square miles. This focused service area encompasses the highest concentrations found which are closest to the former smelter site. See Figure 2. Ecology is providing technical assistance to schools and childcares outside of the service area, including sampling and best management practice guidance documents. Ecology, with the county health departments will re-evaluate the Soil Safety Program service area boundary at the end of 2008.

   Within this service area, Ecology identified the schools and childcares based on several sources of information. Sources include known private and public schools, the local health departments' first-hand knowledge of schools and childcares they have already tested or worked with, Department of Early Learning (DEL) list of licensed childcares, and DEL licensor first-hand knowledge of childcares. There are 132 public and private schools in the King County portion of the service area; 66 public and private schools in the Pierce County portion of the service area; and 10 public and private schools in the Thurston County portion of the service area. The

universe of childcares is dynamic, with new childcares opening while other facilities are closing. Currently, there are over 380 childcares in the King County portion of the service area, over 170 childcares in the Pierce County portion of the service area, and 30 childcares in the Thurston County portion of the service area.

2. *Conduct qualitative evaluations to determine the potential for children's exposure to area-wide soil contamination.*

   The agencies defined "qualitative evaluation" as a personal visit by experienced local health department staff who will determine if children may be exposed to contaminated soil. Under grants from Ecology, the local health departments in King and Pierce counties are conducting the qualitative evaluations. This was deemed appropriate given that the health departments have already done such evaluations in the area, and have valuable knowledge about their local community. These evaluations consist of interviewing owners/operators and staff, and visually inspecting child play areas to determine if soil sampling is needed.

   The 2005-2007grant with the Thurston County health department does not include conducting qualitative evaluations or soil sampling. Ecology will contract for the evaluations and soil sampling in the 2007-2009 biennium.

3. *Conduct soil sampling by December 31, 2009, if the qualitative evaluation determines that children may be routinely exposed to area-wide soil contamination at a property.*

   If the qualitative evaluations indicate children may come into contact with contaminated soil, then the local health departments are sampling the soil in the areas where children play.

   Qualitative evaluations and soil sampling are sequenced as 1) public schools, 2) private schools, 3) childcares – starting in communities closest to the smelter where there is an increased potential for higher levels of contamination, then moving outward. Many of the public schools were tested in earlier studies, and so the school districts are aware of the soil contamination. It was assumed that this level of awareness would facilitate outreach to public schools, allowing for quick sampling at the remaining public schools. Outreach to childcares will take more time, so sampling at childcares will start later. All of the soil collection and lab analysis are covered under the grant from Ecology, making the sampling free for the schools and childcares.

4. *Notify schools and childcares regarding the test results and the steps necessary for implementing best management practices, if soil sample results confirm the presence of area-wide soil contamination.*

   If a school's or childcare's soil has arsenic and lead levels below the Model Toxics Control Act (MTCA) cleanup standards (20 mg/kg for arsenic, 250 mg/kg for lead), the health department is providing a letter explaining the test results.

   If the soils have arsenic or lead levels above MTCA standards, Ecology is meeting with the school district representative or childcare provider to discuss the sampling results and actions needed to reduce exposure. Ecology is helping the facility develop a soil safety action plan. Soil safety actions range from hand-washing and using doormats to removing or covering contaminated soils in the play areas. Ecology is fully funding the soil safety actions, but the schools and childcares will need to maintain them.

5. *Recognize schools and childcares that successfully implement best management practices with a voluntary certification letter.*

   Ecology is providing certificates and window decals to schools and childcares that complete the program. Examples of certificates are provided in Appendix B.

6. *Develop best management practice guidelines for schools and childcares with area-wide soil contamination.*

   Ecology has developed best management practice guidelines. We have termed best management practice guidelines as "soil safety actions." The range of soil safety actions developed reflects concentration, extent, and location of contamination, and the nature and frequency of child use of the area. Ecology will provide the guidelines to schools or childcares wishing to put actions in place without Ecology's assistance. Ecology will encourage such schools and childcares to use the guidelines in creating a healthy and safer environment for children.

7. *Develop a grant program to assist schools and childcares with implementing best management practices.*

   Based on the strong advice of school and childcare stakeholders and state agency partners, Ecology is providing the Soil Safety Program free to schools and childcares. Soil testing is paid for through grants to the local health departments, who will conduct the soil testing. Ecology is managing all the design issues and labor costs for putting soil safety actions in place for schools and childcares with arsenic or lead levels above MTCA standards, with an option for public schools to manage the work themselves through an interagency agreement. This will reduce the paperwork that would be required of a grant program, speed up getting actions in place, and encourage voluntary participation in the program.

8. *Evaluate actions to reduce child exposure to contaminated soils and submit progress reports to the governor and to the appropriate committees of the legislature by December 31, 2006, and December 31, 2008.*

   This report represents the first progress report to be submitted.

In addition, the law requires schools and childcares to work with Ecology to provide site access for soil sampling.

Schools and childcares must provide written permission to the health departments for property access to conduct qualitative evaluations and soil sampling. The health departments are providing a permission form to the schools and childcares for signature. The health departments are making at least 3 attempts to gain access to the schools and childcares through letters and phone calls. If after 3 or more attempts a school or childcare does not provide access, the information will be noted in Ecology's database. Each October, Ecology will evaluate the success of gaining access. If the access rate is lower than performance measures (see Section 4.1.1), then Ecology will re-evaluate the effectiveness of outreach to target audiences, such as childcares.

And the law states, if schools or childcares with contaminated soil do not implement best management practices within six months of receiving written notification of test results, they must notify parents and guardians of the results in writing.

Ecology is offering free design assistance, labor and funding to put actions in place. A school or childcare can use Ecology's assistance, or use its own resources to put actions in place. If a school or childcare does not take action, either with Ecology's assistance or on their own, the facility must notify parents and families in writing about the test results. Ecology will provide an example letter that the school or childcare may use to notify parents. If a school or childcare does not take action within six months, Ecology will request a copy of the letter sent by the facility to the parents and a list of the parents that received the letter.

3.0 Implementation of the Soil Safety Program

Data for the summary of accomplishments is based on activities completed prior to September 30, 2006.

3.1 Education and Outreach

Ecology, PHSKC and TPCHD met with the school districts in the service area to explain the Soil Safety Program and gain access to the public schools to conduct qualitative evaluations. One hundred percent of the school districts granted access.

Ecology sent an introductory letter with an information packet to the private schools. Once the health departments complete sampling of the public schools, they will contact the private schools for access.

Ecology provided a public participation grant to the Childcare Resource & Referral Network (CCRRN). The CCRRN will assist with education to the childcare community regarding the Soil Safety Program. CCRRN will include information on its web site, articles in its newsletters, and prepare a letter of endorsement to be included in the health departments' access request packet. CCRRN will also present at childcare association meetings in King and Pierce counties.

Ecology also provided a briefing to Department of Early Learning childcare licensors. The licensors are prepared to support the Soil Safety Program when the health departments contact individual childcares for access.

3.2 Sampling of Schools and Childcares

Public Schools

The public schools in the Soil Safety Program service area are within 13 school districts – seven districts in King County; five districts in Pierce County; one district in Thurston County. See Figure 3 for a map of public schools within the service area.

In the **King County** portion of the service area, 93 public schools were identified. As of September 30, 2006, qualitative evaluations are complete at 69 of these facilities (i.e., 74% of identified schools have been evaluated). Based on the results of the qualitative evaluation, sampling was required at 63 of the schools (i.e., 91% of those evaluated required sampling). Six schools did not require soil sampling because they had either no play areas, or the play areas were paved. Soil sampling is complete at the 63 schools (i.e., 100% of schools requiring sampling have been sampled). Of the 63 schools tested in King County, 12 require soil safety actions (i.e., 19% of tested schools require soil safety actions). See Figure 4 and Table1 for a summary of these results.

In the **Pierce County** portion of the service area, 55 public schools were identified. Qualitative evaluations are complete at all 55 schools (i.e., 100% of identified schools have been evaluated). Based on the results of the qualitative evaluation, sampling was required at 45 schools (i.e., 82% of those evaluated required sampling). Sampling is complete at these 45 schools (i.e., 100% of schools requiring sampling have been sampled). Nine schools did not require soil sampling because there are no play areas, the play areas are paved, or the schools are outside of the service area. Of the 45 schools tested in Pierce County, 11 require soil safety actions (i.e., 24% of tested schools require soil safety actions). See Figure 5 and Table 1 for a summary of these results.

In the **Thurston County** portion of the service area, eight public schools have been identified. The 2005-2007 grant to the Thurston County Health Department was not expanded to include activities under the Soil Safety Program. Qualitative evaluations and soil sampling have not taken place in Thurston County. Ecology will contract the evaluations and sampling in the 2007-2009 biennium.

Table 1 Summary of Sampling at Public Schools

	Schools identified	Qualitative evaluations complete		Schools requiring sampling		Schools sampled		Schools requiring soil safety actions	
King County	93	69	74%	63	91%	63	100%	12	19%
Pierce County	55	55	100%	45	82%	45	100%	11	24%
Thurston County	8	0	---	---	---	---	---	---	---
Totals	156	124	79%	108	87%	108	100%	23	21%

Private Schools

The private schools within the service area are shown in Figure 6.

In the **King County** portion of the service area, 39 private schools were identified. As of September 30, 2006, qualitative evaluations are complete at 12 of these facilities (i.e., 31% of identified schools have been evaluated). Based on the results of the qualitative evaluation, sampling was required at 11 of the schools (i.e., 92% of those evaluated required sampling). One school did not require soil sampling because its play areas are paved. Soil sampling is complete at the 11 schools (i.e., 100% of schools requiring sampling have been sampled). Of the 11 private schools tested in King County, three require soil safety actions (i.e., 27% of tested schools require soil safety actions). See Figure 7 and Table 2 for a summary of these results.

In the **Pierce County** portion of the service area, 11 private schools were identified. A qualitative evaluation is complete at one private school (i.e., 9% of identified schools have been evaluated). This school was sampled and had results below MTCA standards. See Table 2 for a summary of these results.

In the **Thurston County** portion of the service area, two private schools have been identified. The 2005-2007 grant to the Thurston County Health Department was not expanded to include activities under the Soil Safety Program. Qualitative evaluations and soil sampling have not taken place in Thurston County. Evaluations and sampling will take place by an Ecology contractor in the 2007-2009 biennium.

Table 2 Summary of Sampling at Private Schools

	Schools identified	Qualitative evaluations complete		Schools requiring sampling		Schools sampled		Schools requiring soil safety actions	
King County	39	12	31%	11	92%	11	100%	3	27%
Pierce County	11	1	9%	1	100%	1	100%	0	0%
Thurston County	2	0	---	---	---	---	---	---	---
Totals	52	13	25%	12	92%	12	100%	3	25%

Childcares

The childcares within the service area are shown in Figure 8.

In the **King County** portion of the service area, 394 childcares have been identified. As of September 30, 2006, qualitative evaluations were completed at 91 childcares (i.e., 23% of identified childcares have been evaluated). Based on the results of the qualitative evaluation, sampling was required at 84 of the childcares (i.e., 92% of those evaluated required sampling). Seven childcares did not require soil sampling because the play areas were paved. Soil sampling is complete at the 84 childcares (i.e., 100% of childcares requiring sampling have been sampled).

Of the 84 childcares tested in King County, 10 require soil safety actions (i.e., 12% of tested childcares require soil safety actions). Public Health – Seattle & King County will continue evaluating and sampling childcares in the service area through June of 2009. See Figure 9 and Table 3 for a summary of these results.

In the **Pierce County** portion of the service area, 166 childcares have been identified. Qualitative evaluations are complete at 33 childcares (i.e., 20% of identified childcares have been evaluated). Based on the results of the qualitative evaluation, sampling was required at 30 of the childcares (i.e., 91% of those evaluated required sampling). Three childcares did not require soil sampling because the play areas were paved. Soil sampling is complete at the 30 childcares (i.e., 100% of childcares requiring sampling have been sampled). Of the 30 childcares tested in Pierce County, 13 require soil safety actions (i.e., 43% of tested childcares require soil safety actions). The Tacoma-Pierce County Health Department will continue evaluating and sampling childcares in the service area through June of 2009. See Figure 10 and Table 3 for a summary of these results.

In the **Thurston County** portion of the service area, 27 childcares have been identified. The 2005-2007 grant to the Thurston County Health Department was not expanded to include activities under the Soil Safety Program. Qualitative evaluations and soil sampling have not taken place in Thurston County. Evaluations and sampling will take place by an Ecology contractor in the 2007-2009 biennium.

Table 3 Summary of Sampling at Childcares

	Childcares identified	Qualitative evaluations complete		Childcares requiring sampling		Childcares sampled		Childcares requiring soil safety actions	
King County	394	91	23%	84	92%	84	100%	10	12%
Pierce County	166	33	20%	30	91%	30	100%	13	43%
Thurston County	27	0	---	---	---	---	---	---	---
Totals	587	124	21%	114	92%	114	100%	23	20%

3.3 Soil Safety Actions at Schools and Childcares

As of September 30, 2006, 12 public schools require soil safety actions in the King County portion of the service area. Ecology has initiated soil safety action plans at all 12 schools.

Ecology entered into an interagency agreement with the Vashon-Maury Island School District (in King County). Soil safety actions will be implemented at the elementary school and horticultural garden in December 2006. The actions include using rubber mats under the playground equipment as a barrier to contaminated soil, as well as accidental fall protection. Estimated cost for the soil safety actions is $80,000.

Ecology completed field visits at the remaining 10 schools requiring soil safety actions in King County. Ecology is developing the soil safety action plans, and discussing with the school districts the option of interagency agreements. If the school district chooses to not work under an interagency agreement, Ecology will contract out the work.

In the Pierce County portion of the service area, 11 public schools require soil safety actions. Through field visits, Ecology has initiated soil safety action plans at six of the 11 schools. Ecology is developing the soil safety action plans, and discussing with the school districts the option of interagency agreements. If the school district chooses to not work under an interagency agreement, Ecology will contract out the work.

Also in Pierce County, Ecology completed a field visit with a childcare requiring soil safety actions. Ecology is developing the soil safety action plan, and will contract out the work.

3.4 Resources

Local Toxics Control Account

From the Local Toxics Control Account, Ecology provided as grants $1,045,297 to Public Health Seattle & King County and $980,000 to Tacoma-Pierce County Health Department to conduct soil sampling, and provide education and outreach. Ecology provided $5000 to the Thurston County Health & Social Services Department to provide education and outreach. Ecology anticipates similar funding amounts needed as part of the 2007-2009 grants in order to continue soil sampling, and education and outreach.

State Toxics Control Account - Capital

In the 2005-2007 biennium, Ecology reserved $250,000 of the $5M appropriation (established to cleanup schools and childcares) for cleanups within the Tacoma Smelter Plume Soil Safety Program service area. The remainder of the account is being used to remediate soils at schools in central Washington (see Section 5.0). Of the $250,000, an estimated $80,000 has been contracted under an interagency agreement with the Vashon-Maury Island School District.

In the 2007-2009 biennium, Ecology estimates an additional $2,000,000 will be needed to address soil safety actions at schools and childcares in the service area. This is a conservative estimate, as soil testing is not complete, and the actual number of facilities requiring soil safety actions is not known.

Also in 2007-2009, Ecology will contract soil sampling for the Thurston County schools and childcares already identified. Ecology anticipates $50,000 for soil sampling.

4.0 Evaluation of the Soil Safety Program

4.1 Performance Measures

The agencies identified four performance measures for evaluating the Soil Safety Program, pertaining to gaining access, conducting evaluations/sampling, and encouraging soil safety actions where appropriate.

4.1.1 Gaining Access

Ecology and the health departments will evaluate the success of gaining access to identified schools and childcares in October of each year. The performance measures and actual measures for 2006 are shown in Table 4.

Table 4 Performance Measures – Gaining access

	Schools		Childcares	
	Target	**Actual**	**Target**	**Actual**
October 2006	95%	100%	60%	0%
October 2007	100%	---	70%	---
October 2008	---	---	80%	---
October 2009	---	---	90%	---

The actual measures reflect only the attempts for access during 2006 – they do not include the attempts for access in previous child-use studies. For all public and private schools contacted in King and Pierce counties, the health departments achieved 100% access rate. As of October 2006, the health departments had not yet contacted the majority of private schools or childcares for access as the health departments were sampling at public schools, and education and outreach to childcares was just beginning.

4.1.2 Conducting Qualitative Evaluations/Sampling

Ecology and the health departments will evaluate the effectiveness of the qualitative evaluation and sampling elements of the program in October of each year of the program. Performance is measured by two percentages: 1) percentage of facilities evaluated (i.e., number schools evaluated/number schools granting access); 2) percentage of facilities sampled (i.e., number schools sampled/number schools requiring sampling based on qualitative evaluation). The performance measures for conducting qualitative evaluations and the actual measures for 2006 are shown in Table 5.

Table 5 Performance Measures – Conducting qualitative evaluations

	Schools		Childcares	
	Target	**Actual**	**Target**	**Actual**
October 2006	95%	85%	60%	100%*****
October 2007	100%	---	70%	---
October 2008	---	---	80%	---
October 2009	---	---	90%	---

And the performance measures for conducting sampling and the actual measures for 2006 are shown in Table 6.

Table 6 Performance Measures – Conducting sampling

	Schools		Childcares	
	Target	**Actual**	**Target**	**Actual**
October 2006	95%	100%	60%	100%*****
October 2007	100%	---	70%	---
October 2008	---	---	80%	---
October 2009	---	---	90%	---

The actual measures reflect qualitative evaluations and sampling in previous child-use area studies as well as efforts in 2006. *****For childcares, the actual measures reflect only the results of previous child-use area studies, as childcares were not contacted in 2006.

For schools, 85% of the schools granting access have had qualitative evaluations conducted. As of October 2006, several schools in the King County portion of the service area have granted access but remain to be evaluated. One hundred percent of the schools requiring sampling have been sampled.

For childcares, in previous child-use areas studies 100% of the childcares granting access were evaluated, and 100% of those requiring sampling were sampled.

4.1.3 Encouraging Soil Safety Actions

Ecology and the health departments will evaluate the effectiveness of encouraging the implementation of soil safety action plans in October of each year of the program. Performance is measured by two indicators: 1) percentage of facilities initiating soil safety actions (i.e., number schools initiating soil safety actions/number schools above state standards); 2) percentage of facilities receiving certificates of soil safety action completion (i.e., number schools receiving certificate/number schools above state standards). The performance measures for encouraging soil safety actions and the actual measures for 2006 are shown in Table 7.

Table 7 Performance Measures – Encouraging soil safety actions

	Schools				**Childcares**			
	Soil Safety Action Plan initiated		Soil Safety Action Plan complete		Soil Safety Action Plan initiated		Soil Safety Action Plan complete	
	Target	Actual	Target	Actual	Target	Actual	Target	Actual
October 2006	50%	69%	25%	0%	25%	4%	10%	0%
October 2007	100%	---	75%	---	50%	---	25%	---
October 2008	---	---	100%	---	75%	---	50%	---
October 2009	---	---	---	---	75%	---	75%	---

For schools, 69% of the schools requiring soil safety actions have had soil safety action plans initiated. Soil safety action plans are not yet complete.

For childcares, 4% of the childcares requiring soil safety actions have had soil safety action plans initiated. Soil safety action plans are not yet complete.

4.2 Challenges to Implementation

Much of the first year (July '05 to April '06) was spent designing the program and coordinating closely with stakeholders. The agencies had a goal to create a positive, incentive-based program. The final program design meets the requirements of the law while conveying an overall positive message to the school and childcare communities. The program design was finalized in April 2006, and actual field work began at that time.

The health departments have been successful in gaining access to schools with actual performance at 100% compared to the targeted performance measure of 95% (Table 4). Childcares were not contacted for access in 2006, so the actual performance for gaining access (0%) is less than the targeted performance (60%). Childcares will be contacted after the health

departments complete evaluations and sampling at schools, and after the Childcare Resource & Referral Network initiates outreach to the childcare community.

The actual percentage of qualitative evaluations completed (85%) is less than the targeted performance measure of 95% (Table 5). In King County, the travel time to schools for sampling coupled with only one sampling team has slowed their sampling effort. And, there were challenges in coordinating with schools during summer break. The health departments are exceeding the targeted performance measure for conducting sampling (95%) with sampling at a rate of 100% (Table 6). When the health department is at a school or childcare, they conduct the sampling (if required) immediately following the qualitative evaluation.

For schools, the actual percentage of soil safety action plans initiated (69%) exceeds the targeted performance measure of 50% (Table 7). However, actual completion of soil safety action plans (0%) is less than the targeted completion rate of 25%. Ecology staff turnover and contracting processes have delayed the completion of soil safety actions plans at schools, and the initiation of soil safety action plans at childcares. Ecology is now fully staffed with a Soil Safety Program Coordinator.

4.3 Modifications to Program

The program has been running for just six months. At this time, only one modification is recommended.

The King County portion of the service area is very large with nearly 400 childcares to sample. The vast area coupled with only one sampling team has slowed the health department's progress in conducting qualitative evaluations and sampling. Ecology and Public Health – Seattle & King County are discussing adding more sampling staff to the 2007-2009 grant.

4.4 Next Steps with Soil Safety Program

By the end of 2006, the Tacoma-Pierce County Health Department will have completed evaluation and sampling of public and private schools. Public Health – Seattle & King County will have completed evaluation and sampling of public schools. In 2007, the health departments will address private schools, followed by childcares.

As the sampling takes place at private schools, Childcare Resource & Referral Network will be providing information to the childcares, informing them of the Soil Safety Program. With information about the program, Ecology anticipates childcares will be more responsive to requests for access by the health departments. Ecology will evaluate the effectiveness of the outreach in helping the health departments gain access by surveying participating childcares.

In 2007, Ecology will continue to implement soil safety action plans at schools and childcares requiring action. Ecology anticipates a productive year with the completion of soil safety action plans at public schools, private schools, and many childcares.

5.0 Summary of Accomplishments with Schools in Central Washington

While Chapter 70.140 RCW is specific to areas in western Washington affected by the Tacoma Smelter Plume, Ecology has been working with some schools in central Washington affected by lead arsenate. This section summarizes Ecology's efforts in central Washington.

5.1 Background

As part of Central Washington's rich agricultural history, much of the region consists of current or former orchard land, and has been the site of long-term pesticide application. Ecology has identified lead-arsenate, a pesticide commonly used between the years of 1905 and 1947, as a primary source of increased lead and arsenic concentrations relative to naturally occurring background levels. Lead and arsenic tend to bond with soil particles and often remain at or near ground surface level, posing human exposure risks.

Humans are regularly exposed to low levels of lead and arsenic in the environment, as they are naturally occurring elements. However, elevated concentrations of lead and arsenic may have a negative impact on human health. Young children are generally at greater risk of exposure than adults, from playing outdoors and putting objects into their mouths.

Recognizing that traditional methods of remediation were not appropriate for areas of wide-spread contamination, the Area-Wide Soil Contamination Task Force was established in 2002 to identify and pursue an appropriate course of action. The Task Force Report, published in 2003, addresses the need for risk minimization and prevention at public schools and child care facilities throughout the state.

Ecology addressed Area-Wide soil contamination in Central Washington on a per-county basis. Four priority counties were identified – Okanogan, Chelan, Douglas, and Yakima – as having a high likelihood of soil contamination due to high apple and pear production during the first half of the 20th century. Outdoor play areas throughout Central Washington, such as school yards and parks were identified as a primary concern, due to regular use and disturbance by children.

Based upon Task Force recommendations, Ecology began initial sampling and analysis during the spring of 2002. Aerial photography maps from 1947 and 1927 were reviewed. Ecology selected the Wenatchee area for initial testing due to a high number of school properties located on former orchard land.

5.2 Soil Sampling

Two technologies were used throughout the soil sampling process. An Innov-x portable x-ray fluorescence (XRF) instrument was field tested and determined to be an accurate and low-cost means of high-volume soil analysis. Additionally, Lincoln Elementary in Wenatchee was chosen as the demonstration site for the use of deep mixing technology, as provided by CBA Environmental Services, Inc.

Based on sampling results from the Wenatchee area, Ecology decided to sample all public schools throughout priority counties in Central Washington. Ecology began widespread soil testing during the summer of 2005. Samples were collected for analysis at all public schools in Okanogan, Chelan, and Douglas counties. Yakima County public schools were sampled with the exclusion of Selah School district and schools located on the Yakama Indian Reservation. School properties located within the Selah School District are scheduled to be tested for contamination during the first half of 2007.

Based on these sampling results, Ecology was able to prioritize schools to implement cleanup activities. Prioritization was based on five factors:

1. Levels of contamination: Schools will high levels of lead and/or arsenic contamination will be given priority. The Task Force considered arsenic concentrations below 100 ppm to be in the low to moderate range. Therefore, schools with arsenic levels exceeding 100 ppm will be given priority. The Task Force also considered lead concentrations below 700 ppm to be in the low to moderate range. Therefore, schools with lead contamination exceeding 700 ppm will be given priority.

2. Number of samples exceeding MTCA cleanup levels: Sampling results to date have shown wide variation in the number of samples exceeding MTCA cleanup levels. Some schools have one or two. Other schools have 50% or more samples exceeding MTCA cleanup levels. Priority will be given to schools that have widespread contamination over the entire property. Schools with one or two high levels will be encouraged to implement maintenance activities that reduce exposure, like frequent watering to minimize bare patches or using mulch or sod for cover.

3. At-risk population: Because children are particularly vulnerable to the health effects of lead and/or arsenic, elementary schools will be given priority. Priority will also be given to playfields, whether used by elementary schoolchildren or the community at large.

4. Readiness of schools: All efforts will be made to work with schools and come to mutual agreement about the best timetable for remedial activities. Some factors are listed below:
    a. *Capital projects coordination.* Several schools or school districts have upcoming bond issues, or plans to make necessary improvements to school buildings and/or grounds. Ecology will make an effort to work in conjunction with schools that will be beginning improvement projects.
    b. *Public concern*. If the public concern about a specific school is known to be high, then Ecology may raise the priority of the school.

5. Resource commitments: When Ecology has previously committed or allocated resources to a school, or school district and has made a commitment to complete the work, then the priority of that site may be raised.

5.3 Soil Remediation

Cleanup activities were implemented at eight schools during the summer of 2006. Four schools were located in Wenatchee. Additionally, Ecology selected North Omak Elementary (Okanogan county), Brewster High School (Okanogan county), Manson Elementary (Chelan county), and Naches Intermediate (Yakima county).

Before implementing cleanup activities, Ecology looked at risk exposure. The potential exposure pathways for lead and arsenic in soil are inhalation, ingestion, and dermal absorption. For the purpose of the eight school cleanups, ingestion was considered as a significant exposure pathway. Ingestion of contaminated soil is expected to be the primary route of exposure for metals, particularly with young children. Metals in dust or soil can be ingested accidentally by hand-to-mouth activity. Pica behavior in young children, that is, eating of non-food items, will increase this exposure. Ingestion or inhalation of wind-blown soil or dust are additional pathways of exposure to lead and arsenic. Children are considered a sensitive population because they tend to ingest more soil and dust than adults and because they tend to absorb more of the lead they ingest. Metals are not readily absorbed through the skin, so dermal absorption of metals is not a significant concern at the concentrations found at schools in the area-wide cleanup program.

Evidence of groundwater contamination or the threat of groundwater contamination has not been found relative to area wide lead and arsenic contamination. Extensive soil profile sampling in Central Washington has demonstrated that lead and arsenic contamination does not extend below 30 inches below ground surface (bgs) in undisturbed situations. High levels of lead and arsenic contamination (above 50 ppm for arsenic and above 500 ppm for lead) were not found

below 12 inches bgs. These results may vary in climates with more precipitation, but in this region, the findings were very consistent. Due to the depth of groundwater found in the vicinity of the school, combined with the distribution of the contamination, the risk of lead and arsenic contamination in groundwater is minimal.

All eight school sites were evaluated individually to determine which cleanup methods would be most effective. Most used a combination of excavation and deep mixing technology. In cases where that was not feasible, a cap was applied.

Prior to beginning any excavation, additional sampling was conducted to create a more detailed picture of the lead and arsenic concentrations. As a general rule, any contamination above 100 ppm cannot be deep mixed without excavation to remove some of the contaminant load. Concentrations in the 60-99 ppm range may or may not need to be excavated depending on the depth of contamination and the background concentrations found in the clean soil below.

The deep mixing technology was supplied by CBA Environmental Inc. (CBA) from Hegins, Pennsylvania. The deep mixer is a piece of heavy equipment manufactured by Vermeer Manufacturing and modified by CBA for the purpose of deep soil mixing. The machine is track mounted and weighs between 50 and 120 tons depending on model. A large rotating drum mounted on the front of the machine is lowered to a maximum depth of 4.5 feet bgs where it rotates and mixes the soil. It travels at average speeds between 4 and 8 feet per minute and typically covers between 1/3 and ½ acre per day. Studies conducted by Ecology and CBA have shown a mixing efficiency between 70% and 95% depending on soil types. After the deep mixer has made a mixing pass, a windrow of overburden is deposited next to the mixed soil. This windrow is created as a result of the decompaction caused by deep mixing.

Soil sampling was conducted continuously throughout the cleanup process. Sample collection was varied between the overburden row and various depths in the mixing row itself. As the deep mixer completed each row, that row was sampled and analyzed to ensure the mixing was successful in reducing contaminant levels below MTCA standards. In the event that lead and arsenic levels were not reduced below MTCA cleanup standards, a row could be remixed with deeper soils to reduce concentrations further.

All eight schools have been successfully remediated, and levels of lead and/or arsenic are below MTCA cleanup standards.

Photos of deep mixing

Figures

Appendices