SITE HAZARD ASSESSMENT (DRAFT)
WORKSHEET 1
SUMMARY SCORE SHEET

Site Name/Location (Street, City, County, Facility Site ID Number, Lat/Long):

Duwamish Shipyard Inc.
5658 West Marginal Way SW
Seattle, WA 98106
King County
Ecology Facility Site ID: 2071
T-24N, R-04E, Sec-19
Longitude: -122° 20' 32.52"
Latitude: 47° 33' 5.64"
Site assessed for February 21, 2007 update

Site Description (Include management areas, substances of concern, and quantities):

The Duwamish Shipyard Inc. (DSI) site is located on the west bank of the lower Duwamish Waterway in Seattle. The surrounding area consists of a mixture of industrial, commercial, and residential buildings. The DSI site is entirely covered either with asphalt or concrete-floored buildings and is 4.93 acres in size. This site is bordered to the north by the Alaska Marine Lines (AML) container facility and to the south by the Glacier Northwest Seattle Cement Facility. West Marginal Way borders the DSI site to the west and the Duwamish Waterway abuts the site to the east. The site is served by the City of Seattle water and sewer systems. There are no municipal wells within a two-mile radius of the DSI site. The closest municipal water well is the Boulevard Water System located 4.6 miles from the site.

DSI purchased the property in May 1941. In the beginning, DSI only had a marine railway for docking vessels where boats would be pulled up on the railway and could be sidetracked onto timbers on the shore. The majority of the vessels at the time were wooden fish boats. DSI frequently sidetracked the boats in the fall, worked on them over the winter, and then launched them in the spring. Most of the work was repairing wooden hulls and painting. DSI ended the sidetracking process in the late 1950s.

In 1967, DSI acquired its first floating drydock. It was a small, steel dock that is currently still in use. By 1969, DSI had acquired a second, larger wood drydock that was sold in 1990 and replaced it with the present 1,000-ton steel drydock. Currently, DSI engages in the repair and maintenance of floating vessels and equipment. It provides services to approximately 60 to 65 vessels per year. The majority of the hulls of the vessels repaired are constructed of steel. Occasionally, DSI will work on aluminum hulls or fiberglass, but they no longer work on wooden vessels. DSI's repair services include machine and electrical work, carpentry, steel fabrication, sand blasting, pressure washing, and painting. The haul-out facilities at the site consist of two steel drydocks and a graving dock.

The two steel drydocks are located along the shoreline and have been updated to provide containment for pressure wash wastewater. The wastewater flows to one end of the drydock where it is captured in a collection sump and pumped onshore to a pretreatment system before discharging to the King County sanitary sewer.

The repairs conducted at the graving dock are located below the surface level of the river. To create a dry work environment, water is pumped out once the vessels are floated into the graving dock and the tide gates are closed. Because there is leaking at the tide gate, pumps operate continuously to keep the concrete floor of the dock dry. DSI has installed a containment system to separate pressure wastewater from the water leaking through the tide gates.

The DSI site has a stormwater system that consists of ten catch basins that collect water from the paved parking areas and active industrial areas to a ten-inch diameter trunk line. The water in this line is then discharged to a sump and pumped through a centrifugal separator to remove grit prior to discharge via outfall. Rainfall is the only source of stormwater to this site since the surface drainages are not allowed to enter the site. The catch basins receiving runoff have been fitted with catch basin inserts and oil sorbent pillows. The stormwater system was constructed in the mid-1970s and is currently operated under National Pollutant Discharge Elimination System (NPDES) Permit No. WA-003093-7. This permit also regulates potential stormwater discharges from all three dock locations.

Past remedial actions have been conducted on the DSI site. In 1986, prior to the enactment of the Underground Storage Tank (UST) regulations, a 500-gallon UST storing leaded gasoline was closed in place. Based on historical information, that UST was first installed in the 1960s. At the time of the UST closure, a Seattle City Light representative visited the DSI site and recommended that the Seattle Fire Department fill the UST in place due to the UST location being within close proximity to the 100-foot-tall power pole and adjacent to a building foundation. No subsurface samples were collected at the time of that closure.

During the development of the parcel previously leased to and subsequently purchased by AML, a release of petroleum product from an unknown origin was discovered in the soil. DSI formerly owned and leased this parcel to various businesses for storage of used machinery, trailer and truck parking, and storage and distribution of lumber. In August 1993, Environmental Services Limited performed a preliminary site assessment consisting of five soil borings, five test pits, and four monitoring wells. The only remaining well is monitoring well, MW-4. The results showed total petroleum hydrocarbons (TPH) concentrations in soil and groundwater above the MTCA Method A industrial cleanup levels.

In October 1993, DSI hired Hart Crowser, Inc. (HCI) to oversee the excavation of approximately 650 cubic yards of soil. Several restrictions were encountered during the excavation of the contaminated soil. These restrictions were a 26KV buried powerline, a pad-supported power transformer foundation, the graving dock foundation, and the shallow groundwater table. As a result, the delineated area for excavation was not completed. Upon removal, 12 soil confirmation samples were collected from the excavation sidewalls. All of the twelve samples were below MTCA industrial cleanup levels for semivolatile organic chemicals (SVOCs). Four of the twelve samples were above MTCA levels for NWTPH-Gas, NWTPH-Diesel, and lube oil. The excavation area was backfilled and capped with asphalt. A monitoring well (MW-5) was installed to assess dowgradient groundwater quality.

In 1994, groundwater samples were collected from MW-4 and MW-5 over four events (two wet and two dry) and one event in February of 1999. Analysis of MW-4 indicated a 25 percent reduction in TPH levels, although they exceeded MTCA groundwater cleanup levels based on Method B for surface water protection. Levels were based on surface water rather than drinking water standards since there is no drinking water source in the surrounding area of the DSI site. For all five sampling events, MW-5 did not exceed MTCA groundwater cleanup levels for TPH and were not above detectable concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX). After the remedial action was completed, no additional soil samples were collected.

The DSI site was originally on the Washington Department of Ecology's Confirmed and Suspected Contaminated Sites (Ecology's CSCS) list since March 1, 1988, awaiting site assessment. The DSI site went into independent remedial action and submitted a remedial action report to Ecology in 1994. On November 2, 1994, the DSI site was listed again as awaiting site assessment status after the report revealed soil and groundwater contamination. Remaining contaminated areas were capped with asphalt.

In 2000, four underground storage tanks (USTs) installed between 1968 and 1979 were excavated and removed by Quality Tank Service, Inc. The four USTs contained diesel

fuel and unleaded gasoline. During the initial excavation, 60 cubic yards of soil were excavated with the USTs. Soil samples were collected at the bottom and sidewalls of the excavated area. Seven of these soil samples exceeded the Model Toxics Control Act (MTCA) Method A industrial cleanup levels in soil for Northwest Total Petroleum Hydrocarbons - Diesel (NWTPH - Diesel), Northwest Total Petroleum Hydrocarbons - Gasoline (NWTPH - Gas), and benzene. An additional 20 cubic yards of soil were excavated from the seven soil locations and samples were recollected. Five of the second round of confirmation samples exceeded MTCA industrial cleanup levels. Four of the samples exceeded the NWTPH-Gas cleanup level and one exceeded the benzene cleanup level. No groundwater samples were collected during this sampling event.

On March 24, 2006, Ecology sent a notification letter to the owner of the DSI site that a site assessment was being conducted by Yolanda Pon from Public Health - Seattle & King County (PHSKC). On May 2, 2006, PHSKC spoke with Kyle McCleary regarding the status of the DSI site. Mr. McCleary indicated he was working with David Templeton at Anchor Environmental to conduct a site assessment. PHSKC spoke with Mr. Templeton regarding the site assessment for the DSI site to be completed by the end of 2006.

On July 10, 2006, Ecology sent a letter to DSI regarding corrective action requirements after their review of the UST closure report in 2000 due to the TPH and benzene levels in the soil exceeding the MTCA Method A cleanup levels. The proposed site assessment was to develop a work plan for the continuing cleanup of the site.

Based on review of the available data and field investigations, Anchor Environmental selected 12 upland sampling locations throughout the DSI site. In the work plan, two soil samples and one groundwater sample were collected at each location over a two-day period from September 27 to 28, 2006. Soil samples were collected in two intervals above the groundwater table. The upper sample consisted of a 3-foot composite collected from 0 to 3 feet below ground surface (bgs). The lower sample consisted of a 2-foot composite collected directly above the observed water table, generally between 3 to 5 feet bgs. Groundwater samples were collected after the soil sampling was complete in each borehole. All samples were analyzed for TPH-Gas, TPH-Diesel, total metals, pesticides, Polychlorinated Biphenyls (PCBs), semi-volatile Organic Compounds (sVOCs), and volatiles.

Quite a few of the groundwater samples contained various contaminants that exceeded the MTCA Method A industrial cleanup levels as shown in the following chart in parts per billion (ppb).

Groundwater	Arsenic	Chromium	Lead	Benzo[a]pyrene	Benzene	Vinyl Chloride
DSI - 01	**84.4**	7	3	ND	ND	ND
DSI - 02	**16.4**	49	11	ND	ND	ND
DSI - 03	**9.5**	38	8	0.02	ND	ND
DSI - 04	**11.2**	29	13	ND	ND	**0.6**
DSI - 05	2	6	6	0.01	0.2	**0.3**
DSI - 07	**9.5**	21	6	ND	**180**	ND
DSI - 08	**11.8**	37	12	ND	0.3	**0.4**
DSI - 09	2.6	ND	**55**	0.01	ND	ND
DSI - 11	**6.7**	34	10	ND	ND	ND
DSI - 12	**32.5**	20	**27**	**3.5**	ND	ND
MW - 5	4.9	**54**	2	ND	ND	ND
MTCA Method A Industrial Cleanup Level	5	50	15	0.1	5	0.2

ND = Non-detectable

Quite a few of the soil samples contained various contaminants that exceeded the MTCA Method A industrial cleanup levels as shown in the following chart in parts per million (ppm).

SOIL	NWTPH-Gas	NWTPH-Diesel	Arsenic	Cadmium	Lead	Benzene	Benzo[a]pyrene
DSI - 01 (0'-3')	ND	65	**48.1**	0.4	36	ND	56
DSI - 03 (5'-6.5')	**110**	380	10.4	0.5	94	ND	12
DSI - 06 (0'-3')	**120**	**2700**	7.0	0.3	14	**260**	39
DSI - 06 (4'-6')	13	**2200**	2.2	ND	6	1.7	99
DSI - 07 (0'-3')	**74**	16	4.3	ND	11	**50**	11
DSI - 07 (3'-5')	**36**	20	1.6	ND	3	6.0	5.9
DSI - 09 (3'-5')	**200**	56	**20.2**	**8.5**	**4940**	1.3	23
DSI - 12 (0'-3')	ND	88	17.1	0.2	20	1.4	**3000**
DSI - 12 (3'-5')	27	170	3.3	ND	6	3.0	**7900**
DSI - 22 Catch basin	n/a	n/a	**29.7**	2	350	n/a	21
MTCA Method A Industrial Cleanup Level	30/100 (30 if benzene present)	2000	20	2	1000	30	2000

ND = Non-detectable
n/a = not analyzed

Because the DSI site is located on the Duwamish Waterway, there was a concern of contaminants on the DSI site leaching into the Duwamish Waterway. In 1998, Duwamish Shipyard area sediment samples were collected by the Lower Duwamish Waterway Group to evaluate the suspected sediment impacts from the DSI site. Some of the contaminants in the sediments were similar to those found in the soil and groundwater samples listed above such as arsenic, cadmium, chromium, lead, and benzo[a]pyrene. In addition, the sediment samples indicated that lead exceeded its Sediment Quality Standards (SQS) value and arsenic exceeded both its SQS and Cleanup Screening Level (CSL) values in multiple sediment samples.

On the basis of this SHA, completed by the PHSKC's Environmental Health division, this site will be scored for the surface water due to sediment contamination and groundwater routes.

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): none

ROUTE SCORES:

Surface Water/Human Health: 26.9

Surface Water/Environmental: 48.3

Air/Human Health: NS

Air/Environmental: NS

Ground Water/Human Health: 21.2

OVERALL RANK: 2

WORKSHEET 2
ROUTE DOCUMENTATION

1. SURFACE WATER ROUTE

List those substances to be considered for scoring: Source: 2,3,9

TPH-Gas, TPH-Diesel, Arsenic, Cadmium, Chromium, Lead, Benzene, Benzo(a)pyrene, Vinyl Chloride

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

All of the above substance concentrations are above MTCA Method A cleanup levels.

List those management units to be considered for scoring: Source: 3

Sub-surface soil contamination; some of the contaminants in the sediments are similar to the ones in the on-site soil and groundwater samples.

Explain basis for choice of unit to be used in scoring. Source: 3

Surface sediment is exposed to weather with no containment.

2. AIR ROUTE

List those substances to be considered for scoring: Source:

No air route will be scored for this site because the site is completely covered with asphalt and buildings.

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

List those management units to be considered for scoring: Source:

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

3. GROUND WATER ROUTE

List those substances to be considered for scoring: Source: 2,3

TPH-Gas, TPH-Diesel, Arsenic, Cadmium, Chromium, Lead, Benzene, Benzo(a)pyrene, Vinyl Chloride

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

All of the above substance concentrations are above MTCA Method A cleanup levels.

List those management units to be considered for scoring: Source: 3

Surface soil contamination prior to capping.

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

Surface soil was exposed to weather with no containment prior to being capped.

WORKSHEET 3
SURFACE WATER ROUTE

1.0 SUBSTANCE CHARACTERISTICS

1.1 Human Toxicity

Substance	Drinking Water Standard (ug/l)	Val.	Acute Toxicity (mg/kg-bw)	Val.	Chronic Toxicity (mg/kg/day)	Val.	Carcino-genicity WOE	PF*	Val.
1. TPH-Gas	5.0	8	3306	3	ND	-	A	0.029	5
2. TPH-Diesel	160	4	490	5	0.004	3	ND	-	-
3. Arsenic	50	6	763	5	0.001	5	A	1.75	7
4. Cadmium	5.0	8	225	5	0.0005	5	B1	ND	-
5. Chromium III	100	6	ND	-	1.0	1	ND	-	-
6. Lead	5.0	8	ND	-	ND	-	B2	ND	-
7. Benzene	5	8	3306	3	-	ND	A	.029	5
8. Benzo(a)pyrene	0.2	10	50	10	ND	-	B2	12	7
9. Vinyl Chloride	2	8	500	5	ND	-	A	2.30	7

*Potency Factor

Source: 2,9
Highest Value: 10
(Max.=10)

+2 Bonus Points? yes
Final Toxicity Value: 12
(Max.=12)

1.2 Environmental Toxicity
( ) Freshwater
(x) Marine

Substance	Acute Water Quality Criteria (ug/l)	Value	Non-human Mammalian Acute Toxicity (mg/kg)	Value
1. TPH-Gas	5100	2		
2. TPH-Diesel	2350	2		
3. Arsenic	69	6		
4. Cadmium	43	6		
5. Chromium III	10300	2		
6. Lead	140	4		
7. Benzene	5100	2		
8. Benzo(a)pyrene	300	4		
9. Vinyl Chloride	-	ND		

Source: 2,9 **Value: 6**
(Max.=10)

1.3 Substance Quantity: unknown Source: 3 **Value: 1**
(Max.=10)
Explain basis: sediment contamination from capped site

2.0 MIGRATION POTENTIAL

2.1 Containment Source: 3 **Value: 10**
(Max.=10)
Explain basis: sediment contamination is documented to share similar contaminants with soil and groundwater samples

2.2 Surface Soil Permeability: silt-sand mixtures Source: 3 **Value: 3**
(Max.=7)

2.3 Total Annual Precipitation: 35 inches Source: 5 **Value: 3**
(Max.=5)

2.4 Max. 2-Yr/24-hour Precipitation: 1-2 inches Source: 5 **Value: 2**
(Max.=5)

2.5 Flood Plain: not in flood plain Source: 6 **Value: 0**
(Max.=2)

2.6 Terrain Slope: < 2% Source: 6 **Value: 1**
(Max.=5)

WORKSHEET 3 (CONTINUED)
SURFACE WATER ROUTE

3.0 TARGETS

3.1 Distance to Surface Water: 0 ft; on Duwamish Waterway Source: 6 **Value: 10** (Max.=10)

3.2 Population Served within 2 miles (See WARM Scoring Manual Regarding Direction): pop.= none Source: 8 **Value: 0** (Max.=75)

3.3 Area Irrigated within 2 miles 0.75 (√no. acres) = (Refer to note in 3.2.): 0.75(√0.5) = 0 Source: 8 **Value: 1** (Max.=30)

3.4 Distance to Nearest Fishery Resource: 0 ft, Duwamish Source: 6 **Value: 12** (Max.=12)

3.5 Distance to, and Name(s) of, Nearest Sensitive Environment(s) 0 feet; Duwamish Waterway - protected salmon stream Source: 6 **Value: 12** (Max.=12)

4.0 RELEASE

Explain basis for scoring a release to surface water: confirmed release in sediments on-site along western shore of the Duwamish Waterway Source: 3 **Value: 5** (Max.=5)

WORKSHEET 4
GROUND WATER ROUTE

1.0 SUBSTANCE CHARACTERISTICS

1.1 Human Toxicity

Substance	Drinking Water Standard (ug/l)	Val.	Acute Toxicity (mg/kg-bw)	Val.	Chronic Toxicity (mg/kg/day)	Val.	WOE	Carcino-genicity PF*	Val.
1. TPH-Gas	5.0	8	3306	3	ND	-	A	0.029	5
2. TPH-Diesel	160	4	490	5	0.004	3	ND	-	-
3. Arsenic	50	6	763	5	0.001	5	A	1.75	7
4. Cadmium	5.0	8	225	5	0.0005	5	B1	ND	-
5. Chromium III	100	6	ND	-	1.0	1	ND	-	-
6. Lead	5.0	8	ND	-	ND	-	B2	ND	-
7. Benzene	5	8	3306	3	-	ND	A	.029	5
8. Benzo(a)pyrene	0.2	10	50	10	ND	-	B2	12	7
9. Vinyl Chloride	2	8	500	5	ND	-	A	2.30	7

*Potency Factor

Source: 2
Highest Value: 10 (Max.=10)
+2 Bonus Points? yes
Final Toxicity Value: 12 (Max.=12)

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

Cations/Anions: 3 = 3; 4 = 3; 5 = 1; 6 = 2 Source: 1 **Value: 3** (Max.=3)

OR

Solubility(mg/l): 1 = 1.8E+03(3); 2 = 3.0E+01(1); 7 = 1.8E+03(3); 8 = 1.2E-03(0); 9 = 2.7E+03(3)

1.3 Substance Quantity: unknown Source: 3 **Value: 1** (Max.=10)
Explain basis: default value = 1

2.0 MIGRATION POTENTIAL

2.1 Containment Source: 3 **Value: 5** (Max.=10)
Explain basis: Capped so landfill: no liner (3); cover (0); no leachate collection system (2); no liquids (0)

2.2 Net Precipitation: 24.4 - 5.2 = 19.2 inches Source: 5 **Value: 2** (Max.=5)

2.3 Subsurface Hydraulic Conductivity: silty sand Source: 3 **Value: 3** (Max.=4)

2.4 Vertical Depth to Ground Water: 10 feet Source: 3 **Value: 8** (Max.=8)

WORKSHEET 4 (CONTINUED)
GROUND WATER ROUTE

3.0 TARGETS

3.1 Ground Water Usage: ground water not usable Source: 6 **Value: 1** (Max.=10)

3.2 Distance to Nearest Drinking Water Well: 4.6 miles Source: 7 **Value: 0** (Max.=5)

3.3 Population Served within 2 Miles: none = 0 Source: 8 **Value: 0** (Max.=100)

3.4 Area Irrigated by (Groundwater) Wells within 2 miles: 0.75 √no.acres = 0.75√0 acres = 0 Source: 8 **Value: 0** (Max.=100)

4.0 RELEASE

Explain basis for scoring a release to ground water: confirmed release Source: 3 **Value: 5** (Max.=5)

SOURCES USED IN SCORING

1. Washington Ranking Method Toxicological Database.
2. Preliminary Investigation Data Report, Duwamish Shipyard, Inc. site, Seattle, Washington by Anchor Environmental, LLC, December 2006.
3. Site hazard assessment, Public Health - Seattle & King County, January 2007.
4. National Weather Service Data.
5. Isopluvials of 2-yr., 24hr. precipitation, NOAA atlas 2, vol. IX.
6. Sensitive Areas Coverage, King County Geographic Information System Data
7. Washington State Department of Health Public Water Supply Listing.
8. Washington State Water Use Data.
9. DSI Area Surface Sediment Samples by the Lower Duwamish Waterway Group, Duwamish Shipyard, Inc. site, Seattle, Washington by Anchor Environmental, LLC, June 1999.