WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

INTERIM ACTION REPORT
NACHES INTERMEDIATE SCHOOL
NACHES, WASHINGTON

October 30, 2006

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Toxics Cleanup Program
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1.0 INTRODUCTION

1.1 PURPOSE OF THIS DOCUMENT

The purpose of this report is to detail cleanup activities conducted at Naches Intermediate School during the summer of 2006.

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 taken its toll. 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, four priority counties were identified. 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. Therefore, 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 photographs from 1927 and 1947 showing a high number of school properties located on former orchard land.

Sampling 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 started during the summer of 2006. Four Wenatchee area schools were completed during the first part of the summer. North Omak Elementary, Brewster School District, Manson Elementary, and Naches Intermediate were completed during the later part of the summer.

2.0 SITE DESCRIPTION

Naches Intermediate School is located at 101 Shafer Avenue, within the City of Naches city limits in Yakima County, Washington. More specifically, the site is located at 46º73’00”N and -120º69’45” (GPS Coordinates) in the NE ¼ of the SW ¼ of Section 3, Township 14 North, Range 17 East. The site is approximately ¼ mile north of State Highway 12 and about 11 miles west of the City of Yakima.

Situated on the eastern boundary of the Cascade foothills, this location is approximately 1,500 feet above sea level within the narrow floodplain of the Naches River. Clemans Mountain is located less than 1 mile north of the site and the Naches River is located about ½ mile south of the site. Relief is between 0% and 5% across the site. Ecology well log records suggest depth to groundwater is about 10-12 feet below ground surface. Groundwater will generally flow south toward the Naches River.

According to the United States Department of Agriculture (USDA) Soil Survey of Yakima County Area Washington, local soils are described as Weirman-Ashue type and are considered very deep, somewhat excessively drained soils. Shallow soils consist of alluvium derived from flooding events of the Naches River. Local rock formations are generally composed of basalt and andesite with some sandstone and siltsone, among others. The soil type is typically located on low terraces and flood plains with shallow grade such as the Naches area.

The Soil Survey describes the following soil horizons:

- At 0-8 inches below ground surface (bgs) soil consists of a grayish-brown sandy loam. Soil is typically moist with a soft, granular texture and is considered non-sticky and non-plastic. Soil is typically impregnated with many fine roots and is mildly alkaline.
- At 8-15 inches bgs, soil is similar to the previous horizon but contains few roots and consists of loose, single grain loamy fine sand. Soil remains mildly alkaline.
- Between 15 and 21 inches bgs soil becomes more light-brownish gray in color. Soil remains loamy fine sand and is still considered soft and non-sticky but becomes slightly plastic. Soil remains mildly alkaline.
- At 21-60 inches bgs soil becomes extremely gravelly sand with approximately 75% pebbles and 5% cobbles. Soil is moist, loose, grayish brown in color, and remains mildly alkaline.

During deep mixing activities, soil appeared generally as described above, but with several deep veins of approximately 80% large cobble. These veins extended across the southeast activity field in north-south direction and were at times up to 50 feet across.

3.0 SITE HISTORY

Investigation into possible lead arsenate soil contamination at Naches Intermediate School began in 2005. Aerial photographs of the area from 1947 suggest the property has historically been used as orchard land. Property surrounding Naches Intermediate remains as orchard land today.

Soil samples were collected randomly from around the school and adjacent varsity baseball and recreation fields. X-ray fluorescence (XRF) analysis identified arsenic and lead concentrations of up to 105 parts per million (ppm) and 670 ppm, respectively. A site hazard assessment (SHA) was completed in January 2006 to determine the site's potential threat to human and environmental health, relative to other Washington state sites. Naches Intermediate was assigned an SHA ranking of 5, where 1 represents the highest relative risk and 5 the lowest. Despite SHA rank of 5, the property was considered a priority due to the potential impact that lead and arsenic contamination can have on young children. Therefore, the site was selected for area-wide cleanup efforts in 2006.

Additional soil sampling was conducted in March and August of 2006 to better characterize the nature of lead arsenate soil contamination. XRF soil analysis identified maximum arsenic concentrations of up to 186 ppm and maximum lead concentrations of up to 1249 ppm. Soil remediation began in August 2006 after soil sampling had been completed.

4.0 SITE CONTACT INFORMATION

This project was contracted out by Ecology through a competitive bidding process. All contractor invoices were submitted directly to Ecology for reimbursement. Planning phases of the project were reviewed by the Naches School District prior to beginning field operations. Ecology maintained contact with the district's administrative and maintenance staff throughout site work, maintaining a positive working relationship and exchange of information as needed specific requests. For example, Ecology took into consideration regarding the varsity baseball field by the athletic department.

Ecology acted as general contractor for all work at Naches Intermediate School. Deep mixing was completed by CBA Environmental, excavation was completed by River's Edge Services, and landscaping was completed by Muffett & Sons.

The following table contains contact information for individuals involved in the completion of remedial activities.

Table 4-1: Site Contact Information

Name	Organization	Position	Phone Number
Duane Lyons	Naches School District	Superintendent	(509) 653-2220
Todd Hilmes	Naches Intermediate School	Principal	(509) 653-2701
Steve Wade	Naches School District	Maintenance Supervisor	(509) 945-6729
Bill Walker	Naches School District	Athletic Director	(509) 452-4604
George Williams	CBA Environmental	Deep Mixing	(570) 682-8742
Paul Kemp	River's Edge Services	Excavation	(206) 396-0271
Rod Muffett	Muffett & Sons	Landscaping & Irrigation	(509) 877-2153

5.0 REMEDIAL PROCESS

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 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 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 REMEDIAL PROCESS

5.2.1 SAFETY AND HEALTH

The site was restricted from public access throughout the construction period by a 6-foot high chain link fence. All contractors were required to provide a specific Safety & Health Plan for site construction activities.

5.2.2 DUST CONTROL PLAN

All contractors were was required to control dust and to prepare a dust control plan. Dust control measures, at a minimum, included a water truck.

5.2.3 REMEDIAL ACTIVITIES

The initial remediation plan for Naches Intermediate School was based upon sampling conducted across the site to a depth of approximately 8 inches. This data indicated that there were areas with lead and arsenic contamination high enough that some excavation would be required prior to applying deep mixing technology.

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 the 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 1/2 acre per day. Studies conducted by Ecology and CBA have shown a mixing efficiency between 70% and 95% depending on soil types.

Prior to beginning remedial excavation, additional sampling was conducted to create a more detailed delineation of the lead and arsenic concentrations. This sampling data indicated the following:

- The majority of the south end of the site containing the soccer fields had arsenic concentrations exceeding 100 ppm between 2 inches and 12 inches bgs. This area would require excavation prior to deep mixing for remediation to be successful.
- The baseball field had two hotspots that could be effectively removed without requiring deep mixing.
- The area surrounding the school would need small areas of excavation prior to deep mixing. After the areas of excavation were complete, the entire area could be remediated by deep mixing.

As a general rule, any contamination above 100 ppm cannot be deep mixed without some 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.

A bulldozer was used for excavation prior to deep mixing. After the bulldozer had excavated an area down to a prescribed depth, the XRF was used to analyze post-excavation surface concentrations and determine whether more excavation was required. Extensive sampling demonstrated that arsenic concentrations of approximately 70 ppm were the transition point between the higher surface concentrations and the lower concentrations of the deeper clean soils at this particular site therefore when surface concentrations of 70 ppm were reached, excavation was considered complete for that area. A front-end loader was then used to load the stockpiles into trucks for transport to the landfill. Soil excavated from Naches Intermediate School was transported to the Terrace Heights Landfill for disposal.

Following excavation of hot spots, the Vermeer Soil Leveler was used to blend the top four feet of soil into a homogenous mixture. Soil sampling was conducted continuously throughout the remedial process. As the deep mixer completed each row, that row was sampled and analyzed to ensure the mixing was successful in reducing contaminant levels below Model Toxics Control Act (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. No re-mixing was required at Naches Intermediate School. There were several samples that exceeded MTCA cleanup levels for arsenic, though none were twice the cleanup level. Statistical analysis indicates that less than 10% of samples exceed MTCA standards and no further remedial action is required for the site.

5.3 SAMPLE RESULTS

Remedial activities at Naches Intermediate School were successful in reducing the majority of lead and arsenic concentrations below MTCA cleanup levels for unrestricted land use. Of the 304 samples collected after remediation, 22 exceeded MTCA cleanup levels. Statistical analysis indicates that less than 10% of samples exceed MTCA standards. According to MTCA cleanup guidelines, a site may be considered clean if no more than 10% of samples exceed MTCA cleanup levels and no samples are greater than twice MTCA cleanup levels. Based on these guidelines, no further action is required for the site.

Pre-remediation arsenic samples had an average concentration of 73 ppm and a maximum concentration of 315 ppm. Pre-remediation lead samples had an average concentration of 202 ppm and a maximum concentration of 1496 ppm. Post-remediation arsenic samples had an average concentration of 17 ppm and maximum concentration of 39 ppm. Post-remediation lead samples had an average concentration of 85 ppm and a maximum concentration of 420 ppm. The tables below contain pre and post remediation sample data. Maps containing a general representation of this data are available as figures 1 and 2.

<u>MTCA Method A State Cleaup Levels</u>

As- 20ppm

Pb- 250ppm

Table 5-1: Pre-Remediation Samples

Date	As	Pb	Location	Sample ID
6-Aug-06	**32.89**	**407.19**	Naches	NIT-126 1-4
7-Aug-06	**15.62**	**80.28**	Naches	NIT-1 1-4"
7-Aug-06	**14.75**	**101.07**	Naches	NIT-1 5-8"
7-Aug-06	**36.17**	**123.30**	Naches	NIT-10 1-4"
7-Aug-06	**47.01**	**119.28**	Naches	NIT-10 5-8"
6-Aug-06	**36.92**	**562.21**	Naches	NIT-100 1-4
6-Aug-06	**138.27**	**423.62**	Naches	NIT-100 5-8
6-Aug-06	**70.86**	**606.22**	Naches	NIT-101 1-4
6-Aug-06	**94.95**	**63.11**	Naches	NIT-101 5-8
6-Aug-06	**24.53**	**201.86**	Naches	NIT-102 1-4
6-Aug-06	**58.74**	**117.42**	Naches	NIT-102 5-8
6-Aug-06	**44.63**	**408.18**	Naches	NIT-103 1-4
6-Aug-06	**73.48**	**56.15**	Naches	NIT-103 5-8
6-Aug-06	**35.37**	**214.90**	Naches	NIT-104 1-4
6-Aug-06	**98.76**	**22.04**	Naches	NIT-104 5-8
6-Aug-06	**49.63**	**586.28**	Naches	NIT-105 1-4

Date	As	Pb	Location	Sample ID
6-Aug-06	**119.40**	**84.81**	Naches	NIT-105 5-8
6-Aug-06	**30.16**	**266.61**	Naches	NIT-106 1-4
6-Aug-06	**91.16**	**192.70**	Naches	NIT-106 5-8
6-Aug-06	**51.54**	**384.68**	Naches	NIT-107 1-4
6-Aug-06	**40.68**	**386.15**	Naches	NIT-108 1-4
6-Aug-06	**117.07**	**479.09**	Naches	NIT-108 5-8
6-Aug-06	**48.80**	**284.94**	Naches	NIT-109 1-4
6-Aug-06	**44.34**	**21.62**	Naches	NIT-109 5-8
7-Aug-06	**19.88**	**163.48**	Naches	NIT-11 1-4"
7-Aug-06	**87.09**	**276.79**	Naches	NIT-11 5-8
6-Aug-06	**31.09**	**202.39**	Naches	NIT-110 1-4
6-Aug-06	**84.94**	**17.56**	Naches	NIT-110 5-8
6-Aug-06	**36.25**	**429.05**	Naches	NIT-111 1-4
6-Aug-06	**66.38**	**524.49**	Naches	NIT-112 1-4
6-Aug-06	**87.52**	**190.32**	Naches	NIT-112 5-8
6-Aug-06	**33.35**	**187.44**	Naches	NIT-113 1-4
6-Aug-06	**50.74**	**282.40**	Naches	NIT-113 5-8
6-Aug-06	**85.35**	**675.29**	Naches	NIT-114 1-4
6-Aug-06	**47.01**	**11.39**	Naches	NIT-114 5-8
6-Aug-06	**79.10**	**677.33**	Naches	NIT-114 5-8
6-Aug-06	**78.90**	**712.22**	Naches	NIT-115 1-4
6-Aug-06	**186.20**	**875.21**	Naches	NIT-115 5-8
6-Aug-06	**34.34**	**348.05**	Naches	NIT-116 1-4
6-Aug-06	**64.75**	**576.69**	Naches	NIT-116 5-8
6-Aug-06	**46.98**	**167.93**	Naches	NIT-117 1-4
6-Aug-06	**50.14**	**41.56**	Naches	NIT-117 5-8
6-Aug-06	**32.54**	**350.11**	Naches	NIT-118 1-4
6-Aug-06	**46.25**	**28.97**	Naches	NIT-118 5-8
6-Aug-06	**53.43**	**443.51**	Naches	NIT-119 1-4
6-Aug-06	**129.12**	**643.84**	Naches	NIT-119 5-8
7-Aug-06	**9.25**	**12.64**	Naches	NIT-12 1-4
7-Aug-06	**48.70**	**322.41**	Naches	NIT-12 5-8"
6-Aug-06	**39.62**	**422.63**	Naches	NIT-120 1-4
6-Aug-06	**89.50**	**392.70**	Naches	NIT-120 5-8
6-Aug-06	**28.65**	**374.97**	Naches	NIT-121 1-4
6-Aug-06	**61.23**	**117.84**	Naches	NIT-121 5-8
6-Aug-06		**729.79**	Naches	NIT-122 1-4
6-Aug-06	**27.76**	**25.49**	Naches	NIT-122 5-8
6-Aug-06	**28.83**	**478.72**	Naches	NIT-123 1-4
6-Aug-06	**76.81**	**545.12**	Naches	NIT-123 5-8
6-Aug-06	**28.86**	**519.20**	Naches	NIT-124 1-4
6-Aug-06	**115.79**	**75.31**	Naches	NIT-124 5-8
6-Aug-06	**18.13**	**138.69**	Naches	NIT-125 1-4
6-Aug-06	**69.60**	**100.71**	Naches	NIT-125 5-8

Date	As	Pb	Location	Sample ID
6-Aug-06	**44.01**	**423.35**	Naches	NIT-126 1-4
6-Aug-06	**68.25**	**49.10**	Naches	NIT-126 5-8
6-Aug-06	**37.26**	**458.80**	Naches	NIT-127 1-4
6-Aug-06	**59.47**	**97.53**	Naches	NIT-127 5-8
6-Aug-06	**29.88**	**263.51**	Naches	NIT-128 1-4
6-Aug-06	**34.59**	**110.43**	Naches	NIT-128 5-8
6-Aug-06	**40.65**	**426.71**	Naches	NIT-129 1-4
6-Aug-06	**53.23**	**67.72**	Naches	NIT-129 5-8
7-Aug-06	**16.59**	**63.33**	Naches	NIT-13 1-4
7-Aug-06	**13.32**	**61.30**	Naches	NIT-13 5-8"
6-Aug-06	**29.64**	**263.57**	Naches	NIT-130 1-4
6-Aug-06	**51.10**	**121.05**	Naches	NIT-130 5-8
6-Aug-06	**77.86**	**520.72**	Naches	NIT-131 1-4
6-Aug-06	**61.56**	**349.99**	Naches	NIT-131 5-8
6-Aug-06	**29.92**	**177.93**	Naches	NIT-132 1-4
6-Aug-06	**10.12**	**23.79**	Naches	NIT-132 5-8
6-Aug-06	**22.91**	**110.56**	Naches	NIT-133 1-4
7-Aug-06	**15.70**	**38.39**	Naches	NIT-14 1-4
7-Aug-06	**28.60**	**39.65**	Naches	NIT-14 1-4"
7-Aug-06	**18.88**	**32.47**	Naches	NIT-14 5-8
7-Aug-06	**17.25**	**34.59**	Naches	NIT-14 5-8"
7-Aug-06	**14.39**	**50.97**	Naches	NIT-15 1-4
7-Aug-06	**14.35**	**67.04**	Naches	NIT-15 5-8
7-Aug-06	**22.71**	**134.41**	Naches	NIT-16 1-4
7-Aug-06	**33.04**	**70.37**	Naches	NIT-16 5-8
7-Aug-06	**46.88**	**214.07**	Naches	NIT-17 1-4"
6-Aug-06	**31.96**	**46.32**	Naches	NIT-17 5-8
7-Aug-06	**34.60**	**280.26**	Naches	NIT-18 1-4
7-Aug-06	**100.32**	**587.75**	Naches	NIT-18 5-8
7-Aug-06	**13.57**	**41.36**	Naches	NIT-19 1-4
7-Aug-06	**16.57**	**87.81**	Naches	NIT-19 5-8
7-Aug-06	**13.59**	**49.64**	Naches	NIT-2 1-4
7-Aug-06	**23.38**	**92.99**	Naches	NIT-2 5-8
7-Aug-06	**43.55**	**232.29**	Naches	NIT-20 1-4
6-Aug-06	**36.61**	**27.50**	Naches	NIT-20 5-8
7-Aug-06	**42.96**	**307.69**	Naches	NIT-21 1-4
7-Aug-06	**25.60**	**43.62**	Naches	NIT-21 5-8
7-Aug-06	**36.40**	**221.45**	Naches	NIT-22 1-4
7-Aug-06	**101.63**	**121.16**	Naches	NIT-22 5-8
6-Aug-06	**15.04**	**35.11**	Naches	NIT-23 1-4
6-Aug-06	**12.44**	**15.12**	Naches	NIT-23 5-8
6-Aug-06	**9.62**	**29.29**	Naches	NIT-24 1-4
6-Aug-06	**16.21**	**32.47**	Naches	NIT-24 5-8
6-Aug-06	**15.55**	**38.15**	Naches	NIT-25 1-4

Date	As	Pb	Location	Sample ID
6-Aug-06	**10.11**	**17.32**	Naches	NIT-25 5-8
7-Aug-06	**10.98**	**37.23**	Naches	NIT-26 1-4
7-Aug-06	**8.91**	**14.01**	Naches	NIT-26 5-8
7-Aug-06	**49.16**	**262.41**	Naches	NIT-27 1-4
7-Aug-06	**78.10**	**100.97**	Naches	NIT-27 5-8
7-Aug-06	**42.99**	**473.29**	Naches	NIT-28 1-4
6-Aug-06	**68.10**	**30.48**	Naches	NIT-28 5-8
7-Aug-06	**74.34**	**582.43**	Naches	NIT-29 1-4
7-Aug-06	**80.22**	**523.57**	Naches	NIT-29 1-4
6-Aug-06	**118.57**	**387.29**	Naches	NIT-29 5-8
7-Aug-06	**8.59**	**14.22**	Naches	NIT-3 1-4"
7-Aug-06	**81.59**	**299.89**	Naches	NIT-3 5-8"
7-Aug-06	**9.32**	**20.09**	Naches	NIT-30 1-4
7-Aug-06	**14.00**	**22.66**	Naches	NIT-30 5-8
6-Aug-06	**13.72**	**30.89**	Naches	NIT-31 1-4
7-Aug-06	**13.00**	**18.74**	Naches	NIT-31 5-8
7-Aug-06	**11.86**	**34.50**	Naches	NIT-32 1-4
7-Aug-06	**10.95**	**20.38**	Naches	NIT-32 5-8
7-Aug-06	**11.85**	**42.99**	Naches	NIT-33 1-4
6-Aug-06	**13.14**	**29.94**	Naches	NIT-33 5-8
6-Aug-06	**45.17**	**362.38**	Naches	NIT-34 1-4
6-Aug-06	**116.64**	**596.87**	Naches	NIT-34 5-8
6-Aug-06	**38.43**	**388.73**	Naches	NIT-35 1-4
6-Aug-06	**110.92**	**706.98**	Naches	NIT-35 5-8
6-Aug-06	**10.01**	**19.20**	Naches	NIT-36 1-4
6-Aug-06	**56.30**	**117.66**	Naches	NIT-36 5-8
6-Aug-06	**20.74**	**133.95**	Naches	NIT-37 1-4
6-Aug-06	**23.92**	**91.99**	Naches	NIT-37 5-8
6-Aug-06	**13.33**	**69.43**	Naches	NIT-38 1-4
6-Aug-06	**14.32**	**50.02**	Naches	NIT-38 5-8
6-Aug-06	**12.11**	**18.64**	Naches	NIT-39 1-4
6-Aug-06	**10.04**	**15.81**	Naches	NIT-39 5-8
7-Aug-06	**36.45**	**238.73**	Naches	NIT-4 1-4
7-Aug-06	**94.78**	**625.58**	Naches	NIT-4 5-8
6-Aug-06	**10.53**	**13.38**	Naches	NIT-40 1-4
6-Aug-06	**8.61**	**10.52**	Naches	NIT-40 5-8
6-Aug-06	**9.48**	**28.79**	Naches	NIT-41 1-4
6-Aug-06	**10.16**	**27.71**	Naches	NIT-41 5-8
7-Aug-06	**11.94**	**48.37**	Naches	NIT-42 1-4
7-Aug-06	**16.81**	**42.69**	Naches	NIT-42 5-8
7-Aug-06	**31.90**	**142.49**	Naches	NIT-43 1-4
7-Aug-06	**39.36**	**115.92**	Naches	NIT-43 5-8
7-Aug-06	**13.62**	**22.01**	Naches	NIT-44 1-4
6-Aug-06	**12.16**	**22.51**	Naches	NIT-44 5-8

Date	As	Pb	Location	Sample ID
7-Aug-06	**13.25**	**69.89**	Naches	NIT-45 1-4
7-Aug-06	**16.90**	**129.30**	Naches	NIT-46 1-4
6-Aug-06	**38.88**	**258.84**	Naches	NIT-46 5-8
7-Aug-06	**19.02**	**127.38**	Naches	NIT-47 1-4
6-Aug-06	**32.63**	**66.28**	Naches	NIT-47 5-8
7-Aug-06	**35.05**	**159.63**	Naches	NIT-48 1-4
7-Aug-06	**96.70**	**377.35**	Naches	NIT-48 5-8
6-Aug-06	**33.12**	**217.27**	Naches	NIT-49 1-4
6-Aug-06	**87.84**	**504.54**	Naches	NIT-49 5-8
7-Aug-06	**11.98**	**16.01**	Naches	NIT-5 1-4
7-Aug-06	**40.90**	**195.62**	Naches	NIT-5 5-8
7-Aug-06	**77.67**	**400.25**	Naches	NIT-50 1-4
7-Aug-06	**130.92**	**495.04**	Naches	NIT-50 5-8
6-Aug-06	**11.91**	**14.52**	Naches	NIT-51 1-4
6-Aug-06	**10.17**	**12.86**	Naches	NIT-51 5-8
7-Aug-06	**34.47**	**205.58**	Naches	NIT-52 1-4
7-Aug-06	**85.87**	**386.07**	Naches	NIT-52 5-8
6-Aug-06	**29.61**	**52.81**	Naches	NIT-53 1-4
6-Aug-06	**42.91**	**461.39**	Naches	NIT-53 1-4
6-Aug-06	**158.77**	**563.18**	Naches	NIT-53 5-8
6-Aug-06	**12.51**	**53.97**	Naches	NIT-54 1-4
6-Aug-06	**41.71**	**337.22**	Naches	NIT-54 5-8
6-Aug-06	**69.36**	**356.74**	Naches	NIT-55 5-8
7-Aug-06	**23.52**	**139.01**	Naches	NIT-56 1-4
6-Aug-06	**12.59**	**51.33**	Naches	NIT-57 1-4
6-Aug-06	**20.33**	**244.04**	Naches	NIT-57 5-8
6-Aug-06	**22.82**	**202.62**	Naches	NIT-58 1-4
7-Aug-06	**36.71**	**171.45**	Naches	NIT-58 5-8
6-Aug-06	**11.26**	**44.50**	Naches	NIT-59 1-4
6-Aug-06	**121.26**	**1249.45**	Naches	NIT-59 5-8
7-Aug-06	**36.23**	**129.49**	Naches	NIT-6 1-4
7-Aug-06	**84.86**	**155.33**	Naches	NIT-6 5-8
6-Aug-06	**37.24**	**206.25**	Naches	NIT-60 1-4
7-Aug-06	**123.61**	**651.70**	Naches	NIT-60 5-8
7-Aug-06	**32.92**	**473.81**	Naches	NIT-61 1-4
6-Aug-06	**38.29**	**17.31**	Naches	NIT-61 5-8
6-Aug-06	**9.35**	**11.93**	Naches	NIT-62 1-4
7-Aug-06	**36.78**	**166.85**	Naches	NIT-62 5-8
6-Aug-06	**12.70**	**71.18**	Naches	NIT-63 1-4
6-Aug-06	**47.43**	**232.46**	Naches	NIT-63 5-8
6-Aug-06	**14.61**	**96.79**	Naches	NIT-64 1-4
6-Aug-06	**110.27**	**541.14**	Naches	NIT-64 5-8
6-Aug-06	**13.38**	**21.08**	Naches	NIT-65 1-4
6-Aug-06	**45.20**	**174.58**	Naches	NIT-65 5-8

Date	As	Pb	Location	Sample ID
6-Aug-06	**11.72**	**22.40**	Naches	NIT-66 1-4
6-Aug-06	**8.17**	**10.51**	Naches	NIT-66 5-8
6-Aug-06	**66.02**	**331.07**	Naches	NIT-67 1-4
6-Aug-06	**91.02**	**503.71**	Naches	NIT-67 5-8
6-Aug-06	**48.45**	**224.32**	Naches	NIT-68 1-4
6-Aug-06	**20.36**	**24.70**	Naches	NIT-68 5-8
6-Aug-06	**41.53**	**459.69**	Naches	NIT-69 1-4
6-Aug-06	**44.28**	**52.61**	Naches	NIT-69 5-8
7-Aug-06	**19.30**	**148.32**	Naches	NIT-7 1-4"
7-Aug-06	**67.83**	**524.06**	Naches	NIT-7 5-8"
6-Aug-06	**23.99**	**255.32**	Naches	NIT-70 1-4
6-Aug-06	**37.43**	**62.46**	Naches	NIT-70 5-8
6-Aug-06	**77.06**	**479.10**	Naches	NIT-71 1-4
6-Aug-06	**39.15**	**66.53**	Naches	NIT-71 5-8
6-Aug-06	**26.56**	**137.69**	Naches	NIT-72 1-4
6-Aug-06	**88.17**	**70.00**	Naches	NIT-72 5-8
6-Aug-06	**42.90**	**243.73**	Naches	NIT-73 1-4
6-Aug-06	**65.51**	**39.22**	Naches	NIT-73 5-8
6-Aug-06	**57.76**	**363.54**	Naches	NIT-74 1-4
6-Aug-06	**72.52**	**465.11**	Naches	NIT-74 5-8
6-Aug-06	**23.60**	**271.29**	Naches	NIT-75 1-4
6-Aug-06	**58.44**	**65.52**	Naches	NIT-75 5-8
6-Aug-06	**27.51**	**438.88**	Naches	NIT-76 1-4
6-Aug-06	**39.42**	**22.76**	Naches	NIT-76 5-8
6-Aug-06	**35.93**	**415.42**	Naches	NIT-77 1-4
6-Aug-06	**68.63**	**170.84**	Naches	NIT-77 5-8
6-Aug-06	**61.02**	**465.24**	Naches	NIT-78 1-4
6-Aug-06	**79.58**	**202.50**	Naches	NIT-78 5-8
6-Aug-06	**56.76**	**321.13**	Naches	NIT-79 1-4
6-Aug-06	**55.98**	**31.64**	Naches	NIT-79 5-8
7-Aug-06	**8.18**	**10.21**	Naches	NIT-8 1-4
7-Aug-06	**88.68**	**573.24**	Naches	NIT-8 5-8"
6-Aug-06	**59.51**	**448.43**	Naches	NIT-80 1-4
6-Aug-06	**108.70**	**352.01**	Naches	NIT-80 5-8
6-Aug-06	**74.06**	**546.24**	Naches	NIT-81 1-4
6-Aug-06	**84.24**	**381.20**	Naches	NIT-81 5-8
6-Aug-06	**73.46**	**402.46**	Naches	NIT-82 1-4
6-Aug-06	**77.26**	**243.53**	Naches	NIT-82 5-8
6-Aug-06	**33.22**	**409.55**	Naches	NIT-83 1-4
6-Aug-06	**40.96**	**29.71**	Naches	NIT-83 5-8
6-Aug-06	**37.34**	**486.85**	Naches	NIT-84 1-4
6-Aug-06	**74.55**	**37.59**	Naches	NIT-84 5-8
6-Aug-06	**106.97**	**546.34**	Naches	NIT-85 1-4
6-Aug-06	**84.57**	**225.90**	Naches	NIT-85 5-8

Date	As	Pb	Location	Sample ID
6-Aug-06	**13.57**	**58.45**	Naches	NIT-86 1-4
6-Aug-06	**14.67**	**23.70**	Naches	NIT-86 5-8
6-Aug-06	**64.67**	**477.27**	Naches	NIT-87 1-4
6-Aug-06	**146.25**	**535.91**	Naches	NIT-87 5-8
6-Aug-06	**26.27**	**51.13**	Naches	NIT-88 1-4
6-Aug-06	**35.71**	**110.13**	Naches	NIT-88 5-8
6-Aug-06	**51.32**	**232.64**	Naches	NIT-89 1-4
6-Aug-06	**77.43**	**11.14**	Naches	NIT-89 5-8
7-Aug-06	**33.08**	**260.47**	Naches	NIT-9 1-4"
7-Aug-06	**47.07**	**13.92**	Naches	NIT-9 5-8
6-Aug-06	**104.79**	**389.44**	Naches	NIT-90 1-4
6-Aug-06	**65.20**	**31.90**	Naches	NIT-90 5-8
6-Aug-06	**86.79**	**742.64**	Naches	NIT-91 1-4
6-Aug-06	**126.39**	**27.98**	Naches	NIT-91 5-8
6-Aug-06	**13.99**	**66.55**	Naches	NIT-92 1-4
6-Aug-06	**11.56**	**25.29**	Naches	NIT-92 5-8
6-Aug-06	**44.51**	**428.26**	Naches	NIT-93 1-4
6-Aug-06	**58.56**	**101.52**	Naches	NIT-93 5-8
6-Aug-06	**57.78**	**411.73**	Naches	NIT-94 1-4
6-Aug-06	**99.21**	**227.46**	Naches	NIT-94 5-8
6-Aug-06	**47.12**	**418.89**	Naches	NIT-95 1-4
6-Aug-06	**61.99**	**74.74**	Naches	NIT-95 5-8
6-Aug-06	**27.14**	**423.35**	Naches	NIT-96 1-4
6-Aug-06	**96.32**	**390.23**	Naches	NIT-96 5-8
6-Aug-06	**16.59**	**105.46**	Naches	NIT-97 1-4
6-Aug-06	**43.15**	**12.85**	Naches	NIT-97 5-8
6-Aug-06	**50.64**	**344.66**	Naches	NIT-98 1-4
6-Aug-06	**87.46**	**20.21**	Naches	NIT-98 5-8
6-Aug-06	**39.34**	**302.50**	Naches	NIT-99 1-4
6-Aug-06	**47.34**	**204.08**	Naches	NIT-99 5-8
Average	**47.53**	**226.81**		
Max	**186.20**	**1249.45**		

Table 5-2: Post-Remediation Samples

Date	As	Pb	Location	Sample ID
7-Aug-06	**15.73**	**10.96**	Naches	NIM-1 1s
7-Aug-06	**12.72**	**11.33**	Naches	NIM-1 2c
7-Aug-06	**19.11**	**21.21**	Naches	NIM-1 3s
7-Aug-06	**11.23**	**10.67**	Naches	NIM-1 4s
7-Aug-06	**11.34**	**10.80**	Naches	NIM-1 5c
7-Aug-06	**15.87**	**10.09**	Naches	NIM-1 6s
7-Aug-06	**11.70**	**10.24**	Naches	NIM-1 7c

Date	As	Pb	Location	Sample ID
7-Aug-06	**10.08**	**10.62**	Naches	NIM-1 8s
7-Aug-06	**17.78**	**46.21**	Naches	NIM-1 9c
7-Aug-06	**19.04**	**91.34**	Naches	NIM-1 10s
7-Aug-06	**18.46**	**65.44**	Naches	NIM-1 11c
7-Aug-06	**12.74**	**52.08**	Naches	NIM-1 12s
7-Aug-06	**15.77**	**10.17**	Naches	NIM-2 1c
7-Aug-06	**19.40**	**27.61**	Naches	NIM-2 2s
7-Aug-06	**19.07**	**24.05**	Naches	NIM-2 3c
7-Aug-06	**14.43**	**10.31**	Naches	NIM-2 4s
7-Aug-06	**14.02**	**10.34**	Naches	NIM-2 5c
7-Aug-06	**13.04**	**55.46**	Naches	NIM-2 6s
7-Aug-06	**10.57**	**36.06**	Naches	NIM-2 7c
7-Aug-06	**23.90**	**43.14**	Naches	NIM-2 8s
8-Aug-06	**12.45**	**20.09**	Naches	NIM-3 1
8-Aug-06	**16.21**	**38.87**	Naches	NIM-3 2
8-Aug-06	**14.31**	**19.36**	Naches	NIM-3 3
8-Aug-06	**19.48**	**19.79**	Naches	NIM-3 4
8-Aug-06	**16.77**	**49.67**	Naches	NIM-3 5
8-Aug-06	**16.05**	**23.13**	Naches	NIM-3 6
8-Aug-06	**14.45**	**32.65**	Naches	NIM-3 7
8-Aug-06	**14.67**	**116.87**	Naches	NIM-3 8
8-Aug-06	**10.19**	**19.87**	Naches	NIM-4 1
8-Aug-06	**19.85**	**20.23**	Naches	NIM-4 2
8-Aug-06	**18.36**	**41.33**	Naches	NIM-4 3
8-Aug-06	**16.26**	**39.43**	Naches	NIM-4 4
8-Aug-06	**15.65**	**136.81**	Naches	NIM-4 5
8-Aug-06	**19.89**	**29.66**	Naches	NIM-7 1
8-Aug-06	**14.08**	**19.42**	Naches	NIM-7 2
8-Aug-06	**14.48**	**18.82**	Naches	NIM-7 3
8-Aug-06	**18.01**	**57.50**	Naches	NIM-7 4
8-Aug-06	**17.69**	**78.19**	Naches	NIM-7 5
8-Aug-06	**16.90**	**72.51**	Naches	NIM-5 1
8-Aug-06	**14.95**	**31.48**	Naches	NIM-6 1
8-Aug-06	**15.28**	**36.55**	Naches	NIM-8 1
8-Aug-06	**21.99**	**70.27**	Naches	NIM-8 2
8-Aug-06	**15.84**	**41.37**	Naches	NIM-7 6
8-Aug-06	**18.83**	**27.47**	Naches	NIM-12 1
8-Aug-06	**14.79**	**19.16**	Naches	NIM-12 2
8-Aug-06	**13.81**	**18.52**	Naches	NIM-12 3
8-Aug-06	**19.23**	**19.08**	Naches	NIM-11 1
8-Aug-06	**14.19**	**26.08**	Naches	NIM-11 2
8-Aug-06	**17.79**	**43.42**	Naches	NIM-11 3
8-Aug-06	**16.03**	**103.73**	Naches	NIM-11 4
8-Aug-06	**22.29**	**73.78**	Naches	NIM-11 5

Date	As	Pb	Location	Sample ID
8-Aug-06	**15.74**	**63.53**	Naches	NIM-11 6
8-Aug-06	**14.80**	**19.63**	Naches	NIM-12 4
8-Aug-06	**17.30**	**106.15**	Naches	NIM-12 5
8-Aug-06	**18.89**	**60.24**	Naches	NIM-12 6
8-Aug-06	**12.96**	**19.54**	Naches	NIM-13 1
8-Aug-06	**17.10**	**19.16**	Naches	NIM-13 2
8-Aug-06	**17.33**	**19.18**	Naches	NIM-13 3
8-Aug-06	**14.78**	**83.45**	Naches	NIM-13 4
8-Aug-06	**18.35**	**33.40**	Naches	NIM-13 5
8-Aug-06	**14.89**	**22.86**	Naches	NIM-13 6
8-Aug-06	**23.65**	**40.80**	Naches	NIM-15 1
8-Aug-06	**13.00**	**58.26**	Naches	NIM-15 2
8-Aug-06	**12.10**	**162.01**	Naches	NIM-15 3
8-Aug-06	**12.11**	**58.24**	Naches	NIM-15 4
8-Aug-06	**12.86**	**18.87**	Naches	NIM-15 5
8-Aug-06	**16.72**	**19.23**	Naches	NIM-15 6
8-Aug-06	**17.23**	**19.15**	Naches	NIM-14 1
8-Aug-06	**17.12**	**19.32**	Naches	NIM-14 2
8-Aug-06	**11.39**	**18.69**	Naches	NIM-14 3
8-Aug-06	**19.47**	**72.86**	Naches	NIM-14 4
8-Aug-06	**15.68**	**47.30**	Naches	NIM-14 5
8-Aug-06	**15.78**	**53.73**	Naches	NIM-14 6
8-Aug-06	**22.05**	**18.82**	Naches	NIM-15 7
8-Aug-06	**14.04**	**65.08**	Naches	NIM-15 8
8-Aug-06	**17.31**	**38.65**	Naches	NIM-15 9
8-Aug-06	**18.86**	**34.70**	Naches	NIM-15 10
8-Aug-06	**19.49**	**21.34**	Naches	NIM-16 1
8-Aug-06	**16.23**	**19.24**	Naches	NIM-16 2
8-Aug-06	**20.13**	**19.52**	Naches	NIM-16 3
8-Aug-06	**10.55**	**26.27**	Naches	NIM-16 4
8-Aug-06	**15.51**	**18.14**	Naches	NIM-16 5
8-Aug-06	**14.74**	**19.88**	Naches	NIM-16 6
9-Aug-06	**13.74**	**11.31**	Naches	NIM-17 1s
9-Aug-06	**11.20**	**14.54**	Naches	NIM-17 2c
9-Aug-06	**16.88**	**11.17**	Naches	NIM-17 3s
9-Aug-06	**17.97**	**11.02**	Naches	NIM-17 4c
9-Aug-06	**21.99**	**11.13**	Naches	NIM-17 5s
9-Aug-06	**16.35**	**10.17**	Naches	NIM-17 6c
9-Aug-06	**15.35**	**46.89**	Naches	NIM-17 7s
9-Aug-06	**12.57**	**41.08**	Naches	NIM-17 8c
9-Aug-06	**8.51**	**11.16**	Naches	Topsoil
9-Aug-06	**19.87**	**12.08**	Naches	NIM-18 1s
9-Aug-06	**8.56**	**11.02**	Naches	NIM-18 2c
9-Aug-06	**15.96**	**19.11**	Naches	NIM-18 3s

Date	As	Pb	Location	Sample ID
9-Aug-06	**20.11**	**11.20**	Naches	NIM-18 4c
9-Aug-06	**14.31**	**22.29**	Naches	NIM-18 5s
9-Aug-06	**19.05**	**11.02**	Naches	NIM-18 6c
9-Aug-06	**16.73**	**11.67**	Naches	NIM-18 7s
9-Aug-06	**17.39**	**10.22**	Naches	NIM-18 8c
9-Aug-06	**12.49**	**11.80**	Naches	NIM-19 1s
9-Aug-06	**11.19**	**10.99**	Naches	NIM-19 2c
9-Aug-06	**8.30**	**10.48**	Naches	NIM-19 3s
9-Aug-06	**8.80**	**10.76**	Naches	NIM-19 4c
9-Aug-06	**17.44**	**18.29**	Naches	NIM-19 5s
9-Aug-06	**12.27**	**10.70**	Naches	NIM-19 6c
9-Aug-06	**9.17**	**11.19**	Naches	NIM-19 7s
9-Aug-06	**8.99**	**11.01**	Naches	NIM-19 8c
9-Aug-06	**31.36**	**11.13**	Naches	NIM-20 2c
9-Aug-06	**15.14**	**10.73**	Naches	NIM-20 2c
9-Aug-06	**13.47**	**10.11**	Naches	NIM-20 3s
9-Aug-06	**11.71**	**11.29**	Naches	NIM-20 4c
9-Aug-06	**19.80**	**10.63**	Naches	NIM-20 5s
9-Aug-06	**15.19**	**12.54**	Naches	NIM-20 6c
9-Aug-06	**8.74**	**10.77**	Naches	NIM-20 7s
9-Aug-06	**9.58**	**12.89**	Naches	NIM-20 8c
10-Aug-06	**16.90**	**23.09**	Naches	NIM-21 1s
10-Aug-06	**17.83**	**97.69**	Naches	NIM-21 2c
10-Aug-06	**17.87**	**21.96**	Naches	NIM-21 3s
10-Aug-06	**13.95**	**13.89**	Naches	NIM-21 4c
10-Aug-06	**12.02**	**11.79**	Naches	NIM-22 1s
10-Aug-06	**14.59**	**30.08**	Naches	NIM-22 2c
10-Aug-06	**12.26**	**12.57**	Naches	NIM-22 3s
10-Aug-06	**10.88**	**20.11**	Naches	NIM-22 4c
10-Aug-06	**18.31**	**16.10**	Naches	NIM-23 1s
10-Aug-06	**16.56**	**10.61**	Naches	NIM-23 2c
10-Aug-06	**11.03**	**24.41**	Naches	NIM-23 3s
10-Aug-06	**13.54**	**19.54**	Naches	NIM-23 4c
10-Aug-06	**18.54**	**14.37**	Naches	NIM-24 1s
10-Aug-06	**8.34**	**12.19**	Naches	NIM-24 2c
10-Aug-06	**10.84**	**10.07**	Naches	NIM-24 3s
10-Aug-06	**11.01**	**9.44**	Naches	NIM-24 4c
10-Aug-06	**18.58**	**10.55**	Naches	NIM-24 5s
10-Aug-06	**9.33**	**12.58**	Naches	NIM-24 6c
10-Aug-06	**18.43**	**43.13**	Naches	NIM-24 7s
10-Aug-06	**19.78**	**36.60**	Naches	NIM-24 8c
10-Aug-06	**18.72**	**10.59**	Naches	NIM-25 1s
10-Aug-06	**12.13**	**10.92**	Naches	NIM-25 2c
10-Aug-06	**19.77**	**11.08**	Naches	NIM-25 3s

Date	As	Pb	Location	Sample ID
10-Aug-06	**8.13**	**10.00**	Naches	NIM-25 4c
11-Aug-06	**17.66**	**17.94**	Naches	NIM-26 1s
11-Aug-06	**15.06**	**32.27**	Naches	NIM-26 2c
11-Aug-06	**12.56**	**14.81**	Naches	NIM-26 3s
11-Aug-06	**17.50**	**15.30**	Naches	NIM-26 4c
11-Aug-06	**16.20**	**11.54**	Naches	NIM-27 1s
11-Aug-06	**14.37**	**10.95**	Naches	NIM-27 2c
11-Aug-06	**11.53**	**11.83**	Naches	NIM-27 3s
11-Aug-06	**13.55**	**19.59**	Naches	NIM-27 4c
11-Aug-06	**14.43**	**10.41**	Naches	NIM-28 1s
11-Aug-06	**15.67**	**19.09**	Naches	NIM-28 2c
11-Aug-06	**14.75**	**11.37**	Naches	NIM-28 3s
11-Aug-06	**17.51**	**11.99**	Naches	NIM-28 4c
11-Aug-06	**16.81**	**13.29**	Naches	NIM-29 1s
11-Aug-06	**19.20**	**11.01**	Naches	NIM-29 2c
11-Aug-06	**10.92**	**14.73**	Naches	NIM-30 1s
11-Aug-06	**18.85**	**11.28**	Naches	NIM-29 3s
11-Aug-06	**20.35**	**15.62**	Naches	NIM-29 4c
11-Aug-06	**11.10**	**16.76**	Naches	NIM-30 2c
11-Aug-06	**13.87**	**56.26**	Naches	NIM-30 3s
11-Aug-06	**13.66**	**31.28**	Naches	NIM-30 4c
11-Aug-06	**14.43**	**17.57**	Naches	NIM-31 1s
11-Aug-06	**12.09**	**21.37**	Naches	NIM-31 2c
11-Aug-06	**17.64**	**40.27**	Naches	NIM-31 3s
11-Aug-06	**19.87**	**66.34**	Naches	NIM-31 4c
14-Aug-06	**15.52**	**11.59**	Naches	NIM-32 1c
14-Aug-06	**19.44**	**11.82**	Naches	NIM-32 2c
14-Aug-06	**14.88**	**38.01**	Naches	NIM-32 3c
14-Aug-06	**20.92**	**23.17**	Naches	NIM-32 4c
14-Aug-06	**15.65**	**16.08**	Naches	NIM-33 1c
14-Aug-06	**11.14**	**16.84**	Naches	NIM-33 2c
14-Aug-06	**15.94**	**43.40**	Naches	NIM-33 3c
14-Aug-06	**19.72**	**30.16**	Naches	NIM-33 4c
14-Aug-06	**10.13**	**11.54**	Naches	NIM-34 1c
14-Aug-06	**13.92**	**13.19**	Naches	NIM-34 2c
14-Aug-06	**11.45**	**21.93**	Naches	NIM-34 3c
14-Aug-06	**14.99**	**81.21**	Naches	NIM-34 4c
14-Aug-06	**13.60**	**14.29**	Naches	NIM-35 1s
14-Aug-06	**14.61**	**20.11**	Naches	NIM-35 2c
14-Aug-06	**17.44**	**38.24**	Naches	NIM-35 3c
14-Aug-06	**14.89**	**56.00**	Naches	NIM-35 4c
14-Aug-06	**9.56**	**15.31**	Naches	NIM-36 1c
14-Aug-06	**31.34**	**11.58**	Naches	NIM-36 2c
14-Aug-06	**7.67**	**9.89**	Naches	NIM-36 3s

Date	As	Pb	Location	Sample ID
14-Aug-06	**9.46**	**12.16**	Naches	NIM-36 4c
14-Aug-06	**15.31**	**27.93**	Naches	NIM-37 1c
14-Aug-06	**12.34**	**11.57**	Naches	NIM-37 2c
14-Aug-06	**15.19**	**12.56**	Naches	NIM-37 3c
14-Aug-06	**16.23**	**11.43**	Naches	NIM-38 1c
14-Aug-06	**9.09**	**12.59**	Naches	NIM-38 2c
14-Aug-06	**10.76**	**10.90**	Naches	NIM-38 3c
14-Aug-06	**31.52**	**17.18**	Naches	NIM-39 1c
14-Aug-06	**22.29**	**29.49**	Naches	NIM-39 2c
14-Aug-06	**18.77**	**12.07**	Naches	NIM-39 3c
14-Aug-06	**17.04**	**15.50**	Naches	NIM-40 1c
14-Aug-06	**9.81**	**14.86**	Naches	NIM-40 2c
14-Aug-06	**18.42**	**11.73**	Naches	NIM-41 1c
14-Aug-06	**14.37**	**10.85**	Naches	NIM-41 2c
14-Aug-06	**14.50**	**12.97**	Naches	NIM-42 1c
14-Aug-06	**16.56**	**12.84**	Naches	NIM-42 2c
14-Aug-06	**13.49**	**12.94**	Naches	NIM-43 1c
14-Aug-06	**10.64**	**13.56**	Naches	NIM-43 2c
14-Aug-06	**17.03**	**21.51**	Naches	NIM-44 1c
14-Aug-06	**11.75**	**10.89**	Naches	NIM-44 2c
14-Aug-06	**13.80**	**11.10**	Naches	NIM-45 1s
14-Aug-06	**9.01**	**10.83**	Naches	NIM-45 2c
14-Aug-06	**8.31**	**11.06**	Naches	NIM-46 1s
14-Aug-06	**8.94**	**11.04**	Naches	NIM-46 2c
16-Aug-06	**9.07**	**11.71**	Naches	NIM-59 1c
16-Aug-06	**8.69**	**11.21**	Naches	NIM-59 2c
16-Aug-06	**8.99**	**11.99**	Naches	NIM-59 3c
16-Aug-06	**7.95**	**10.40**	Naches	NIM-59 4c
16-Aug-06	**9.21**	**15.16**	Naches	NIM-59 5c
16-Aug-06	**8.53**	**10.29**	Naches	NIM-59 6c
16-Aug-06	**9.51**	**13.02**	Naches	NIM-60 1c
16-Aug-06	**17.68**	**10.54**	Naches	NIM-60 2c
16-Aug-06	**16.65**	**11.43**	Naches	NIM-60 3c
16-Aug-06	**10.18**	**19.15**	Naches	NIM-60 4c
16-Aug-06	**8.54**	**10.48**	Naches	NIM-61 1s
16-Aug-06	**11.31**	**16.64**	Naches	NIM-61 2c
16-Aug-06	**19.05**	**26.46**	Naches	NIM-62 1c
16-Aug-06	**11.26**	**14.87**	Naches	NIM-62 2c
16-Aug-06	**27.60**	**59.71**	Naches	NIM-63 1c
16-Aug-06	**13.70**	**27.40**	Naches	NIM-63 2c
16-Aug-06	**11.70**	**45.62**	Naches	NIM-64 1c
16-Aug-06	**19.70**	**41.28**	Naches	NIM-64 2c
16-Aug-06	**17.54**	**29.94**	Naches	NIM-65 1c
16-Aug-06	**10.64**	**29.51**	Naches	NIM-65 2c

Date	As	Pb	Location	Sample ID
16-Aug-06	**15.33**	**11.64**	Naches	NIM-66 1c
16-Aug-06	**17.23**	**49.38**	Naches	NIM-66 2c
16-Aug-06	**9.63**	**14.29**	Naches	NIM-67 1c
16-Aug-06	**11.01**	**17.64**	Naches	NIM-67 2c
16-Aug-06	**12.14**	**18.78**	Naches	NIM-68 1c
16-Aug-06	**16.38**	**42.82**	Naches	NIM-68 2c
16-Aug-06	**10.09**	**11.48**	Naches	NIM-69 1c
16-Aug-06	**23.69**	**56.47**	Naches	NIM-69 2c
16-Aug-06	**12.48**	**22.42**	Naches	NIM-70 1c
16-Aug-06	**12.16**	**35.62**	Naches	NIM-70 2c
17-Aug-06	**16.38**	**20.16**	Naches	NIM-71 1c
17-Aug-06	**12.42**	**10.98**	Naches	NIM-71 2c
17-Aug-06	**12.22**	**35.08**	Naches	NIM-72 1c
17-Aug-06	**18.29**	**18.03**	Naches	NIM-72 2c
17-Aug-06	**36.65**	**27.98**	Naches	NIM-73 1c
17-Aug-06	**11.33**	**18.08**	Naches	NIM-73 2c
17-Aug-06	**16.61**	**14.86**	Naches	NIM-73 3c
17-Aug-06	**21.69**	**34.86**	Naches	NIM-74 1c
17-Aug-06	**13.68**	**40.14**	Naches	NIM-74 2c
17-Aug-06	**14.17**	**18.58**	Naches	NIM-75 1c
17-Aug-06	**27.13**	**11.75**	Naches	NIM-75 2c
17-Aug-06	**11.55**	**81.58**	Naches	NIM-76 1c
17-Aug-06	**12.21**	**75.66**	Naches	NIM-76 2c
17-Aug-06	**19.78**	**27.78**	Naches	NIM-77 1c
17-Aug-06	**14.54**	**16.64**	Naches	NIM-77 2c
17-Aug-06	**10.39**	**35.92**	Naches	NIM-77 3c
17-Aug-06	**11.66**	**20.57**	Naches	NIM-78 1c
17-Aug-06	**14.30**	**10.76**	Naches	NIM-78 2c
17-Aug-06	**12.21**	**29.36**	Naches	NIM-78 3c
17-Aug-06	**14.28**	**50.49**	Naches	NIM-79 1c
17-Aug-06	**12.74**	**10.75**	Naches	NIM-79 2c
17-Aug-06	**10.26**	**18.80**	Naches	NIM-80 1c
17-Aug-06	**14.55**	**15.90**	Naches	NIM-80 2c
17-Aug-06	**10.71**	**25.37**	Naches	NIM-81 1s
17-Aug-06	**10.84**	**24.01**	Naches	NIM-81 2c
17-Aug-06	**14.00**	**28.16**	Naches	NIM-82 1c
17-Aug-06	**15.72**	**19.75**	Naches	NIM-82 2c
17-Aug-06	**10.06**	**27.58**	Naches	NIM-83 1c
17-Aug-06	**30.07**	**35.27**	Naches	NIM-82 3c
17-Aug-06	**11.39**	**33.45**	Naches	NIM-83 2c
17-Aug-06	**16.73**	**15.19**	Naches	NIM-83 3c
17-Aug-06	**11.91**	**21.51**	Naches	NIM-84 1c
17-Aug-06	**12.62**	**11.50**	Naches	NIM-84 2c
17-Aug-06	**16.15**	**26.68**	Naches	NIM-84 3c

Date	As	Pb	Location	Sample ID
18-Aug-06	**11.36**	**37.67**	Naches	NEM-1 1
18-Aug-06	**12.37**	**30.66**	Naches	NEM-1 2
18-Aug-06	**15.76**	**13.67**	Naches	NEM-1 3
18-Aug-06	**11.93**	**14.01**	Naches	NEM-1 4
18-Aug-06	**11.97**	**29.02**	Naches	NEM-2 1
18-Aug-06	**10.90**	**21.62**	Naches	NEM-2 2
18-Aug-06	**10.31**	**11.22**	Naches	NEM-2 3
18-Aug-06	**10.87**	**33.41**	Naches	NEM-3 1
18-Aug-06	**11.62**	**62.93**	Naches	NEM-3 2
18-Aug-06	**19.14**	**41.20**	Naches	NEM-3 3
18-Aug-06	**16.87**	**19.14**	Naches	NEM-3 4
18-Aug-06	**11.68**	**36.90**	Naches	NEM-4 1
18-Aug-06	**12.50**	**58.20**	Naches	NEM-4 2
18-Aug-06	**14.92**	**70.47**	Naches	NEM-4 3
18-Aug-06	**18.42**	**18.78**	Naches	NEM-4 4
18-Aug-06	**16.42**	**105.67**	Naches	NEM-5 1
18-Aug-06	**19.78**	**190.61**	Naches	NEM-5 2
18-Aug-06	**18.11**	**36.08**	Naches	NEM-5 3
18-Aug-06	**11.13**	**11.84**	Naches	NEM-5 4
18-Aug-06	**12.36**	**102.59**	Naches	NEM-6
18-Aug-06	**20.40**	**88.41**	Naches	NEM-7
18-Aug-06	**11.93**	**59.00**	Naches	NEM-8
18-Aug-06	**12.92**	**31.22**	Naches	NEM-9
18-Aug-06	**10.66**	**114.04**	Naches	NEM-10
18-Aug-06	**19.87**	**37.34**	Naches	NEM-11
18-Aug-06	**12.50**	**39.21**	Naches	NEM-12
18-Aug-06	**39.19**	**57.59**	Naches	NEM-13
18-Aug-06	**14.79**	**50.77**	Naches	NEM-14
18-Aug-06	**15.91**	**130.18**	Naches	NEM-15
18-Aug-06	**16.83**	**45.61**	Naches	NEM-16
18-Aug-06	**16.17**	**66.65**	Naches	NEM-17
18-Aug-06	**11.41**	**34.79**	Naches	NEM-18
18-Aug-06	**12.45**	**51.64**	Naches	NEM-19
Average	**15.07**	**29.30**		
Max	**39.19**	**190.61**		

6.0 PROJECT SUMMARY

Soil samples collected at Naches Intermediate School during sampling events in 2005 and 2006 indicated lead and arsenic contamination existed in surface soils at concentrations above MTCA cleanup levels. Following excavation of large portions of the property, deep mixing technology was used to blend the contaminated surface soil with deeper clean soils. As a result, lead and arsenic concentrations at the site were spread throughout a four foot soil profile and the majority of soil on site no longer contains concentrations above MTCA cleanup levels. Though some samples still slightly exceed MTCA cleanup levels, statistical analysis was used to show that fewer than 10% of samples exceeded MTCA cleanup levels and none were twice the MTCA cleanup level. MTCA cleanup guidelines require no further action at a site when these conditions are met. Following remediation, the site was restored to its original condition.

7.0 APPENDICES

Appendix A: Figures

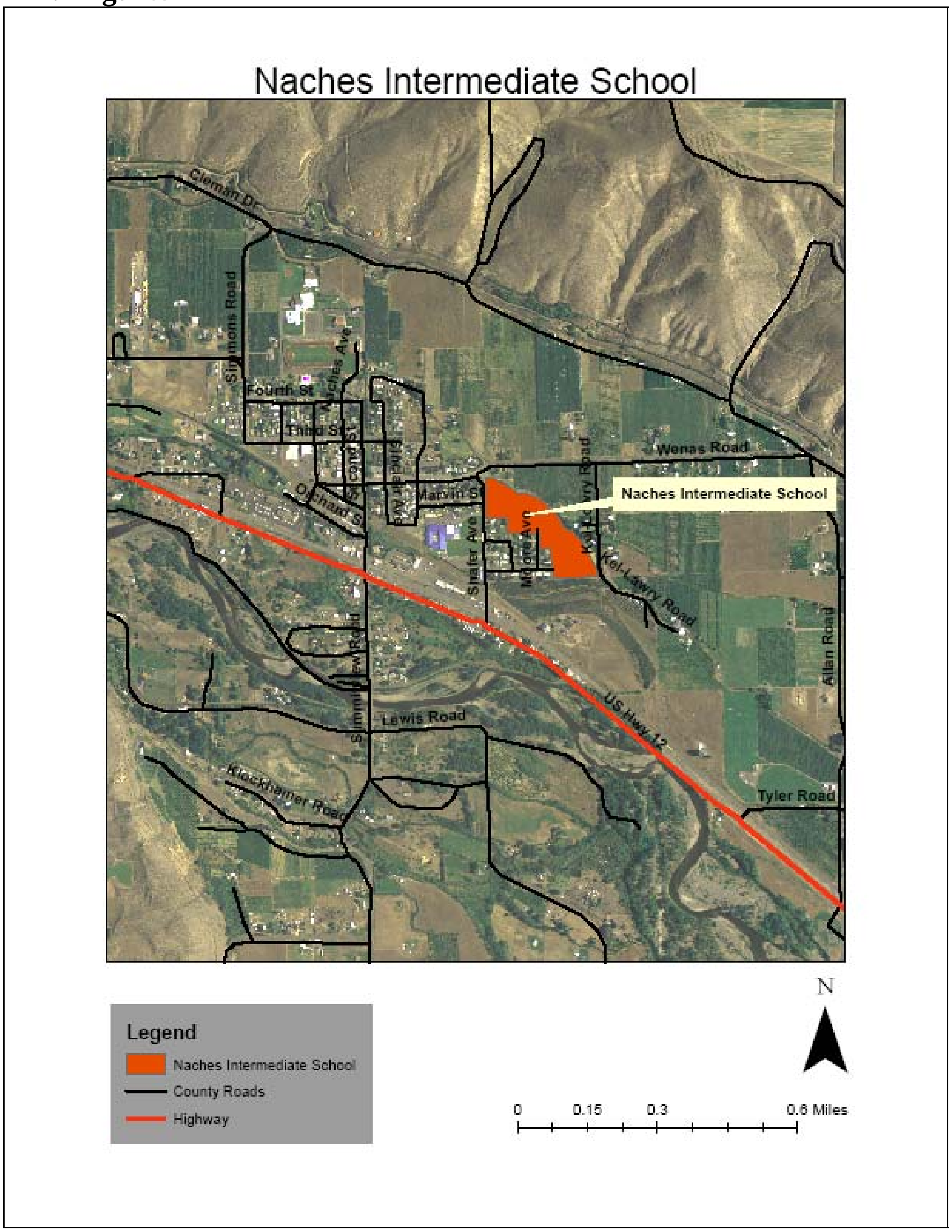


Figure F-1: Vicinity Map

Naches Intermediate School Pre-Remediation Arsenic Concentrations

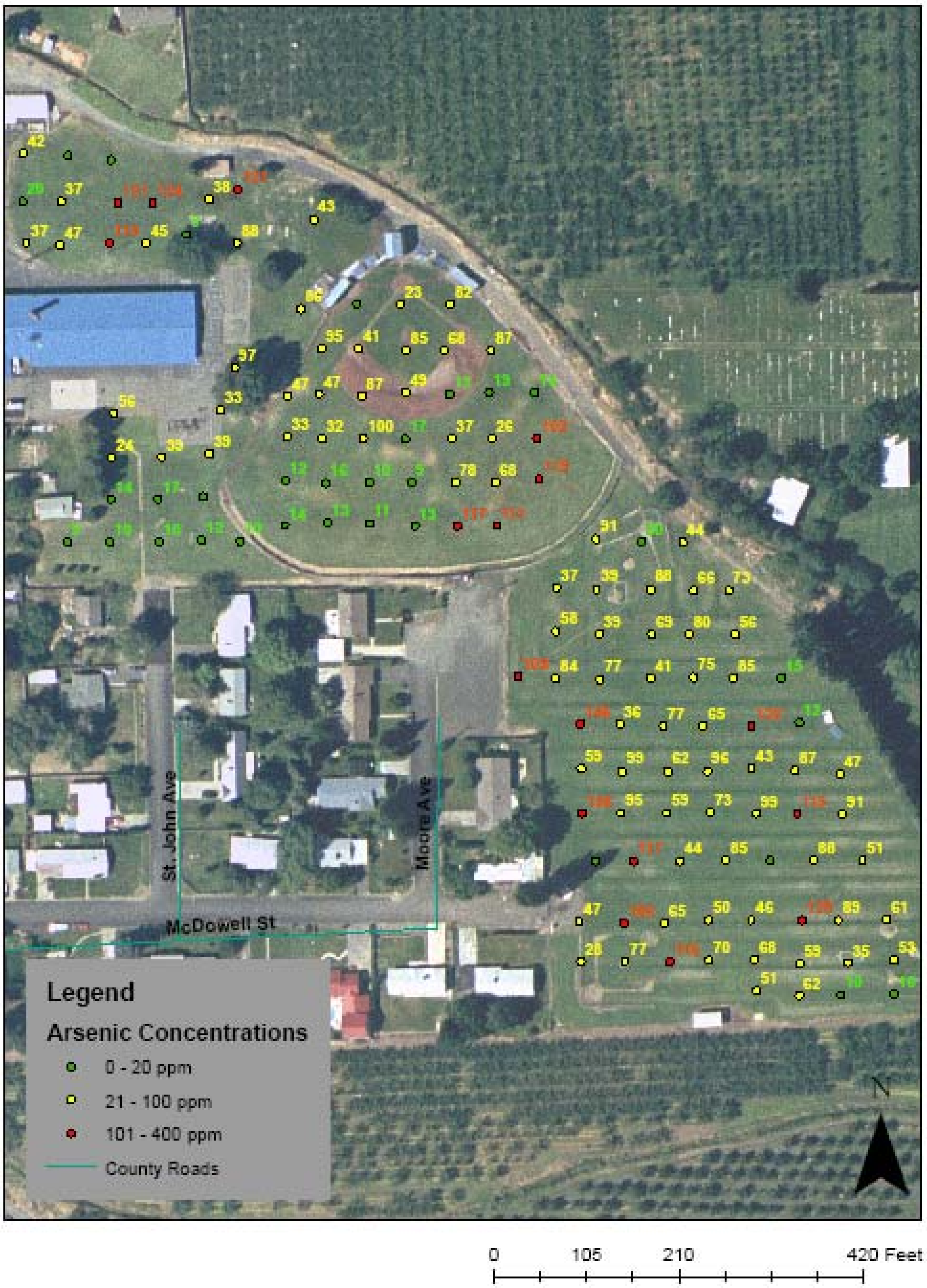


Figure F-2: Pre-Remediation Concentrations

Naches Intermediate School Post-Remediation Arsenic Concentrations

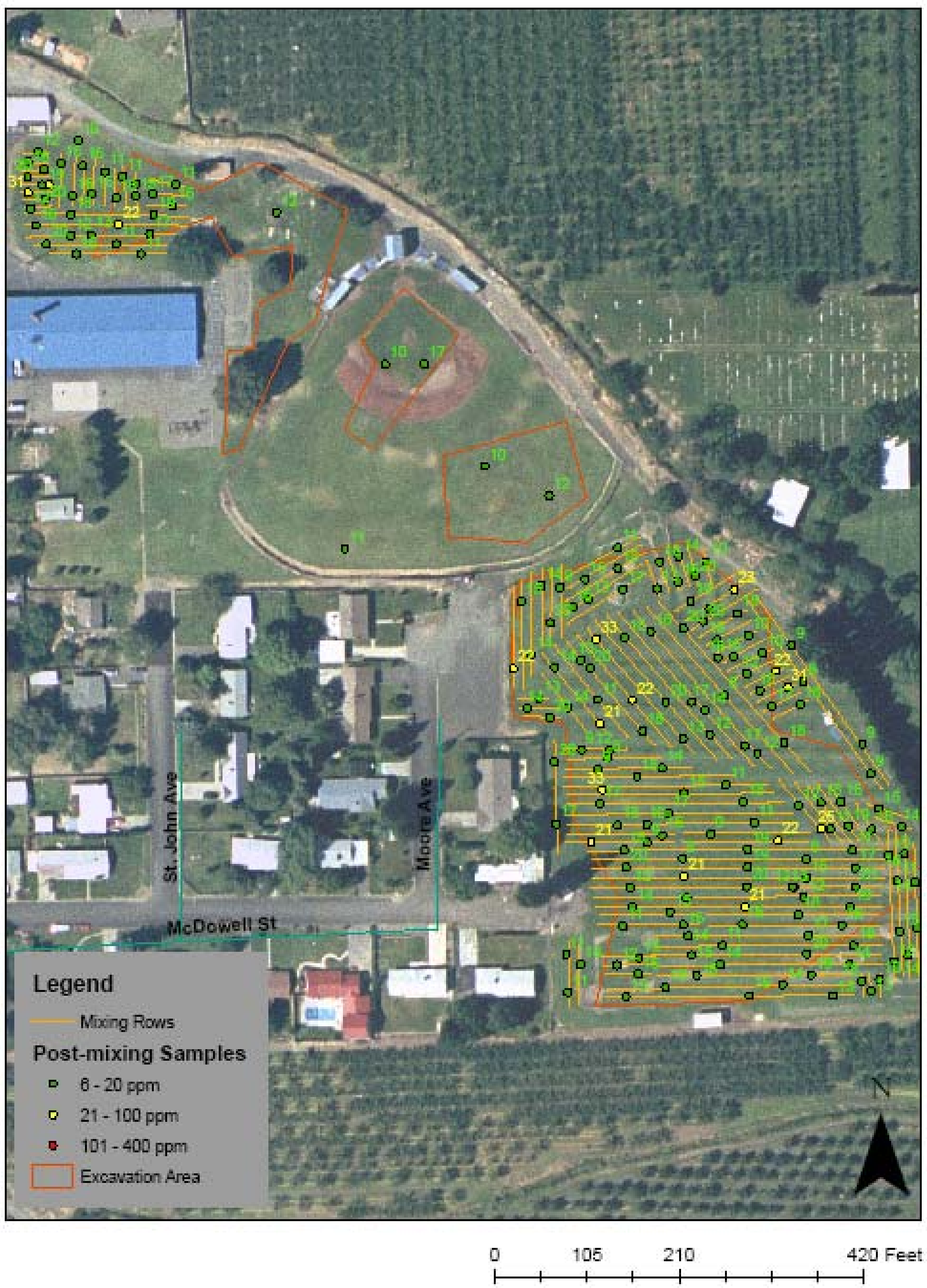


Figure F-3: Post-Remediation Concentrations

Appendix B: XRF USE

The summer 2006 area-wide contamination clean-up projects involved the collection and analysis of a vast 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

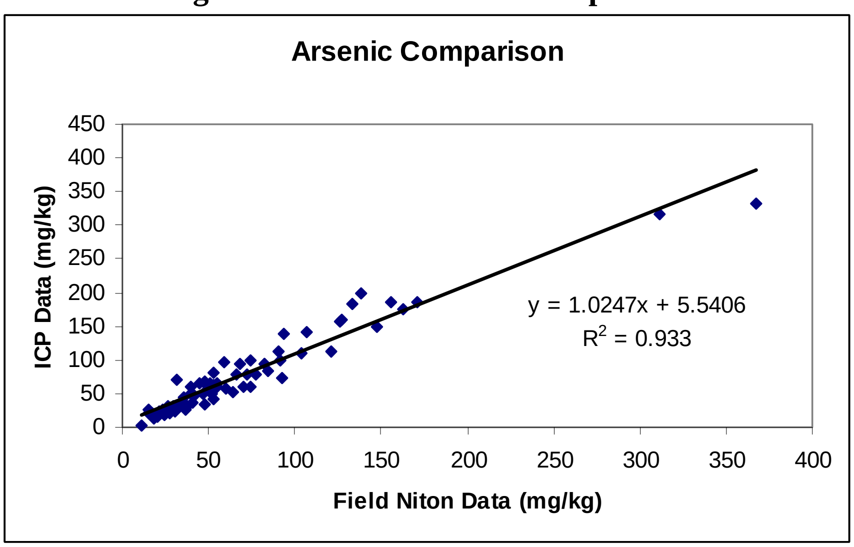
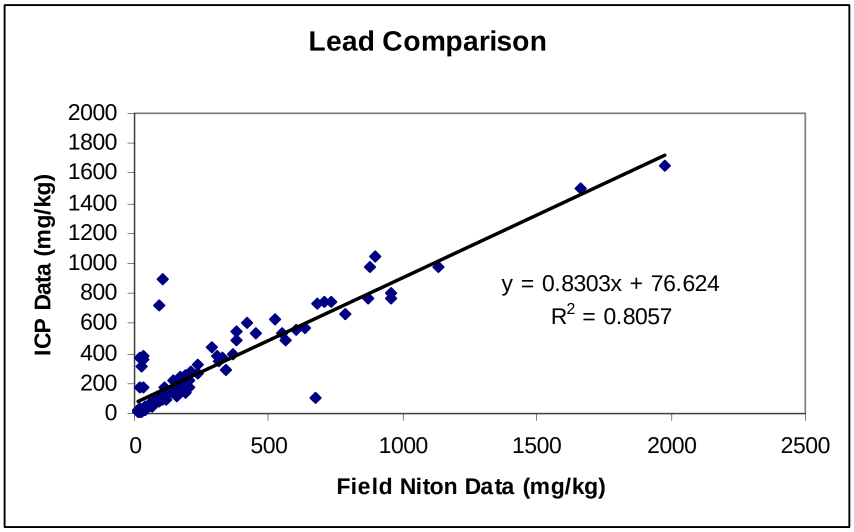


Figure B-2: 2002 Lead Comparison



During the summer 2006 projects, soil samples were collected and analyzed with the XRF instruments from a variety of locations. These locations included: undisturbed portions of the school playfields, sections of the playfields where initial soil excavations had occurred, and areas that had been processed by the deep mixer. As timely decision making was often required to keep the projects on schedule, the ability to assess the effectiveness of remediation activities with on-site soil analysis was invaluable to the overall success of the project. The XRF could determine concentrations of lead and arsenic in minutes. Sending samples for laboratory analysis at standard rates takes 2-3 weeks and would have drastically reduced the efficiency of remedial activities. Real-time results from these field analyses enabled project staff to make decisions such as whether the removal of additional soil was necessary or whether the barrel of the deep mixer should be raised to mix less soil or lowered to mix more.

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

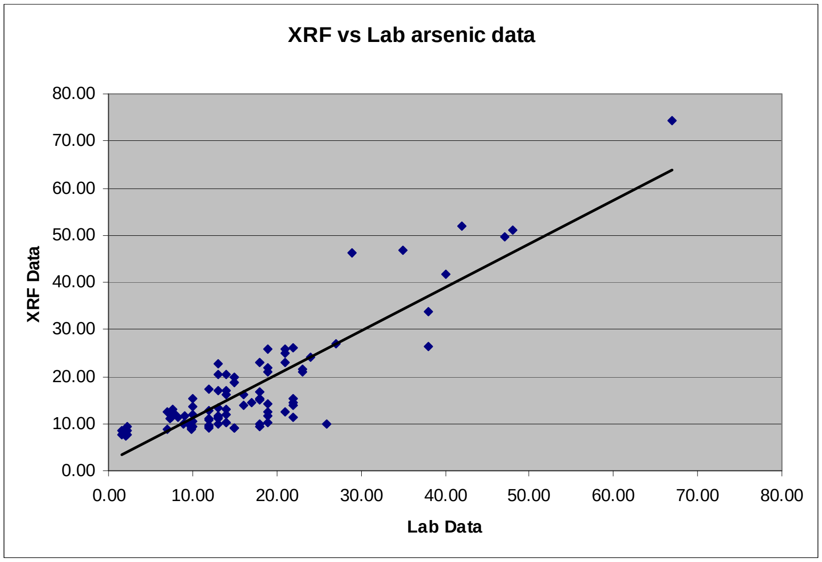
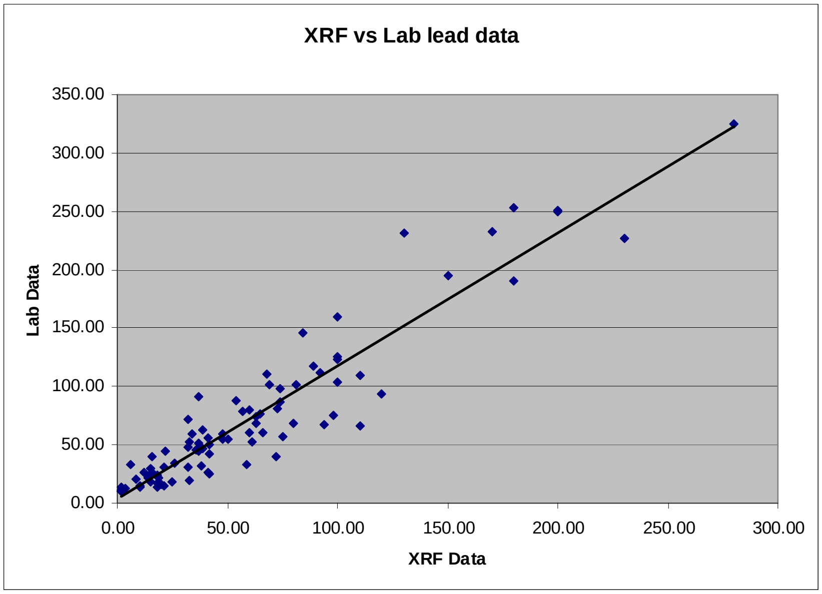


Figure B-4: 2006 Lead Comparison



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.

Finally, in addition to the time saving benefits of the XRF instruments, their use proved to be a cost effective option for sample analysis. Due to the area (total acreage) covered during the school remediation projects, a large number of samples were required to characterize site progress. Use of the instruments resulted in a significant reduction in the number of soil samples sent off for laboratory analysis at a cost of $62-$66 per sample. Therefore, instead of project money being spent on one time analyses, it was invested in a second XRF instrument which enabled remediation work to occur simultaneously in several locations. Not only has the instrument paid for itself over the course of a single summer, but it will now be available for use in many future projects.

Appendix C: Costs

Remediation costs for Naches Intermediate School were higher than anticipated for the following reasons:

- Heavy machinery caused cracks in the asphalt, as well as track marks in the soil, both requiring repair or restorative efforts.
- Contractors got too close to drainage areas and caused a clay storm sewer line to break.
- Additional work was needed on the playground to return the area to the original state.
- Soil export and topsoil import exceeded the bid amounts.
- Areas of large rock were encountered during the deep mixing process. If the mixing depth was reduced to avoid the rock, the mixing would not have been successful. Therefore, the import of clean topsoil was required to maintain a useable playing surface.
- Additional excavation and re-grading were required.

Naches Intermediate School Remediation Costs

Mobilization	
Soil Transport/Disposal	$51,800.00
Grading and Compaction	$25,800.00
Grading and Compaction	$25,800.00
Equipment Shipping/ Transport	$7,939.50
Mobilization/Demobilization	$13,166.67
Deep Mixing Costs	
Vertical Mixing	$79,387.50
Excavation Costs	
Soil Excavation	$109,627.92
Landscaping	
Baseball infield	$9,876.27
Repair grounds and sod	$4,030.00
Topsoil	$256,721.00
Sod	$19,324.80
Additional Seed	$8,344.00
Irrigation	
Irrigation System Removal and Installation	$58,000.000
Sprinkler Work	$62,470.47
Miscellaneous	
Playground equipment removal/reinstallation	$4,000.00
Repair of drain line	$7,503.14
Basketball court	$1,125.00
Expand play area	$2,130.00
Additional bonding	$10,769.33
Additional playground work	$4,575.60
Total	$826,416.00
Acres remediated	6.32
Cost per acre	$130,762.02
Square feet remediated	275,299.2
Cost per square foot	$3.00

Appendix D: Photo Log

Photo D-1
Deep mixer in action at Naches Intermediate

Photo D-2

Import, export and grading activities happening simultaneously

Photo D-3
Hotspot excavation and backfill at the baseball field

Photo D-4
Naches Intermediate play area post-remediation

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.

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