WORKSHEET 1
Summary Score Sheet

SITE INFORMATION:

Name: **Barge Lincoln Elementary School**
Address: **219 East "I" Street**
City: **Yakima** County: **Yakima** State: **WA** Zip: **98901**
Section/Township/Range: **S18/ T13N/ R19E**
Latitude: **46° 36' 54"** Longitude: **120° 30' 26"**
TCP ID #: **5075703**

Site scored/ranked for the February 21, 2007 update.

SITE DESCRIPTION (management areas, substances of concern, and quantities):

Barge-Lincoln Elementary School is located in northeast Yakima near the Yakima River and consists of approximately six acres. The school is located within a residential zone, however few houses are located nearby.

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 cottling 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 Pb and As. The Washington Department of Ecology (Ecology) obtained permission from Yakima School District to sample and test the soils for lead and arsenic from all of the Barge Lincoln school grounds.

The soils throughout the property were sampled by the Department of Ecology on August 8, 2005. Samples were taken from the top 6 inches using a core sampler. The samples were analyzed for lead and arsenic X-Ray Fluorescence Spectroscopy.

Sampling results at Barge Lincoln Elementary School indicate that contaminant levels in soil exceed the Model Toxics Control Act Method A cleanup levels for lead (250ppm) and/or arsenic (20ppm) in 13 of 19 soil samples. The highest levels of arsenic and lead detected at the site were 78.8 ppm and 595.2 ppm, respectively. These concentrations require the site be scored and ranked under the Washington Ranking Method (WARM).

SPECIAL CONSIDERATIONS (include limitations in site file data or data which cannot be accommodated in the model, but which are important in evaluating the risk associated with the site, or any other factor(s) over-riding a decision of no further action for the site):

Due to the nature of metals in soil, it is assumed that lead and arsenic are likely not present at high concentrations at depths greater than four feet. This has been documented at several sites and seems

consistent for sites where lead arsenate pesticide was used. Samples were collected at a depth of six inches; however, for the purposes of this assessment, it is assumed that contamination extends to a depth of three feet.

Because of the presence of children at the school grounds, ingestion of contaminated soil is of concern and is considered the greatest risk to children. WARM scoring does not consider ingestion as an exposure route. However, the use of school grounds by children and their incidental ingestion of lead and arsenic contaminated soil are being addressed by Ecology through remediation efforts and by the State Department of Health through education.

ROUTE SCORES:

Surface Water/Human Health:	**6.9**	Surface Water/Environmental.:	**11.1**
Air/Human Health:	**3.8**	Air/Environmental:	**NS**
Groundwater/Human Health:	**69.5**		

OVERALL RANK: 3

WORKSHEET 2
Route Documentation

1. **SURFACE WATER ROUTE**
   a. List those substances to be considered for scoring: Source: 1

      Lead and arsenic

   b. Explain basis for choice of substance(s) to be used in scoring.

      Analytical results from soil sampling indicate the presence of these hazardous substances at levels which exceed our current Method A cleanup levels.

   c. List those management units to be considered for scoring: Source 1

      Surface and subsurface soils

   d. Explain basis for choice of unit to be used in scoring:

      Spills/discharges caused soil contamination

2. **AIR ROUTE**
   a. List those substances to be considered for scoring: Source: 1

      Lead and arsenic

   b. Explain basis for choice of substance(s) to be used in scoring:

      Analytical results from soil sampling indicate the presence of these hazardous substances at levels which exceed our current Method A cleanup levels.

   c. List those management units to be considered for scoring: Source: 1

      Surface and subsurface soils

   d. Explain basis for choice of unit to be used in scoring:

      Spills/discharges caused soil contamination

3. **GROUNDWATER ROUTE**
   a. List those substances to be considered for scoring: Source: 1

      Lead and arsenic

   b. Explain basis for choice of substance(s) to be used in scoring:

      Analytical results from soil sampling indicate the presence of these hazardous substances at levels which exceed our current Method A cleanup levels.

   c. List those management units to be considered for scoring: Source: 1

      Surface and subsurface soils

   d. Explain basis for choice of unit to be used in scoring:

      Spills/discharges caused soil contamination

WORKSHEET 4
Surface Water Route

1.0 SUBSTANCE CHARACTERISTICS

1.1 Human Toxicity

	Substance	Drinking Water Standard (µg/L)	Value	Acute Toxicity (mg/kg-bw)	Value	Chronic Toxicity (mg/kg/day)	Value	Carcinogenicity		Value
								WOE	PF*	
1	Lead	5	8	NA	5	0.001	10	ND	ND	ND
2	Arsenic	10	8	763	ND	0.001	5	1.0	1.75	7

******Potency Factor*

Source: 1, 2

Highest Value: 10
(Max = 10)

Plus 2 Bonus Points? 2

Final Toxicity Value: 12
(Max = 12)

1.2 Environmental Toxicity

	Substance	Acute Water Quality Criteria		Non-Human Mammalian Acute Toxicity	
		(µg/L)	Value	(mg/kg)	Value
1	Lead	82	6	ND	--
2	Arsenic	360	4	ND	--

Source: 1, 2

Highest Value: 6
(Max = 10)

1.3 Substance Quantity (areal extent)

Explain Basis: One sample was collected from each randomly selected square in a 50' * 50'grid. Thirteen samples exceeded MTCA cleanup levels. Therefore, by calculating 13 * 2500 sq. ft, 32500 sq. feet can be estimated as contaminated.

Source: 8

Value: 5
(Max = 10)

2.0 MIGRATION POTENTIAL

		Source	Value
2.1	**Containment:** Management unit scored as a spills/discharges/contaminated soil at the surface, with ineffectively maintained run-on/runoff controls (vegetated buffer). **Explain basis:** While a portion of the site is capped (parking lots, buildings, etc), soil samples were collected from only uncapped areas (i.e. in bare soil or beneath grass) at a depth of six inches.	1, 3	**4** (Max = 10)
2.2	**Surface Soil Permeability:** the site consists of loam	3, 8	**3** (Max = 7)
2.3	**Total Annual Precipitation:** average annual precipitation for Yakima WSO AP, WA = 8.15 in	9	**1** (Max = 5)
2.4	**Max 2yr/24hr Precipitation:** one inch	3	**1** (Max = 2)
2.5	**Flood Plain:** Not in a flood plain	10	**0** (Max = 2)
2.6	**Terrain Slope:** (1080-1060)/4500 = 0.4%	10	**1** (Max = 5)

3.0 TARGETS

		Source	Value
3.1	**Distance to Surface Water:** ~4800 feet	10	**4** (Max = 10)
3.2	**Population Served within 2 miles (see WARM Scoring Manual Regarding Direction):** $\sqrt{18} = 4.2$	6	**4** (Max = 75)
3.3	**Area Irrigated by surface water within 2 miles : (0.75)*√ # acres =** $0.75 * \sqrt{21} = 3.4$	6	**3** (Max = 30)
3.4	**Distance to Nearest Fishery Resource:** ~4800 feet	10	**3** (Max = 12)
3.5	**Distance to, and Name(s) of, Nearest Sensitive Environment(s):** freshwater wetlands ~2100 ft	10	**9** (Max = 12)

4.0 RELEASE

Explain Basis: Not documented	Source: 1, 3 **Value: 0** (Max = 5)

WORKSHEET 5
Air Route

1.0 SUBSTANCE CHARACTERISTICS

1.1. Introduction

1.2 Human Toxicity

	Substance	Air Standard ($\mu g/m^3$)	Value	Acute Toxicity (mg/m^3)	Value	Chronic Toxicity (mg/kg/day)	Value	Carcinogenicity WOE	Carcinogenicity PF*	Value
1	Lead	0.5	10	ND	--	0.001	10	B2	ND	--
2	Arsenic	0.00023	10	ND	--	0.001	5	A	50	9

* *Potency Factor*

Source: 1, 2, 3
Highest Value: 10
(Max = 10)
Plus 2 Bonus Points? 2
Final Toxicity Value: 12
(Max = 12)

1.3 Mobility (Use numbers to refer to above listed substances)

	1.3.1 Gaseous Mobility	1.3.2 Particulate Mobility		
	Vapor Pressure(s) (mmHg)	Soil Type	Erodibility	Climatic Factor
1		loam	56	10 - 30

Source: NA
Value: --
(Max = 4)

Source: 3, 8
Value: 1
(Max = 4)

1.4 Highest Human Health Toxicity/ Mobility Matrix Value (from Table A-7)

Final Matrix Value: 6
(Max = 24)

1.5 Environmental Toxicity/Mobility

	Substance	Non-human Mammalian Inhalation Toxicity (mg/m^3)	Acute Value	Mobility (mmHg)	Value	Matrix Value
1	Lead	ND	--	ND	--	--
2	Arsenic	ND	--	ND	--	--

Highest Environmental Toxicity/Mobility Matrix Value (from Table A-7) = **Final Matrix Value: 0**
(Max = 24)

1.6 Substance Quantity (areal extent)	
Explain Basis: ~32500 sq. ft (see Surface Water Route 1.3)	Source: 3, 8 **Value: 6** (Max = 10)

2.0 MIGRATION POTENTIAL

		Source	Value
2.1	**Containment:** Uncontaminated soil cover <2 feet thick	3	**5** (Max = 10)

3.0 TARGETS

		Source	Value
3.1	**Nearest Population:** <1000 feet to school	3, 7	**10** (Max = 10)
3.2	**Distance to [and name(s) of] nearest sensitive environment(s) [fisheries excluded]:** Not scored		**0** (Max = 7)
3.3	**Population served within 0.5 miles: √ pop. = √50 = 7.1**	6	**7** (Max = 75)

4.0 RELEASE

Explain Basis for scoring a release to air: Not documented	Source: 3, 7 **Value: 0** (Max = 5)

WORKSHEET 6
Groundwater Route

1.0 SUBSTANCE CHARACTERISTICS

1.2 Human Toxicity

	Substance	Drinking Water Standard (µg/L)	Value	Acute Toxicity (mg/ kg-bw)	Value	Chronic Toxicity (mg/kg/day)	Value	Carcinogenicity		Value
								WOE	PF*	
1	Lead	5	8	NA	5	0.001	10	ND	ND	ND
2	Arsenic	10	8	763	ND	0.001	5	1.0	1.75	7

* *Potency Factor*

Source: 1, 2

Highest Value: 10
(Max = 10)

Plus 2 Bonus Points? 2

Final Toxicity Value: 12
(Max = 12)

1.2 Mobility (use numbers to refer to above listed substances)

Cations/Anions [Coefficient of Aqueous Migration (K)] OR	Solubility (mg/L)
1= K > 1.0 = 2	1=
2= K is 0.1 to 1.0 = 3	2=

Source: 3

Value: 3
(Max = 3)

1.3 Substance Quantity (volume):

Explain basis: One sample was collected from each randomly selected square in a 50' * 50'grid. Thirteen samples exceeded MTCA cleanup levels. Therefore, calculating 13 * 2500 sq. ft, 32500 sq. feet can be estimated as contaminated. Based on previous sampling sessions where lead/arsenic has been detected to depths up to 4', Ecology has determined that is likely that contaminated soil extends to a depth of 3' bgs. Therefore the estimated volume of contamination is calculated as follows.

32500' * 3' = 97500 ft^3 or ~3611 yd^3

Source: 1, 3

Value: 4
(Max=10)

2.0 MIGRATION POTENTIAL

		Source	Value
2.1	**Containment (explain basis):** While a portion of the site is capped (parking lots, buildings, etc), soil samples were collected from only uncapped areas (i.e. in bare soil or beneath grass) at a depth of six inches.	3	**10** (Max = 10)
2.2	**Net precipitation:** 4.7" – 3" = 1.7"	2	**1** (Max = 5)
2.3	**Subsurface hydraulic conductivity:** the site consists of loam	3	**3** (Max = 4)
2.4	**Vertical depth to groundwater:** water well reports nearby indicate groundwater is likely less than 14 feet below ground surface	3, 5	**8** (Max = 8)

3.0 TARGETS

		Source	Value
3.1	**Groundwater usage:** Public supply, but alternate sources available with minimum hookup requirements	3	**4** (Max = 10)
3.2	**Distance to nearest drinking water well:** ~2000 **feet**	3, 5	**3** (Max = 5)
3.3	**Population served within 2 miles:** √ **pop.** = >10,000	3, 7	**100** (Max = 100)
3.4	**Area irrigated by (groundwater) wells within 2 miles:** **(0.75)*√# acres** = 0.75 * √1857 = 32.3	3, 6	**32** (Max = 50)

4.0 RELEASE

	Source	Value
Explain basis for scoring a release to groundwater: Not documented	3	**0** (Max = 5)

SOURCES USED IN SCORING

1. Analytical results of soil sampling conducted on August 8, 2005 by the WA State Dept. of Ecology
2. Washington State Department of Ecology, Toxicology Database for Use in Washington Ranking Method Scoring, January 1992
3. Washington State Department of Ecology, WARM Scoring Manual, April 1992.
4. Washington Climate – Net Rainfall Table
5. Washington State Department of Ecology, Water Well Reports
6. Washington State Department of Ecology, Water Rights Application System (WRATS) printouts
7. Washington State Department of Health, Office of Drinking Water Sentry website printout for public water supplies
8. Barge Lincoln Elementary School file, WSDOE records at the Central Regional Office
9. Western Regional Climate Center's Historical Climate Information

10. Yakima County Land Info Portal Website