WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

INTERIM ACTION REPORT
ROBERT E. LEE ELEMENTARY SCHOOL
WENATCHEE, WASHINGTON

Facility/Site ID # 7763612

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Prepared by Washington State Department of Ecology
Toxics Cleanup Program
Mark Dunbar (509) 454-7836

TABLE OF CONTENTS

1 INTRODUCTION

1.1 PURPOSE OF THIS DOCUMENT

The purpose of this report is to document cleanup activities conducted at Robert E. Lee (Lee) Elementary School (Site) during the summer of 2008.

1.2 AREA WIDE INTRODUCTION

Area-wide soil contamination is defined as contamination above state cleanup levels that is dispersed over a large geographic area. The soil contamination in this case is a result of central Washington's orchard industry. Much of the region consists of current or former orchard land, where long-term pesticide application has left persistent chemicals in the soil. Lead-arsenate, a pesticide commonly used between the years of 1905 and 1947 to control the codling moth, has been identified as the primary source of increased lead and arsenic concentrations.

Due to their chemical structure, lead and arsenic tend to bond with soil particles and often remain at or near ground surface level for decades, creating an exposure pathway through inhalation and/or ingestion.

Although lead and arsenic are naturally occurring elements, elevated concentrations have been proven to have a negative impact on human health. Young children are generally more susceptible than adults, which is why Ecology has focused remediation efforts on schools.

Because of the unique nature of area-wide contamination, traditional methods of remediation are not feasible. Therefore, the Area-Wide Soil Contamination Task Force was established in 2002 to identify and pursue effective statewide strategies. Recommendations from the Task Force included soil testing, qualitative evaluations, and protective measures at child-use areas.

In the central Washington region, Okanogan, Chelan, Douglas, and Yakima counties were targeted based on the large volume of apple and pear production during the first half of the 20th century. Ecology's Central Regional Office (CRO) began initial sampling and analysis during the spring of 2002 in the Wenatchee area. This area was chosen based on aerial photography from 1927 and 1947 that showed a high number of school properties located on former orchard land.

Results from the Wenatchee area showed several schools with soil contamination exceeding state cleanup standards. Based on these results, soil testing was implemented in the four priority counties. Over 100 public schools were tested for lead and arsenic during the summer of 2005. Of the schools sampled, Ecology's CRO identified 35 schools with soil contamination exceeding state cleanup standards.

The 35 schools were then prioritized for remedial activities. Remedial activities at Lee Elementary were initiated and completed during the summer of 2008.

2 SITE DESCRIPTION

Lee Elementary is centrally located at 1455 North Baker Avenue, East Wenatchee, Washington. The school is situated in a residential area in the SE quarter of Section 2, T22N, R20E. The portion of the school grounds remediated for lead and arsenic includes the grass covered play area in the northeast corner of the school property. Lee Elementary hosts approximately 455 students.

According to the NRCS Soil Survey for the Chelan County Area, soil at the site is predominantly classified as Quincy loamy fine sand (274), 0 to 15 percent slopes. Quincy loamy fine sand is formed from a parent material of eolian sands, on terraces at an elevation of 600 to 1,400 feet. Mean annual precipitation is 8 to 10 inches, and the mean annual air temperature is 49 to 51 degrees F, with a frost-free period of 140 to 195 days. Quincy loamy fine sand is excessively drained with a depth to restrictive feature and depth to water table of more than 80 inches. The typical soil profile is 0 to 10 inches loamy fine sand and 10 to 60 inches fine sand.

3 SITE HISTORY

This site was included in an area-wide lead and arsenic sampling program which involved collecting samples from schools suspected of having a history of past pesticide use. Prior to the mid-1940s, lead arsenate was the most widely used chemical used to control codling moths on fruit trees. Lead (Pb) and arsenic (As) are known to be very stable in soil and tend to stay near the surface. Because of this historical background, it was suspected that the soil in the school playground might be contaminated with lead and arsenic. The Washington Department of Ecology (Ecology) obtained permission from the Eastmont School District to sample and test the soils for lead and arsenic from Lee Elementary.

The soils throughout the property were sampled by the Department of Ecology in 2002. Samples were taken from the top six inches using a core sampler. The samples were analyzed for lead and arsenic using X-Ray Fluorescence (XRF) Spectroscopy.

Sampling results at Lee Elementary indicated that contaminant levels in soil exceeded the Model Toxics Control Act Method A cleanup levels for lead (250 ppm) and/or arsenic (20 ppm) in 3 of 22 soil samples. The highest levels of arsenic and lead detected at the site were 71 ppm and 260 ppm, respectively. These concentrations required the site be scored and ranked under the Washington Ranking Method (WARM). The site was ranked a “5” and placed on Ecology’s Hazardous Sites List in 2005.

To prevent exposure to contaminated soil a geotextile barrier and 6-inch cap of clean soil were installed over the existing play area. Turf replacement was accomplished with sod. Because contamination was not removed from the site, a restrictive covenant will be issued to restrict future development or improvements on the site that could expose contaminated soil.

4 SITE CONTACT INFORMATION

Remedial activities were designed, supervised, and funded by Ecology. Construction was performed by a licensed general contractor. Bremmer Construction Inc, a local Wenatchee construction company, was the general contractor for the project. Ecology monitored construction on a daily basis and maintained contact with Eastmont School District staff throughout the project.

The following table contains contact information for the primary individuals with whom Ecology interacted during the remediation process.

Table 1: Site Contacts

Name	Organization	Position	Phone Number
David Bremmer	Bremmer Construction Inc.	General Contractor	(509) 664-1000
Gary Dexter	Eastmont School District	Superintendent (Acting)	(509) 884-6970

5 REMEDIAL ACTIVITIES

5.1 RISK

The potential exposure pathways for lead and arsenic in soil are inhalation, ingestion, and dermal absorption. It is important to consider that ingestion is not considered as an exposure pathway in the site hazard assessment ranking method. For the purpose of this cleanup, 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.

5.2 SAFETY AND HEALTH

The site was restricted from public access throughout the construction period by a combination of chain link fence and orange safety netting. The contractor was required to provide a specific Safety & Health Plan for the site construction activities.

5.3 DUST CONTROL PLAN

The contactor was required to control dust and to prepare a dust control plan. Dust control measures included the use of the existing irrigation system and a water truck.

5.4 REMEDIAL PROCESS

Capping was chosen as the most efficient remedial option for the site. The remedial process was very simple. The existing grass turf was tilled to a depth of approximately six inches. A permeable geotextile fabric was then installed over the existing soil surface. The geotextile was placed in rolls that were 15 feet wide and they were overlapped a minimum of 12 inches. The fabric was secured with 6 inch long landscaping staples and then covered with clean topsoil. Approximately 1000 tons of topsoil were imported onsite. The topsoil was tested for the presence of lead and arsenic prior to import. Neither lead nor arsenic were detected above background concentrations. Following topsoil import and grading, compost was worked into the surface as a soil amendment, and sod was installed on the remediated area.

5.5 SAMPLE RESULTS

Initial sampling between the surface and 8 inches bgs found average arsenic concentrations of 16.2 ppm with a maximum concentration of 71 ppm. Initial lead concentrations averaged 74.6 ppm with a maximum concentration of 260 ppm. Sample data can be viewed in the table below.

Table 2: Pre-Remedial Samples

Lee Elementary School

LAT: 47.42677

LONG: -120.28935

Sample ID	Pb (ppm)	As (ppm)
243	74	16
244	120	27
245	44	10
246	47	11
247	55	13
248	53	7.3
249	260	71
250	40	13
251	150	20
252	47	13
253	100	18
254	47	15
255	53	13
256	10	1.9
257	34	6.1
258	120	18
259	44	11

260	66	13
261	100	20
262	29	6
263	77	18
264	72	15

6 PROJECT SUMMARY

Soil samples collected at Lee Elementary indicated lead and arsenic contamination existed in surface soils at concentrations above MTCA cleanup levels. The course of action that was taken was to cap the field with clean soil. A permeable geotextile fabric was placed on top of the contaminated soil, followed by new topsoil and sod to restore the site to the original condition. As a result, the lead and arsenic contaminated soil is contained within the site, and a restrictive covenant will be filed to restrict future improvements or redevelopment of the site.

7 Appendices

7.1 Appendix A: FIGURES

Figure A-1: Vicinity Map

Figure A-2: Remediation Area Map

7.2 Appendix B: XRF USE

The summer 2008 area-wide contamination clean-up projects involved the collection and analysis of a large number of soil samples. Concentrations of lead and arsenic in these soil samples provided information as to whether or not an area was contaminated, and this information was used to determine how the remedial activities would proceed. Therefore project staff needed a way to quickly and reliably evaluate soil arsenic and lead concentrations. This was achieved through the use of two portable X-Ray Fluorescence (XRF) Analyzers manufactured by Innov-x Systems.

The instruments use x-ray technology to excite elemental electrons in a soil sample and cause these elements to emit characteristic x-rays. The intensity of these elemental x-rays is then measured to determine the amount of a particular element present in the sample. The entire analysis is performed in approximately one minute and the data is stored in a removable Hewlett-Packard (HP) iPAQ personal data assistant which can transmit the information to a laptop.

The use of portable XRF units for the determination of soil elemental concentrations has been described by EPA Method 6200 and has been found to provide, "a rapid field screening procedure" for site characterization [US EPA]. Results from the study conducted by Ecology in 2002 (as shown in the graphs below) found that a portable Niton XRF had a correlation coefficient (r2 value) between field and Inductively-Coupled Plasma (ICP) laboratory analyses of 0.8057 for lead and 0.933 for arsenic. In addition, a verification study conducted by the EPA Superfund Innovative Technology Evaluation (SITE) Monitoring and Measurement Technology (MMT) Program provides additional support for the use of this technology. The investigation compared an Innov-x XRF model, similar to the one used by Ecology, with reference laboratory data and showed a correlation coefficient of 0.8762 for arsenic and 0.91 for lead [US EPA]. All of this data shows that an XRF can be an effective tool for characterizing large contamination sites.

Figure B-1: 2002 Arsenic Comparison

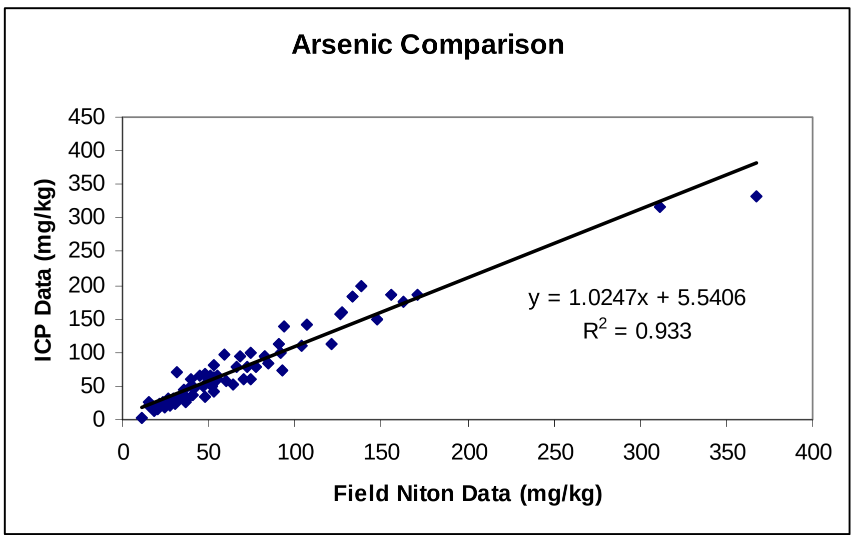
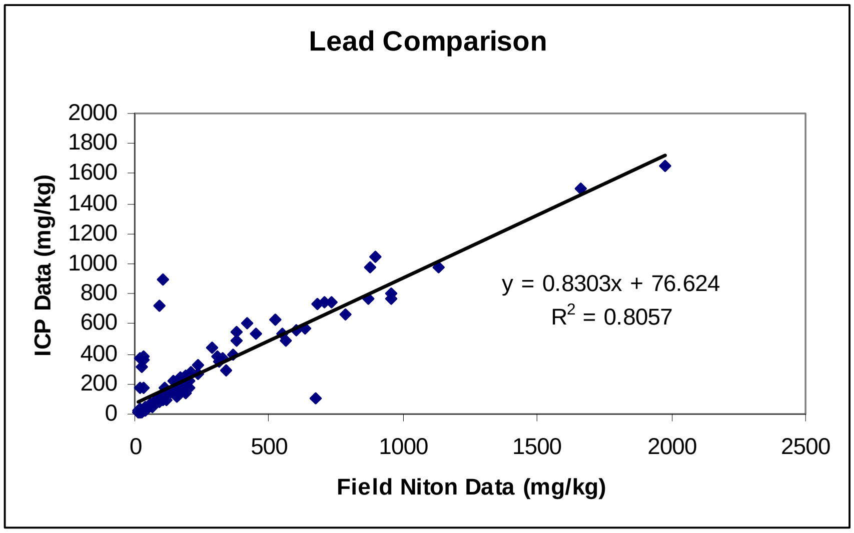


Figure B-2: 2002 Lead Comparison



Following the completion of the remediation projects conducted in 2006, additional samples were collected for comparison between XRF and Lab ICP methods. A total of 95 additional samples were collected and analyzed by both methods. These samples were analyzed by XRF prior to packaging in clean sealed jar. The analysis (as shown in the graphs below) found that the Innov-X XRF had a correlation coefficient (r2 value) between field and Inductively-Coupled Plasma (ICP) laboratory analyses of 0.779 for arsenic and 0.893 for lead. It should be noted that many of the data points were actually detection limits of both analysis methods for samples where lead or arsenic was not detected. When those non-detect data points are removed, the analysis found that the Innov-X XRF had a correlation coefficient (r2 value) between field and Inductively-Coupled Plasma (ICP) laboratory analyses of 0.838 for arsenic and 0.879 for lead.

Figure B-3: 2006 Arsenic Comparison

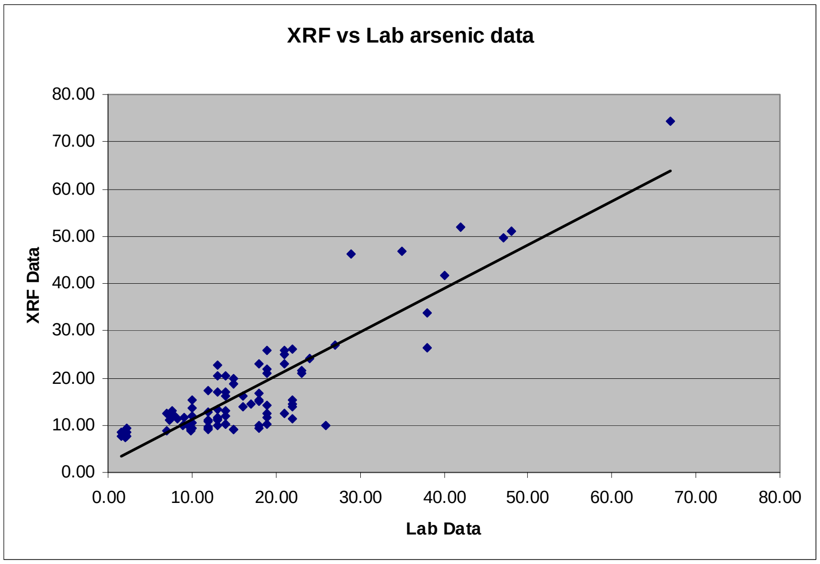
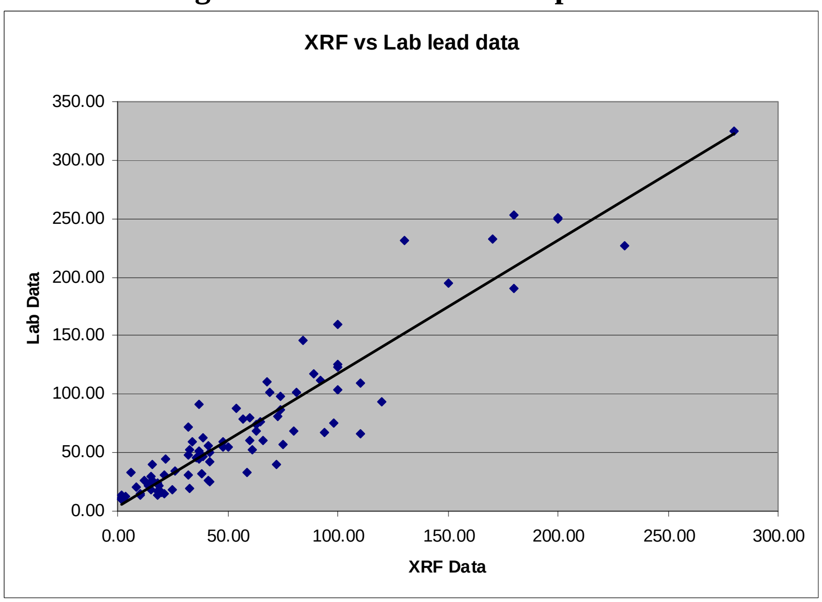


Figure B-4: 2006 Lead Comparison



Project staff followed all safety protocols for use of the XRF instruments including completion of mandatory information and safety trainings before sampling analysis began. In order to reduce health risks associated with radiation exposure, the instruments were operated while in a docking station and careful attention was paid to eliminate direct x-ray exposure. Actual amounts of radiation exposure as regulated by OSHA were monitored with the use of dosimeters which were carried by all sampling personnel.

7.3 Appendix C: COSTS

Table 2: Lee Elementary School Remediation Costs

Irrigation system modification and repair	$7,000.00
Supply and install geotextile	$3,500.00
Till existing sod layer	$500.00
Topsoil import and placement	$17,367.20
Soil amendment	$1,300.00
Install and maintain sod	$10,400.00
Subtotal	$40,067.20
State Sales Tax	*$3205.38*
Total	**$43,272.58**

7.4 Appendix D: PHOTO LOG

Photo D-1: Lee Elementary School placing geotextile

Photo D-2: Lee Elementary School placing soil

Photo D-3: Lee Elementary School sod

Photo D-4: Lee Elementary School complete

7.5 Appendix E: Bibliography

US EPA. Method 6200. "Field Portable X-Ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment". January 1998.

US EPA. "Innovative Technology Verification Report: XRF Technologies for Measuring Trace Elements in Soil and Sediment: Innov-X XT400 Series XRF Analyzer". EPA/540/R-06/002. February 2006.

Natural Resources Conservation Service Web Soil Survey National Cooperative, "Soil Survey Area: Douglas County, Washington," June 9, 2009.