OLYMPUS ENVIRONMENTAL, INC.

SITE INVESTIGATION REPORT
METALS AND PESTICIDES TESTING
WENATCHEE SCHOOL DISTRICT
WENATCHEE, WASHINGTON

PREPARED FOR
WENATCHEE SCHOOL DISTRICT

JULY 12, 1991

91-3528

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1.0 INTRODUCTION

This report discusses the field operations and presents analytical results for soil sampling conducted for the Wenatchee School District (WSD). This report also provides recommendations to the WSD for future management of the project sites. This field investigation was conducted by Olympus Environmental, Inc (OEI) and Shannon & Wilson, Inc (S&W) on June 24, 25, & 26, 1991. This project was conducted for the WSD in an effort to determine if metals and/or pesticides were present in the surface soils (0 to 36") of either of the parcels of property the WSD plans to develop.

1.1 Background

The WSD has proposed development of a middle school and elementary school on two separate parcels of land in Wenatchee, Washington (Figure 1). The proposed middle school site consists of 25 acres. Currently 3 acres of the middle school site is orchard, 5 acres is recently cut down orchard, and 17 acres is pasture.

The proposed elementary school site consists of 15 acres. Currently, 7 of these acres is an orchard, approximately 4 acres is planted with alfalfa, and 4 acres are not utilized. The alfalfa field was planted about 5 years ago and prior to that it was an orchard.

On May 10, 1991 a composite surface soil sample was collected from each of the proposed sites by Mr. Virgil Todd of the WSD. The sampling was performed at the request of the local health district. The samples were analyzed for total lead and total arsenic at Cascade Analytical, Inc. in Wenatchee, Washington. Sample results were reported as 290 parts per million (ppm) lead and 78 ppm arsenic at the Elementary School site and 460 ppm lead and 142 ppm arsenic at the Middle School site.

2.0 REGULATORY OVERVIEW

Materials containing substances which are considered hazardous (such as lead and arsenic) are regulated on both the federal and state levels. In March of 1989, a toxic waste cleanup law went into effect in the state of

Washington. This law was passed by voters as Initiative 97 and is known as the Model Toxics Control Act, Chapter 70.105D RCW. In this law, the responsibility for hazardous substances regulation is granted to the Department of Ecology. On the federal level, authority for regulation of hazardous substances is given to Environmental Protection Agency (EPA). EPA interprets site hazardous substances cleanup levels on a case-by-case basis.

2.1 State Authority

In the Model Toxics Control Act the responsibility for hazardous substances regulation is granted to the Department of Ecology. Chapter 173-340 WAC, Part I is titled Overall Cleanup Process and states the following:

"(1) Purpose ...the Model Toxics Control Act. It establishes administrative processes and standards to identify, investigate, and cleanup facilities where hazardous substances have come to be located."

"(2) Applicability ...shall apply to all facilities where there has been a release or threatened release of a hazardous substances that may pose a threat to human health or the environment. Under this chapter, the department may require or take those actions necessary to investigate and remedy these releases."

Chapter 173-340 WAC, Part VII, in the Model Toxics Control Act is titled Cleanup Standards. "Soil cleanup levels shall be based on estimates of the reasonable maximum exposure expected to occur under both current and future site use conditions. The department has determined that residential site use is generally the site use requiring the most protective cleanup levels and that exposure to hazardous substances under residential site use conditions represents the reasonable maximum exposure scenario. In the event of a release of a hazardous substance, treatment, removal, and/or containment measures shall be implemented for those soils with hazardous substance concentrations which exceed cleanup levels..." There are three basic methods for establishing cleanup levels: Method A - Tables, Method B - Standard Method, and Method C - Conditional Method. Cleanup standards have been established for particular constituents which are found on the proposed school sites are summarized in Table 1.

T-1274-01

TABLE 1

STATE OF WASHINGTON
COMPLIANCE LEVELS - SOIL

Parameter	CAS Number	Cleanup Level
Arsenic	7440-38-2	20.0 mg/kg (1)(2)
Barium	7440-39-3	100.0 mg/kg (3)
Cadmium	7440-43-9	2.0 mg/kg (1)
Chromium	7440-47-3	100.0 mg/kg (1)
Lead	7439-92-1	250.0 mg/kg (1)
Mercury (inorganic)	7439-97-6	1.0 mg/kg (1)
Selenium	7782-49-2	1.0 mg/kg (3)
Lindane	58-89-9	1.0 mg/kg (1)
Heptachlor	76-44-8	2.0 µg/kg (3)
Heptachlor Epoxide	1024-57-3	0.9 µg/kg (3)
Aldrin	309-00-2	0.5 µg/kg (3)
Endrin	72-20-8	0.02 mg/kg (3)
Chlordane	57-74-9	6.0 µg/kg (3)(4)
DDT (includes DDE and DDD)	50-29-3	1.0 mg/kg (1)

(1) Reference - Method A Cleanup Levels - Soils, Chapter 173-340 WAC, Model Toxics Control Act (MTCA) Cleanup Regulation - February 28, 1991.

(2) mg/kg = milligrams/kilogram (parts per million).

(3) Reference - Table 1, Groundwater Quality Criteria, Chapter 173-200 WAC, Water Quality Standards for Ground Waters of the State of Washington, October 31, 1990 and MTCA Method B Cleanup Levels (ii)A.

(4) µg/kg = micrograms/kilogram (parts per billion).

3.0 SITE INVESTIGATION

3.1 *Summary of Sampling Program*

This investigation was performed in general accordance with the Work Plan; Metals and Pesticides Testing, Wenatchee School District; Wenatchee, Washington (OEI, June 20, 1991). Both surface and subsurface soil samples were collected from both WSD properties. A hexagonal grid system was used to designate sampling locations at each of the properties. A total of 50 samples from the two sites were collected. Forty-two of these samples were collected from the top 3 inches of soil, and 8 samples were collected from a depth of 15 to 36 inches. All the samples were analyzed for total metals and total pesticides. In addition, five surface samples were analyzed by Toxic Characteristic Leaching Procedure (TCLP) metals.

3.2 *Summary of Field Activities*

3.2.1 The Hexagonal Grid

The number of samples required to estimate the mean concentration of constituents at the each of the two orchard sites dependant on the allowable error of estimation, the preferred statistical significance level, and the coefficient of variation of the constituents at the sites. The number of samples required was determined from the following equation:

$$n = (C_v \times t_\alpha / p)^2$$

where

C_v = coefficient of variation
t_α = t-statistic at desired confidence level
p = allowable error of estimation.

While significance levels and allowable errors of estimation can be selected based on the degree of permissible risk, the coefficient of variation must be approximated from prior experience and general assumptions about the initial placement and subsequent dispersion of the constituents.

Several assumptions and objectives were made to obtain an initial estimate of mean constituent concentrations at each site including: a confidence level of 90% or greater; an allowable error of estimation of 25% to 50% of the mean; constituents were placed and/or dispersed approximately uniformly over the two sites; and the coefficient of variation was the same for constituents at both sites and will be on the order of 50% to 100%.

Based on these objectives and assumptions, achievable confidence levels were determined for both sites with various total number of samples.
Results indicated that unless the coefficient of variation is near 50% or less, it is not possible to achieve a 90% confidence level in the mean constituent concentrations with an allowable error of estimation of 25% at the 15 acre site. However, if an allowable error of nearer to 50% is deemed adequate, the desired level of confidence could be attained with as few as eight samples unless the true coefficient of variation is greater than 75%. Similar conclusions could be drawn for the 25 acre site with the exception that the desired confidence level can be achieved with a 25% allowable error of estimation if the site coefficient of variation is about 50% or less.

Based on these assumptions and the statistical analysis, it was determined that the minimum number of samples to be statically valid for each site was 11 samples at the Elementary School site and 19 at the Middle School site.

A triangular patterned systematic sampling design was used to collect the samples. This systematic sampling design was selected to improve sampling efficiency. As stated in The Hazardous Waste Consultant, in an article titled Optimal Sampling Grids for Hazardous Waste Sites "a sampling point on a square grid only covers 77% of the area of a sampling point on a triangular grid. This means that only 77 sampling points will be required by the triangular grid for every 100 points on the square grid."

Thirty-one surface soil sampling locations were randomly selected on a triangular patterned sampling system. The method used is outlined in the EPA document entitled "Preparation of Soil Sampling Protocol Techniques and Strategies" EPA-600/4-83-020, May 1983. Six additional biased sample locations were field selected based on site conditions. In addition, five split samples and eight subsurface samples were obtained.

3.2.2 Plotting Sample Locations

Sampling locations were found by sighting straight lines using a survey transit, a rod, and a 100 foot measuring tape. All sampling locations were staked prior to collecting any samples.

At the middle school site (Figure 2), the starting grid was grid mark F4. The distance between each sight line at this site was 115 feet. This distance was determined

by using a scaled drawing provided by the WSD on the morning of June 24, 1991. The original site map was not to scale. Due to this fact, the grid system developed did not correctly fit the actual site. Therefore, bias samples were taken to account for areas not covered. The starting location for the grid system at the elementary school site was at grid mark E4 (Figure 3). The distance between each grid mark at this site was 171.4 feet.

Table 2 summarizes sampling grid locations, chemical analysis performed, and the samples numbers.

TABLE 2

SUMMARY OF SAMPLING LOCATIONS AND ANALYSIS

Elementary School Site

Grid Location	Analysis to be performed	Sample Number
Surface Samples		
G10	Total Metals, TP	WSDE-G10-01-SF-0
H10	Total Metals, TP	WSDE-H10-02-SF-0
G9	Total Metals, TP	WSDE-G9-03-SF-0
H9	Total Metals, TP	WSDE-H9-04-SF-0
J9	Total Metals, TP	WSDE-J9-05-SF-0
G7	Total Metals, TP	WSDE-G7-06-SF-0
H7	Total Metals, TP, TCLP	WSDE-H7-07-SF-0
D6	Total Metals, TP	WSDE-D6-08-SF-0
E5	Total Metals, TP	WSDE-E5-09-SF-0
C4	Total Metals, TP	WSDE-C4-10-SF-0
C3	Total Metals, TP, TCLP	WSDE-C3-11-SF-0
D2	Total Metals, TP	WSDE-D2-12-SF-0
Subsurface Samples		
G9	Total Metals	WSDE-G9-13-SB-0
H7	Total Metals	WSDE-H7-14-SB-0
C4	Total Metals	WSDE-C4-15-SB-0
Split Samples (Surface Samples)		
H9	Total Metals, TP	WSDE-H9-16-SF-1
C4	Total Metals, TP	WSDE-C4-17-SF-1
Biased Surface Samples		
Concrete Slab	Total Metals, TP	WSDE-BS-18-SF-0
Drum and Plow	Total Metals, TP	WSDE-BS-19-SF-0

TP = Total Pesticides
TCLP = TCLP Metals and Pesticides

TABLE 2 (continued)

SUMMARY OF SAMPLING LOCATIONS AND ANALYSIS

Middle School Site

Grid Location	Analysis to be Performed	Sample Number
Surface Samples		
C6	Total Metals, TP	WSDM-C6-20-SF-0
E8	Total Metals, TP	WSDM-E8-21-SF-0
B4	Total Metals, TP	WSDM-B4-22-SF-0
C5	Total Metals, TP	WSDM-C5-23-SF-0
D6	Total Metals, TP, TCLP	WSDM-D6-24-SF-0
F8	Total Metals, TP	WSDM-F8-25-SF-0
C4	Total Metals, TP	WSDM-C4-26-SF-0
F7	Total Metals, TP	WSDM-F7-27-SF-0
G8	Total Metals, TP	WSDM-G8-28-SF-0
H9	Total Metals, TP	WSDM-H9-29-SF-0
G7	Total Metals, TP, TCLP	WSDM-G7-30-SF-0
H8	Total Metals, TP	WSDM-H8-31-SF-0
D3	Total Metals, TP	WSDM-D3-32-SF-0
F5	Total Metals, TP	WSDM-F5-33-SF-0
D2	Total Metals, TP	WSDM-D2-34-SF-0
G5	Total Metals, TP	WSDM-G5-35-SF-0
I7	Total Metals, TP	WSDM-I7-36-SF-0
G4	Total Metals, TP	WSDM-G4-37-SF-0
H5	Total Metals, TP, TCLP	WSDM-H5-38-SF-0
Subsurface Samples		
E8	Total Metals	WSDM-E8-39-SB-0
C5	Total Metals	WSDM-C5-40-SB-0
H9	Total Metals	WSDM-H9-41-SB-0
F5	Total Metals	WSDM-F5-42-SB-0
H5	Total Metals	WSDM-H5-43-SB-0
Split Samples (surface samples)		
F8	Total Metals, TP	WSDM-F8-44-SF-1
C4	Total Metals, TP	WSDM-C4-45-SF-1
F5	Total Metals, TP	WSDM-F5-46-SF-1

TABLE 2 (continued)

SUMMARY OF SAMPLING LOCATIONS AND ANALYSIS

Middle School Site (continued)

Grid Location	Analysis to be Performed	Sample Number
Biased Surface Samples		
Dump Area	Total Metals, TP	WSDM-BS-47-SF-0
Pasture off Grid	Total Metals, TP	WSDM-BS-48-SF-0
Stockpiled Soil	Total Metals, TP	WSDM-BS-49-SF-0
Building by Orchard	Total Metals, TP	WSDM-BS-50-SF-0

TP = Total Pesticides
TCLP = TCLP Metals and Pesticides

3.2.3 Collection of Surface Samples

All surface soil samples were obtained from the top three inches of the soil. Thirty-one surface soil samples were collected from randomly selected grid locations as explained earlier within this report. The six bias samples were collected, sampling locations were selected on site conditions such as near old structures, dumping areas, stockpiles, irrigation ditches, and to obtain information not covered with the grid system.

Middle School Site (Figure 4)

Four bias surface soil samples were taken at the middle school site. Bias sample WSDM-BS-47-SF-0 was taken in a dump area located approximately in the center of the property. This dump area contained garbage, wood debris, soil mixtures, manure, bricks, and piping. Areas were charred possibly from past burnings.

Bias sample WSDM-BS-48-SF-0 was taken from the west-central area of the cow pasture. This area was not covered with the hexagonal grid system, therefore a sample was taken to determine the general area conditions.

Bias sample WSDM-BS-49-SF-0 was taken from stockpiled soil on the site. Approximately 2,000 cubic yards of stockpiled soil exist on the site. The backhoe operator indicated that the soils may be from development of the WSD football field.

Bias sample WSDM-BS-50-SF-0 was taken from the north end of the property in front of two abandoned buildings. The buildings appeared to be used for storage of materials for the adjacent orchard.

Elementary School Site (Figure 5)

Bias sample WSDE-BS-18-SF-0 was taken near an empty rusted 55 gallon drum and an old plow. No labels were located on the drum.

Bias sample WSDE-BS-19-SF-0 was taken by a concrete slab near the south-west corner of the property. Stained soils and containers labeled insecticides, rodenticides, fertilizer, oil, and other debris were on and surrounding the slab. Most of the containers were empty, but some contained materials.

3.3 *Subsurface Soil Sampling*

Subsurface soil samples were obtained from a depth of approximately 1.5 feet from test pits excavated by a

backhoe. Two samples were obtained from a depth of approximately 3 feet. The sampling plan called to take all subsurface samples at approximately 3 feet. However, field conditions hampered the excavating effort and restricted the advancement of most test pits to a depth of 1.5 feet.

Subsurface sampling locations are depicted in Figures 2, 3 and 4, 5. Sample number WSDM-F5-42-SB-0 was relocated to just inside the cow pasture near the fence since access to grid mark F5 was not capable with the backhoe.

Top soil down to approximately two feet was uniform, dry, extremely dense, brown, organic silty sand to a sandy silt, some clay was encountered at a few locations.

3.4 *Field Documentation*

Information regarding site activities, conditions, sampling information, and field measurements was documented in the field logbook. The field logbook maintains a complete and accurate account of all field activities.

3.5 *Sample Handling*

Samples were obtained, labeled, and handled in accordance with the site work plan. Samples were stored in cooled ice chests and subsequently delivered to the analytical laboratory, Friedman & Bruya, Inc (FBI), on June 22, 1991.

Corrections were made on the chain of custody forms and the field logbook pages after delivering the samples to the lab. In addition, changes were made to the analytical report upon receiving it from the laboratory. The corrections include changing the following sample numbers.

From	To
WSDE-H9-04-SF-1	WSDE-H9-04-SF-0
WSDE-C4-10-SF-1	WSDE-C4-10-SF-0
WSDM-F8-25-SF-1	WSDE-F8-25-SF-0
WSDM-C4-26-SF-1	WSDE-C4-26-SF-0
WSDM-F5-33-SF-1	WSDE-F5-33-SF-0

3.6 *Data Sources Evaluated*

Data sources used for preliminary assessment included, photos, maps, and other studies covering these properties. The following list identifies the data sources.

Public Record Review

* EPA RCRA (1/16/91)
* EPA CERCLIS (7/18/90)
* Ecology Toxics Cleanup Program (12/12/90)
* LUST (2/21/90)

Aerial Photos

1978 22-23-60IE-211E, 1:24,000
1967 WV-67, 1:6,000
1973 24-19IE-21-23E, 1:30,000

Other Data Sources

Washington State Department of Ecology incident files

3.7 *Regulatory Agency Listing*

The Washington State Department of Ecology (Ecology) Toxics Cleanup Program affected Media and Contaminants report (March 1991) identifies 1 site within 3 blocks of the proposed school locations. The site is located at the following address:

Wenatchee Pesticide
1100 N. Western Avenue
Wenatchee, Washington

Wenatchee Pesticide is also on the EPA Resource Conservation and Recovery Act (RCRA) listing which confirms it generates hazardous materials.

The Department of Ecology Leaking Underground Storage Tanks (LUST) list indicates three sites within the school areas which currently or in past have had underground storage tanks (UST). Two these sites have had the tanks removed. Although, one UST site was still operational (as of February 1991). The tank is registered, contains unleaded gasoline, and is located at the following address:

Tree Fruit Extension Research Center
1100 N. Western Avenue
Wenatchee, Washington

4.0 ANALYTICAL RESULTS

4.1 *Analytical Methods*

Samples were collected and submitted for laboratory analysis by FBI. Samples were analyzed for constituents potentially found within soils at an orchard based on

discussions with a representative of the Chelan-Douglas Health District on June 4, 1991. These included chlorinated pesticides and selected total metals. In addition, several samples were analyzed using the Toxicity Leaching Characteristic Procedure (TCLP) for metals. Table 2 summarizes the analyses performed, random grid locations, and corresponding sample numbers.

All samples were submitted for chlorinated pesticides analysis. Analities in the chlorinated pesticide scan were: Lindane, Heptachlor, Heptachlor Epoxide, Aldrin, Endrin, Chlordane, p,p-DDE, p,p-DDD, and p,p-DDT. The samples were extracted with methylene chloride and analyzed on a Hewlett-Packard 5890 gas chromatograph with an electron capture detection system. The column that was used was a 30 meter, 0.25 millimeter inner diameter, J&W Scientific DB-5, with a 0.25 meter film thickness. The samples were injected split less for 0.5 minutes at 200 degrees Centigrade. The oven temperature was held for 2 minutes and then raised at 10 degrees Centigrade per minute to 300 degrees and held for 5 minutes.

Samples were also submitted for selected total metals analysis by Inductively Coupled Plasma (ICP) Method 6010. Sample digestion and analysis was in accordance to Modified Method 3050 (to obtain a lower detection limit) and Method 6010 as specified by EPA in the Test Methods for Evaluating Solid Waste SW-846. Metals which were analyzed include Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, and Selenium.

In addition, five samples were submitted for TCLP metals analysis in accordance with 40 CFR, Part 261. Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium and Silver are the TCLP metals.

4.2 Analytical Results

A total of 50 samples were collected and submitted for analysis which include 37 environmental surface samples, five surface quality assurance samples (splits), and eight subsurface samples. All surface samples were analyzed for chlorinated pesticide and selected total metals. In addition, five of these samples were submitted for TCLP metals analysis. Subsurface samples were analyzed only for the selected total metals. Table 3 is a summary of the sampling analysis results. Results for several constituents are also shown on Figures 4 and 5.

Statistical measurements were performed on Arsenic, Lead, Chlordane, and DDT. These constituents were selected because of consistently high concentrations, and toxicity reasons (permissible exposure limits, harmful effects,

Table 3 Summary of Sampling Analysis Results

Wenatchee School District

Prepared by Olympus Environmental, Inc.

Job # 91-3528

Analyte \ Sample #	WSDE-G10-01-SF-0	WSDE-H10-02-SF-0	WSDE-G9-03-SF-0	WSDE-H9-04-SF-0	WSDE-J9-05-SF-0	WSDE-J9-06-SF-0	WSDE-H7-07-SF-0	WSDE-D6-08-SF-0	WSDE-E5-09-SF-0	WSDE-C4-10-SF-0	WSDE-C3-11-SF-0	WSDE-D2-12-SF-0	WSDE-G9-13-SB-0	WSDE-H7-14-SB-0	WSDE-CA-15-SB-0	WSDE-H9-16-SF-1	WSDE-C4-17-SF-1
Total Metals (ppm)																	
Arsenic	59	84	98	120	53	105	23	73	27	50	15	4.5	38	17	68	91	51
Barium	64	65	76	72	50	66	36	60	43	61	50	26	67	86	67	58	53
Cadmium	0.8	1.0	1.1	1.1	1.0	1.1	0.5	0.9	<0.5	1.0	1.0	<0.5	0.7	1.0	0.9	0.9	1.0
Chromium	9.0	11	13	11	9.9	11	5.8	7.8	4.8	11	8.7	3.9	13	15	12	9.8	9.6
Lead	290	370	450	450	330	400	170	310	130	390	77	23	17	12	14	400	350
Mercury	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.3	<0.5	0.78	<0.5	<0.5	<0.5	<0.5	<0.5
Selenium	1.1	1.8	1.4	1.1	1.0	1.0	<0.5	0.76	0.7	<0.5	1.2	<0.5	0.6	3.0	3.6	1.1	1.3
Total Pesticides (ppb)																	
Lindane	<0.5	<5	<5	<0.5	<0.5	<5	<0.5	<0.5	<0.5	<5	<0.82	<5				<0.5	<5
Heptachlor	<0.6	<5	<5	0.79	<0.5	<5	<0.6	<0.6	<0.61	<5	<1	<5				<0.5	<5
Heptachlor Epoxide	3.5	<5	<5	1.6	5.4	<5	5.8	9.3	4.8	<5	<0.8	<5				3.7	<5
Aldrin	<0.5	<5	<5	<0.5	<4	<5	<2	<0.5	<0.5	<5	<0.8	<5				<0.5	<5
Endrin	43	44	37	12	78	33	34	<0.78	19	<5	<0.78	<5				18	<5
Chlordane	60	<5	<5	45	20	<5	36	170	36	<5	0.98	<5				49	<5
DDT (Includes DDE & DDD)	1,800	2,100	2,100	1,400	1,300	1,500	2,400	4,300	8,500	870	340	88				1,400	910
TCLP Metals (ppm)																	
Arsenic							<0.05				0.07						
Barium							0.54				0.57						
Cadmium							<0.05				<0.05						
Chromium							<0.05				<0.05						
Lead							0.24				4.9						
Mercury							<0.05				<0.05						
Selenium							<0.05				<0.05						
Silver							<0.05				<0.05						

Table 3 — Summary of Sampling Analysis Results

Wenatchee School District

Prepared by Olympus Environmental, Inc. — **Job # 91-3528**

Analyte \ Sample #	WSDE-B5-18-SF-0	WSDE-B9-19-SF-0	WSDM-C6-20-SF-0	WSDM-E8-21-SF-0	WSDM-B4-22-SF-0	WSDM-C5-23-SF-0	WSDM-D6-24-SF-0	WSDM-F8-25-SF-0	WSDM-C4-26-SF-0	WSDM-F7-27-SF-0	WSDM-G8-28-SF-0	WSDM-H9-29-SF-0	WSDM-G7-30-SF-0	WSDM-H8-31-SF-0	WSDM-D3-32-SF-0	WSDM-F5-33-SF-0	WSDM-D2-34-SF-0
Total Metals (ppm)																	
Arsenic	35	43	46	77	74	110	69	63	110	47	31	32	57	49	120	38	75
Barium	46	51	37	80	69	57	76	71	78	2.4	0.9	57	78	74	57	44	60
Cadmium	0.6	0.9	0.8	1.0	0.9	0.9	0.8	0.9	1.0	0.9	0.2	0.6	0.8	0.8	0.7	0.5	0.7
Chromium	7.8	10	9.5	10	11	11	9.2	10	13	44	2.6	52	14	15	10	18	8.0
Lead	240	280	290	920	1,100	2,000	1,100	440	1,000	350	140	480	390	450	1,300	340	1,400
Mercury	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Selenium	1.2	1.2	1.5	1.5	1.1	1.0	1.7	1.6	1.8	1.2	15	2.5	<0.5	5.3	1.4	1.6	1.2
Total Pesticides (ppb)																	
Lindane	<5	<5	<5	3.2	<4.9	<5	8.9	<5	9	4.2	<5	<0.8	<0.5	<5	1.8	<4.9	<5
Heptachlor	<5	<5	<5	3.1	<0.6	<5	<0.6	<5	<5	2.2	<5	<1	<0.6	<5	<0.6	<6	<5
Heptachlor Epoxide	<5	<5	98	4.7	53	120	64	<5	140	2.0	<5	1.7	<0.5	<5	65	17	43
Aldrin	<5	<5	<5	3.7	<4.8	<5	<0.5	<5	<5	1.4	<5	<0.8	<0.5	<5	<0.48	15	<5
Endrin	48	6	<5	16	<4.7	220	78	<5	320	<5	<5	8.5	<5	<5	<4.7	<47	<5
Chlordane	<5	<5	870	24	750	2,300	660	16	1,800	19	24	17	<7.9	10	1,100	120	<5
DDT (includes DDE & DDD)	880	850	25,000	88	13,000	46,000	34,000	10	23,000	43	49	49	<6	41	28,000	48,000	27,000
TCLP Metals (ppm)																	
Arsenic							<0.05				0.07						
Barium							0.54				0.57						
Cadmium							<0.05				<0.05						
Chromium							<0.05				<0.05						
Lead							0.24				4.9						
Mercury							<0.05				<0.05						
Selenium							<0.05				<0.05						
Silver							<0.05				<0.05						

Table 3 — Summary of Sampling Analysis Results

Wenatchee School District

Prepared by Olympus Environmental, Inc.

Job # 91-3528

Analyte \ Sample #	WSDM-05-35-SF-0	WSDM-I7-36-SF-0	WSDM-G4-37-SF-0	WSDM-H5-38-SF-0	WSDM-E8-39-SB-0	WSDM-C5-40-SB-0	WSDM-H9-41-SB-0	WSDM-F5-42-SB-0	WSDM-H5-43-SB-0	WSDM-F8-44-SF-1	WSDM-C4-45-SF-1	WSDM-F5-46-SF-1	WSDM-B9-47-SF-0	WSDM-B8-48-SF-0	WSDM-B8-49-SF-0	WSDM-B8-50-SF-0
Total Metals (ppm)																
Arsenic	77	32	69	70	68	60	35	57	40	60	120	46	6.0	95	14	42
Barium	92	170	84	71	79	70	56	59	94	73	82	48	35	84	99	76
Cadmium	0.9	2.1	1.0	0.8	0.9	0.8	0.7	1.0	0.8	0.9	1.2	0.5	0.5	1.4	1.1	0.8
Chromium	18	31	19	15	12	11	10	13	17	11	14	24	19	160	19	14
Lead	200	160	450	450	15	13	14	9.5	17	470	990	430	67	600	18	250
Mercury	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Selenium	5.3	3.6	5.3	<0.5	1.8	<0.5	<0.5	2.6	<0.5	0.8	1.4	1.4	<0.5	0.6	2.1	1.1
Total Pesticides (ppb)																
Lindane	<5	<0.5	<0.5	<0.5						<5	<5	<5	<5	<5	<5	<5
Heptachlor	<5	<0.6	<0.6	<0.6						<5	<5	<5	<5	<5	<5	<5
Heptachlor Epoxide	<5	<0.5	<0.5	0.6						<5	89	86	<5	<5	<5	<5
Aldrin	<5	<0.5	<0.5	<0.5						<5	<5	<5	<5	<5	<5	<5
Endrin	<5	<5	<5	2.1						<5	230	130	<5	<5	<5	<5
Chlordane	<5	9.3	<0.8	4.9						6	<5	820	<5	<5	<5	<5
DDT (includes DDE & DDD)	<5	37	69	55						<5	16,000	27,000	<5	26	<5	40
TCLP Metals (ppm)																
Arsenic				0.44												
Barium				0.60												
Cadmium				<0.05												
Chromium				<0.05												
Lead				0.48												
Mercury				<0.05												
Selenium				<0.05												
Silver				<0.05												

and risk factors). Other analytes detected at the sites include: Selenium, Barium, Heptachlor, Heptachlor Epoxide, Endrin, and Aldrin. Of these, Selenium was the only analyte which laboratory results were consistent and the detection limit was consistently below the regulatory limit.

Selenium levels ranged from not detected to 5 ppm, although according to the "Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States", U.S. Geological Survey Professional Paper 1270 these could be considered background concentrations.

All surface soil sample results were used for statistical calculations. Arsenic statistical information for the proposed elementary school site is depicted in Figure 6, and presented in Table 4. The mean arsenic concentration was calculated to be 56 ppm concentrations. At a 95% confidence level it can be stated that the site is above the regulatory limit of 20 ppm arsenic.

Lead, Chlordane, and DDT mean concentrations were calculated to be 280 ppm, 26 ppb, and 3.6 ppm, respectively. Table 4 and Table 5 present statistical information. Chlordane is slightly above the regulatory limit of 6 ppb at a 90% confidence level. Lead and DDT levels are not above Method A cleanup levels at a 90% or 95% confidence level.

Table 6 and Table 7 show the statistical results for the proposed Middle School site. The mean values for Arsenic, Lead, DDT, and Chlordane are 61 ppm, 600 ppm, 8.2 ppm, and 340 ppb, respectively. All constituents are above the regulatory cleanup limits with a 95% confidence level.

No statistical evidence can be obtained between surface and subsurface Arsenic and Lead levels.

4.3 *Quality Assurance/Data Quality Review*

All field and sampling activities performed by S&W and OEI were in accordance with the Work Plan for Metals and Pesticides Testing on the Wenatchee School District properties. All analytical work conducted at FBI were in accordance with their in-house quality assurance/quality control (QA/QC) plan.

The overall completeness of the data quality for the organic and inorganic analyses was good. Quality control parameters were reviewed, including matrix spike and matrix spike duplicate recoveries, blanks, detection limits, holding times, and laboratory duplicates.

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Table 6

Wenatchee School District, Middle School Site

Surface Samples, Metals

Sample	Arsenic ppm	Lead ppm
WSDM-B04-22-SF-0	74	1100
WSDM-B05-47-SF-0	6	67
WSDM-B05-48-SF-0	95	600
WSDM-B05-49-SF-0	14	18
WSDM-B05-50-SF-0	42	250
WSDM-C04-26-SF-0	110	1000
WSDM-C05-23-SF-0	110	2000
WSDM-C06-20-SF-0	46	290
WSDM-D02-34-SF-0	75	1400
WSDM-D03-32-SF-0	120	1300
WSDM-D06-24-SF-0	69	1100
WSDM-E08-21-SF-0	77	920
WSDM-F05-33-SF-0	38	340
WSDM-F07-27-SF-0	47	350
WSDM-F08-25-SF-0	63	440
WSDM-G04-37-SF-0	69	450
WSDM-G05-35-SF-0	77	200
WSDM-G07-30-SF-0	57	390
WSDM-G08-28-SF-0	31	140
WSDM-H05-38-SF-0	70	450
WSDM-H08-31-SF-0	49	450
WSDM-H09-29-SF-0	32	480
WSDM-I07-36-SF-0	32	160

Statistical Summary		
Sample count	23	23
Minimum, ppm	6	18
Maximum, ppm	120	2000
Range, ppm	110	1980
Mean, ppm	61	600
Std. Deviation, ppm	29	490
Coeff. of Variation	48%	82%
95% Confidence Limit	13	210
90% Confidence Limit	11	180

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Table 7

Wenatchee School District, Middle School Site

Surface Samples, Pesticides

Sample	DDT (includes DDD & DDE) ppb	Chlordane ppb
WSDM-B04-22-SF-0	1300	750
WSDM-B05-47-SF-0	<5	<5
WSDM-B05-48-SF-0	26	<5
WSDM-B05-49-SF-0	<5	<5
WSDM-B05-50-SF-0	40	<5
WSDM-C01-26-SF-0	23000	1800
WSDM-C05-23-SF-0	46000	2300
WSDM-C06-20-SF-0	25000	870
WSDM-D02-34-SF-0	27000	<5
WSDM-D03-32-SF-0	28000	1100
WSDM-D06-24-SF-0	34000	660
WSDM-E08-21-SF-0	88	24
WSDM-F05-33-SF-0	4800	120
WSDM-F07-27-SF-0	43	19
WSDM-F08-25-SF-0	10	16
WSDM-G04-37-SF-0	69	<0.8
WSDM-G05-35-SF-0	<5	<5
WSDM-G07-30-SF-0	<5	<7.9
WSDM-G08-28-SF-0	49	24
WSDM-H05-38-SF-0	55	4.9
WSDM-H08-31-SF-0	41	10
WSDM-H09-29-SF-0	49	17
WSDM-I07-36-SF-0	37	9.3

Statistical Summary		
Sample count	23	23 (1)
Minimum, ~~ppm~~ ppb	<5	<5
Maximum, ~~ppm~~ ppb	46000	2300
Range, ~~ppm~~ ppb	46000	2300
Mean, ~~ppm~~ ppb ppb	8200	340
Std. Deviation, ~~ppm~~	14000	620
Coeff. of Variation	170%	180%
95% Confidence Limit	6100	270
90% Confidence Limit	5000	220

NOTE (1): A value equal to half of the detection limit was used for samples falling below the detection limit.

CHANGES PER MARLA @ OLYMPUS

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Table 4

Wenatchee School District, Elementary School Site

Surface Samples, Metals

Sample	Arsenic ppm	Lead ppm
WSDE-B05-18-SF-0	35	240
WSDE-B05-19-SF-0	43	280
WSDE-C03-11-SF-0	15	77
WSDE-C04-10-SF-0	50	390
WSDE-D02-12-SF-0	4.5	23
WSDE-D06-08-SF-0	73	310
WSDE-E05-09-SF-0	27	130
WSDE-G07-06-SF-0	105	400
WSDE-G09-03-SF-0	98	450
WSDE-G10-01-SF-0	59	290
WSDE-H07-07-SF-0	23	170
WSDE-H09-04-SF-0	120	450
WSDE-H10-02-SF-0	84	370
WSDE-J09-05-SF-0	53	330
Statistical Summary		
Sample count	14	14
Minimum, ppm	4.5	23
Maximum, ppm	120	450
Range, ppm	120	430
Mean, ppm	56	280
Std. Deviation, ppm	34	130
Coeff. of Variation	60%	46%
95% Confidence Limit	20	75
90% Confidence Limit	16	62

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Table 5

Wenatchee School District, Elementary School Site

Surface Samples, Pesticides

Sample	DDT (includes DDD & DDE) ppb	Chlordane ppb
WSDE-B05-18-SF-0	880	<5
WSDE-B05-19-SF-0	850	<5
WSDE-C03-11-SF-0	340	0.98
WSDE-C04-10-SF-0	870	<5
WSDE-D02-12-SF-0	88.0	<5
WSDE-D02-34-SF-0	27000	<5
WSDE-D06-08-SF-0	4300	170
WSDE-E05-09-SF-0	8500	36
WSDE-G07-06-SF-0	1500	<5
WSDE-G09-03-SF-0	2100	<5
WSDE-G10-01-SF-0	1800	60
WSDE-H07-07-SF-0	2400	36
WSDE-H09-04-SF-0	1400	45
WSDE-H10-02-SF-0	910	<5
WSDE-J09-05-SF-0	1300	20
Statistical Summary		
Sample count	15	15 (1)
Minimum, ~~ppm~~ PPB	88	1
Maximum, ~~ppm~~ PPB	27000	170
Range, ~~ppm~~ PPB	27000	169
Mean, ~~ppm~~ PPB	3600	26
Std. Deviation, ~~ppm~~ PPB	6600	43
Coeff. of Variation	180%	170%
95% Confidence Limit	3700	24
90% Confidence Limit	3000	19

NOTE (1): A value equal to half of the detection limit was used for samples falling below the detection limit.

CHANGES PER MARLA @ OLYMPUS

END

Initial calibration, all calibration verification and continuing calibration verification was conducted according to the laboratory in-house QA/QC plan. The quality control data supporting the analytical results is acceptable.

All organic and inorganic analities were run within their holding times except for the pesticide analysis for sample number WSDM-BS-50-SF-0. The holding time for pesticides are seven days for extraction, 40 days for analysis; and the holding time for metals are six months for analysis. Sample number WSDM-BS-50-SF-0 was extracted 10 days after it was collected.

Detection limits were within acceptable ranges except in some of the pesticides constituents. Pesticide detection limits for some sample number were elevated; FBI attributed the higher detection limits to high default readings.

Method blanks were generated in the laboratory to assess the degree to which laboratory operations and procedures cause false-positive analytical results for samples. No metals or chlorinated pesticides were detected above the reporting limit in the method blanks. Method blanks were run with each batch of field samples submitted by the project team to FBI.

Spike percent recoveries are used to determine the laboratory accuracy. All metal matrix spike and matrix spike duplicate recoveries were within the default limits of 50-150%, except the recoveries for lead on sample number WSDE-D2-12-SF-0. Further QA/QC checks are currently being performed by FBI. Several of the analities were spiked in insufficient amounts to give meaningful recovery data, no further action is required. Most pesticide matrix spike and matrix spike duplicate recoveries are within EPA CLP or SW-846 control limits. Sample number WSDM-H5-38-SF-0 had suspect recovery results for p,p'-DDT.

Laboratory duplicate sample analysis were run to indicate the precision of the sample results. The relative percent differences (RPD) for the metal analities in all cases fall below the 35% control limit (most cases were below 30%). Percent recoveries for the chlorinated pesticides were variable, in most cases the RPD's were below 30%, although in the worst case the RPD was 180%. The variable RPD's for the pesticide analities are most likely due to non-homogeneous sample aliquotes taken at the time of extraction. Factors which could attribute to non-homogeneous sample aliquotes are clusters of organic material containing pesticides within the sample, not adequate sample mixing or an extraction problem these

are both unlikely because of good metal recoveries and set laboratory procedures.

In addition, to laboratory QA/QC procedures, quality control samples were prepared in the field by sampling personnel. Ten percent of the total number of soil samples were collected as field splits. The project team used its own discretion for selecting when and where field QA/QC samples were collected. Rationale for choosing the time and location for collecting these samples included: whether the analytical data from a particular sample is of high interest, schedule requirements and random selection. All field splits were collected in the same manner as actual environmental samples and subsequently submitted to the laboratory for analysis. Split samples were collected to check the laboratory's comparability and precision.

A total of five soil split samples were obtained during the sampling effort. Split samples were analyzed for chlorinate pesticides and total metals. The reproducibility in the metal analities was good in all cases less the 30%. Again, the percent recoveries for the chlorinated pesticides were variable, ranging from 0% to 150%.

5.0 RECOMMENDATIONS

Action should be taken to remove the empty and partially full containers which were observed near the concrete pad at the Elementary School site. Empty containers most likely can be disposed of in the garbage. The partially full containers should be applied as originally intended, and then empty containers thrown away. We recommend WSD contacts the vendors/suppliers for these products for proper disposal information.

To assure that unacceptable risks do not result from the ingestion or inhalation of hazardous substances which have been identified on both the proposed Elementary School site and proposed Middle School site a risk assessment according to the MTCA could be performed. The Department of Ecology may require a risk assessment. A risk assessment will establish the cancer risk, and the acute or chronic toxic effects on human health via direct contact with contaminated soil. The assessment may show that the risk associated with the contaminates on site are below any cancer risk or toxic effect on human health and no further action is required.

Another possible approach, given WSD's development plans which include earthwork, could include a phase of contaminated soil removal. Contaminated soil could be

disposed of off site, or possibly collected on site and capped under construction work such as a parking area. This approach will require some additional sampling and investigation to establish the extent and limits of the contamination. Subsurface soil samples obtained by our work show a decrease from surface contamination levels. It may be possible to remove the contaminants of concern and thereby eliminate the need for further risk assessment work.

OEI recommends that the Department of Ecology be approached when planning further work regarding soil contamination at the two sites.

6.0 REFERENCES

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