

APPENDIX A

Groundwater Monitoring Plan



Pier 69 □ 2711 Alaskan Way
Seattle, WA 98121

Letter of Transmittal

To: Ms. Piper Peterson Lee – USEPA, Region 10
1200 Sixth Avenue, Suite 900, ECL-111
Seattle, Washington 98101 -3140
Date: March 4, 2008

From: Katie Hendrickson and Roy Kuroiwa

Project reference: Terminal 117 Early Action Area

Hardcopy:	Electronic:	Description:
2	X	Interim Groundwater Monitoring Plan, Lower Duwamish Waterway Superfund Site, Terminal 117 Early Action Area
2	X	Quality Assurance Project Plan, Non-Time Critical Removal Action, Preliminary Investigation and Interim Groundwater Monitoring Plan, Lower Duwamish Waterway Superfund Site, Terminal 117 Early Action Area
2	x	Health and Safety Plan, Groundwater Sampling and Monitoring Well Installation, Terminal 117

cc:

Hardcopy:	Electronic:	Name:	Company:
1	X	Kym Takasaki	U.S. Army Corps of Engineers
1	X	Rick Thomas	Dept of Ecology
1	X	Marla Steinhoff	NOAA
1	X	B.J. Cummings	Duwamish River Cleanup Coalition
1	X	Glen St. Amant	Muckleshoot Tribe
2	X	Tom Meyer	Seattle City Light
2	X	Roy Kuroiwa	Port of Seattle
2	X	Warren Hansen	Windward
2	X	Reid Carscadden	Integral

Signature

Lower Duwamish Waterway Superfund Site *Terminal 117 Early Action Area*

INTERIM GROUNDWATER MONITORING PLAN

Prepared for

The Port of Seattle
and
The City of Seattle

For submittal to:

US Environmental Protection Agency, Region 10
1200 Sixth Avenue
Seattle, WA 98101

March 4, 2008

Prepared by:



Table of Contents

List of Tables	i
List of Maps	i
Acronyms	ii
1 Introduction	1
1.1 MONITORING OBJECTIVES	1
1.2 HISTORICAL SITE OPERATIONS	1
1.3 PREVIOUS REMOVAL ACTIONS	2
2 Site Description	4
2.1 GEOLOGY	4
2.2 HYDROGEOLOGY	4
2.3 GROUNDWATER DATA	5
3 Groundwater Monitoring Program	6
3.1 GROUNDWATER MONITORING NETWORK	6
3.2 MONITORING OBJECTIVES	6
3.3 MONITORING WELL INSTALLATION	8
3.4 GROUNDWATER SAMPLING AND ANALYSIS	8
3.5 TIDAL STUDY	9
4 Schedule and Reporting	9
5 References	10

List of Tables

<i>Table 1.</i>	<i>Station-by-station description of the monitoring objectives</i>	<i>7</i>
-----------------	--	----------

List of Maps

<i>Map 1.</i>	<i>Well location map</i>	<i>3</i>
---------------	--------------------------	----------

Acronyms

Acronym	Definition
Adjacent Streets	City-owned adjacent streets in the vicinity of T-117 that are a portion of the T-117 EAA
AOC	Administrative Order on Consent
bgs	below ground surface
City	City of Seattle
cm/s	centimeters per second
EAA	Early Action Area
EPA	US Environmental Protection Agency
LDW	Lower Duwamish Waterway
MLLW	mean lower low water
NAPL	non-aqueous phase liquid
NTCRA	non-time-critical removal action
PCB	polychlorinated biphenyl
Port	Port
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
SOW	Statement of Work
SVOC	semivolatile organic compound
T-117	Terminal 117
T-117 Upland	Port-owned upland T-117 property portion of the T-117 EAA
TCRA	time-critical removal action
TPH	total petroleum hydrocarbons
VOC	volatile organic compound

1 Introduction

Terminal 117 (T-117) is located at 8700 Dallas Avenue South in Seattle, Washington (Map 1). T-117 Early Action Area (EAA) previously included the bank, mudflat, shoreline and sediments adjacent to T-117 (T-117 Bank and Sediments), and is now expanded to also include the upland of T-117 (T-117 Upland) and nearby street right-of-ways (Adjacent Streets). The most recent Statement of Work (SOW) also expands the scope of the non-time-critical removal action (NTCRA) to include an assessment of the potential for recontamination of the T-117 EAA from the adjoining Basin Oil and South Park Marina properties. The T-117 EAA and potential recontamination properties are shown on Map 1.

This document describes the interim groundwater monitoring plan for T-117 in preparation for the NTCRA at the site. This plan is written to meet the groundwater monitoring requirements specified in the SOW. A Quality Assurance Project Plan (QAPP) has also been prepared in accordance with the SOW and discusses in detail the methodology of the tasks described in this plan.

1.1 MONITORING OBJECTIVES

The objectives of the groundwater monitoring are to:

- ◆ Determine if groundwater migrating onto the T-117 Upland contains contaminants at levels that have the potential to recontaminate the T-117 Upland.
- ◆ Determine if groundwater at the T-117 Upland contains contaminants at levels that have the potential to cause unacceptable human exposures or cause contaminants to migrate into Lower Duwamish Waterway (LDW) sediments (including any bank or sediment areas created as part of the NTCRA) at levels exceeding the Washington State Sediment Management Standards or Washington State Water Quality Standards.

1.2 HISTORICAL SITE OPERATIONS

The Duwamish Manufacturing Company reportedly began asphalt manufacturing operations at T-117 around 1937 and continued until 1978 (URS, 1994) at the general location corresponding with the present-day west half of T-117. In 1978, the business was sold and came to be known as the Malarkey Asphalt Company and continued roofing asphalt manufacturing operations at T-117 until 1993. A mixture of oils was used in the roofing asphalt manufacturing process. These oils included waste mineral oils to fuel boilers and heaters that are presumed to be the source of polychlorinated biphenyls (PCBs).

From 1989 to as late as 1995, Basin Oil leased a 10,000-gal. horizontal tank from the Malarkey Asphalt Company for storing and processing used oil (EPA 1995). After the

asphalt plant closed in the late 1990s, portions of the property were occupied by Evergreen West Wholesale (a lumber wholesaler) for untreated lumber storage and loading (Windward et al. 2003). For a brief period of time, Basin Oil also used a portion of the interior of the south building on the T-117 property for storage and oil filter processing (Windward et al. 2003). Basin Oil occupied the south building from approximately 2003 until late 2004 through a lease with the Port.

In 1999, the Port acquired the asphalt plant parcels and related buildings located between the shoreline parcel (already owned by the Port as successor in interest to KCCWD1) and Dallas Avenue S. The port consolidated these parcels to form the present-day T-117. During the Port's ownership of the property, Port Construction Services used the outdoor area near the small office/carport for the storage of miscellaneous materials. International Inspection, a provider of non-destructive testing services, formerly leased the north building and the small office/carport. Second Use Building Materials, Inc., a recycling business that obtains reusable building materials from demolition projects for resale to the public, leased the south building for inventory storage. The site has been vacant since February 2007. No additional tenants are currently planned for the property.

1.3 PREVIOUS REMOVAL ACTIONS

Two time-critical removal actions (TCRAs) have been conducted at the T-117 Upland. A removal of upland soils was conducted by the Port of Seattle (Port) in 1999 pursuant to an Administrative Order on Consent (AOC). In 2006, following the discovery of additional soil contamination, and under the terms of a separate Settlement Agreement, the Port carried out an additional TCRA for the removal of T-117 upland soils with the most exposed or highest concentrations of PCBs.

The City of Seattle (City) completed a series of independent interim remedial actions between December 2004 and October 2005 to reduce the potential human health exposure associated with the PCB-impacted soil in the streets, ROWs, and yards in the vicinity of T-117. The interim actions included removal of PCB-impacted soil from residential properties and adjacent unpaved road edges, temporary paving of PCB-impacted soil within portions of the City Streets, and collection and treatment of stormwater runoff from the impacted area. The interim actions performed by City are described in detail in the South Park soil remediation project site characterization data report (Integral 2006).

2 Site Description

2.1 GEOLOGY

The shallow soil at T-117 and the adjacent streets consists of fill material ranging from 2 to 8 ft in thickness. This fill generally consists of sand with varying amounts of silt mixed with anthropogenic materials (e.g. bricks, rubble, and wood). The native alluvium underlying the fill extends to a depth of 95 ft below ground surface (bgs) (Wilbur, 2002) and consists of discontinuous silt units with interbedded sands, silty sands, and some gravel. Thin peat deposits have also been encountered.

The 1999 TCRA removal area was backfilled to depths ranging from approximately 2 to 6 ft with quarry spalls, consisting of large angular rocks. This backfill was overlain with an asphalt pavement system (gravel sub-grade and bituminous pavement) approximately 1 foot thick (Onsite, 2000). The 2006 TCRA excavation was backfilled with clean granular fill from approximately two to seven ft and paved with Class B asphalt.

2.2 HYDROGEOLOGY

Hydrogeology at T-117 consists of an unconfined aquifer that is generally located within the native alluvium unit, though shallow groundwater extends upward into the overlying silty sand fill soil. Groundwater level data collected during previous investigations (SECOR, 1997; Hart Crowser, 1992) indicate that groundwater near T-117 occurs between about 5 and 12 ft bgs. The groundwater beneath T-117 is hydraulically connected to the LDW and is tidally influenced. Groundwater is recharged from surrounding land areas to the west of T-117 (Wilbur, 2002). Groundwater recharge due to stormwater falling upon the T-117 Upland Area is limited by existing paving and stormwater drainage structures that route stormwater to catch basins and ultimately the LDW.

Tidal influence has been observed in all monitoring wells located in the upland T-117 area and were documented by piezometric measurements conducted in 1998 (SECOR, 1998a and b), 2003 (Windward et al., 2005a), 2004 (Windward et al., 2005a), and 2005 (Windward et al., 2005c). During the 2003 tidal study, the water levels in the LDW varied by approximately 12.8 ft and water levels in the T-117 wells varied by 5.1 ft (MW-3) to 7.8 ft (MW-6). The magnitude of the water level variation decreased inland. MW-6 had a significantly greater response than the other shoreline wells that varied by between 6 and 6.3 ft. Groundwater elevations varied between 3.5 and 12.6 ft mean lower low water (MLLW). Net groundwater flow is toward the LDW. Groundwater flow may be altered locally in the vicinity of the septic drain field located near the southeast side of the North Building.

Monitoring well MW-01 on Basin Oil and three recently installed monitoring wells along the shoreline at SPM are the only other monitoring wells in the vicinity of the T-

117. Groundwater level information from these wells, along with the two new proposed monitoring wells discussed in this document, will help define the gradient at and immediately adjacent to T117.

Hydraulic conductivities for typical silty sand units such as the fill soil range from 10^{-1} to 10^{-5} centimeters per second (cm/s). Silt units, such as the upper portion of the native alluvium that is immediately below the fill unit, typically have hydraulic conductivities ranging from 10^{-3} to 10^{-7} cm/s (Freeze and Cherry, 1979).

2.3 GROUNDWATER DATA

Historical groundwater conditions are detailed in the Data Gaps Report (Windward et al., 2003). Groundwater quality data from 2003 to 2006 sampling events are presented in Appendix A. Locations of groundwater monitoring wells are shown in Map 1.

Mineral oil has a very low solubility, even compared to other hydrocarbons from the same carbon range. As a result, mineral oil and associated PCBs would typically be found adsorbed to soil particles or as a free-phase, non-aqueous phase liquid (NAPL).

In 2003, monitoring wells MW-1, MW-2, MW-3 and MW-4 were sampled for PCBs, PAH, TPH and BTEX. No analytes were detected in monitoring wells MW-1, MW-2 and MW-4. In monitoring well MW-3, PAHs, diesel range hydrocarbons, lube oil range hydrocarbons and xylenes were detected.

No analytes were detected during the 2004 sampling event which analyzed groundwater for PCBs, semivolatile organic compounds (SVOCs), and volatile organic compounds (VOCs). The 2005 samples were analyzed for PCBs and total petroleum hydrocarbons (TPH) only. The only analytes detected during the 2005 sampling event were Aroclor® 1260 in MW-5 (an estimated concentration of 0.04 µg/L) and diesel range hydrocarbons in MW-2 (0.5 mg/L). In 2006, only one well, MW-5, was sampled to confirm the 2005 result. Aroclor® 1260 was detected again in 2006 in MW-5 at a concentration of 0.30 µg/L.

During the most recent sampling event in August 2006, monitoring wells MW-4, MW-5, MW-6, MW-7 and MW-8 were sampled and analyzed for PCBs, TPH, metals and SVOCs. PCBs were detected in monitoring wells MW-5 (estimated 0.029 mg/L), MW6 (estimated 0.020 mg/L), and MW-8 (estimated 0.021 mg/L). No TPH or any SVOCs were detected. Arsenic, cadmium, chromium, lead and mercury were detected in several wells.

During the 2004 and 2005 tidal studies, an oil water interface probe was used to determine the presence or absence of NAPL in the groundwater monitoring wells. In 2004, no NAPL was detected in any of the wells. During the 2005 study trace amounts of NAPL, essentially a sheen (<0.01 ft thick), were detected in MW-2 and MW-7 (Windward et al., 2005b). This sheen was only noted during the portion of the tidal cycle when the water level in the well was high. The highest TPH concentrations at T-117 are noted in the vicinity of MW-2. The temporal occurrence of the sheen during

only high water levels suggests that the hydrocarbons generating the sheen are held in the soil matrix during low water levels and accumulate in the well during high water levels. Only one measurement during the tidal study indicated a trace NAPL or sheen (<0.01 ft thick) in MW-7. This measurement has not been confirmed by additional sampling.

3 Groundwater Monitoring Program

The groundwater monitoring program will consist of a minimum of one year of quarterly monitoring. Sample will be collected from 10 monitoring wells and analyzed for a wide range of chemicals. In addition, a 24-hour tidal study will be conducted. Information on these tasks is discussed below.

3.1 GROUNDWATER MONITORING NETWORK

The groundwater monitoring network will consist of 10 monitoring wells (Map 1). Three shoreline wells are currently located on-site (MW-2, MW-6 and MW-7). Shoreline monitoring wells MW-4, MW-5, and MW-8 were abandoned during the 2006 TCRA; these wells will be replaced. Per EPA's request, monitoring well MW-4 will be installed approximately 60 feet to the northeast of the original location to better monitor the area downgradient of the 2006 TCRA. The existing upland monitoring wells, MW-1 and MW-3 will be supplemented by two additional new groundwater monitoring wells (MW-9 and MW-10) installed along the Dallas Avenue street right-of-way. Monitoring wells MW-1 and MW-3 have not been sampled in recent years but are assumed to be in good condition. The new wells MW-9 and MW-10 will be sited down-gradient from potential offsite contamination sources from the neighboring Basin Oil property.

3.2 MONITORING OBJECTIVES

The monitoring wells are located to provide specific information on the T-117 Upland groundwater (Table 1). Monitoring wells (MW-2 through MW-8) are located along the shoreline to assess the groundwater entering the LDW. Additionally, MW-2 and MW-6 are located downgradient of the highest PCB concentrations in contact with groundwater. The shoreline wells are spread out along the entire T-117 Upland shoreline border. Monitoring well MW-3 is located in the center of T-117 Upland near an historical industrial well. New monitoring wells MW-9 and MW-10 will assess the groundwater quality entering the site from Basin Oil.

The net groundwater flow is towards the LDW. The groundwater flow path is expected to be generally perpendicular to the shoreline at all well locations. The screened interval in the newly installed wells will be placed to intercept the top of the water table during all seasons.

Table 1. Station-by-station description of the monitoring objectives

STATION NUMBER	PURPOSE	EXPECTED GROUNDWATER FLOW PATH	SCREEN INTERVAL (ft bgs)	BOREHOLE SAMPLES TO BE COLLECTED AND ANALYZED
MW-1	Located in low spot on Basin Oil property to determine recontamination potential to the T-117 Upland	Towards the LDW	5 - 15	None. Existing well ^a
MW-2	Well located immediately downgradient of the highest PCB concentrations in contact with water to determine recontamination potential to the LDW sediments	Towards the LDW	4 – 14	None. Existing well ^a
MW-3	Downgradient of central Upland area of site, Adjacent Streets and Basin Oil. Upgradient of LDW shoreline between MW-5 and MW-6 to determine recontamination potential to the LDW sediments	Towards the LDW	1.5 – 11.5	None. Existing well ^a
MW-4 (replacement but moved approximately 60 feet to the northwest)	Downgradient of high PCB concentrations and TCRA removal area to determine recontamination potential to the LDW sediments	Towards the LDW	4 – 14	0.5 – 2 ft bgs 2.5 – 4 ft bgs 5 – 6.5 ft bgs 7.5 – 9 ft bgs 10 – 11.5 ft bgs 12.5 – 14ft bgs
MW-5 (replacement)	Downgradient of high PCB concentrations to determine recontamination potential to the LDW sediments	Towards the LDW	5 -15	0.5 – 2 ft bgs 2.5 – 4 ft bgs 5 – 6.5 ft bgs 7.5 – 9 ft bgs 10 – 11.5 ft bgs 12.5 – 14ft bgs
MW-6	Well located immediately downgradient of the highest PCB concentrations in contact with water to determine recontamination potential to the LDW sediments	Towards the LDW	5 - 15	None. Existing well ^a
MW-7	Downgradient of the Northeast edge of the site, near border with South Park Marina to determine recontamination potential to the LDW sediments	Towards the LDW	10 – 20	None. Existing well ^a
MW-8 (replacement)	Downgradient of the northern section of the site to determine recontamination potential to the LDW sediments	Towards the LDW	9 – 19	0.5 – 2 ft bgs 2.5 – 4 ft bgs 5 – 6.5 ft bgs 7.5 – 9 ft bgs 10 – 11.5 ft bgs 12.5 – 14ft bgs
New well (MW-9)	Upgradient of T117 Upland (Also downgradient from potential Basin Oil impacts) to determine recontamination potential to the T-117 Upland	Towards the LDW	5 – 15	0.5 – 2 ft bgs 2.5 – 4 ft bgs 5 – 6.5 ft bgs 7.5 – 9 ft bgs 10 – 11.5 ft bgs 12.5 – 14ft bgs
New well (MW-10)	Upgradient of T117 Upland. (Also downgradient from potential Basin Oil impacts) to determine recontamination potential to the T-117 Upland	Towards the LDW	5 – 15	0.5 – 2 ft bgs 2.5 – 4 ft bgs 5 – 6.5 ft bgs 7.5 – 9 ft bgs 10 – 11.5 ft bgs 12.5 – 14ft bgs

^a Soil samples were already collected and analyzed from these locations the during the installation of these wells prior to this groundwater water monitoring program

3.3 MONITORING WELL INSTALLATION

All monitoring wells will be drilled using a hollow-stem auger drill rig or sonic drilling. The new and replacement monitoring wells will be constructed so that the screened interval intercepts the top of groundwater table. The monitoring wells will be constructed of Schedule 40 polyvinyl chloride (PVC) pipe with 10 ft of 10-slot screen. Additional well construction details are provided in the QAPP.

As discussed in the QAPP, soil samples collected will be classified and described using the Unified Soil Classification System and standard geological terminology. Soil samples will be submitted for PCB analysis by Method 8082 and TPH by NWTPH-Dx. Based on previous investigations, a sufficient volume of soil for sampling will be obtained from each boring at each depth.

- ◆ 0.5 to 2 ft bgs
- ◆ 2.5 to 4 ft bgs
- ◆ 5 to 6.5 ft bgs
- ◆ 7.5 to 9 ft bgs
- ◆ 10 to 11.5 ft bgs
- ◆ 12.5 to 14 ft bgs.

Soil samples will be submitted for PCB analysis by Method 8082 and TPH by NWTPH-Dx. Based on previous investigations, a sufficient volume of soil for sampling will be obtained from each boring at each depth.

3.4 GROUNDWATER SAMPLING AND ANALYSIS

Groundwater samples will be collected using low-flow sampling techniques as detailed in the QAPP. One groundwater sample will be collected from each monitoring well on a quarterly basis. Groundwater samples will be submitted for the following analysis:

- ◆ PCBs by Method 8082
- ◆ TPH (gasoline and oil) by NWTPH-Dx and NWTPH-Gx
- ◆ TSS by Method 160.2
- ◆ SVOCs including PAHs by 8270D SIM
- ◆ BTEX by NWTPH-Gx/EPA 8021
- ◆ VOC by 8260
- ◆ Total and dissolved priority pollutant metals by 6010 and 7470.

Per the SOW, the Port and City may request that EPA approve a reduction in the analyte list upon demonstration that certain analytes are not of concern at specific

monitoring locations or throughout the T-117 EAA. The Port and City may also request that EPA approve a reduction in monitoring frequency after completion of one (1) year of groundwater monitoring.

3.5 TIDAL STUDY

A 24-hour tidal study will be performed at all the monitoring wells in the monitoring network. The 24-hour tidal study will be conducted in accordance with the QAPP. Pressure transducers will be installed in the monitoring wells and programmed to take and record readings every 10 minutes for 24 hours. An additional sensor will be installed in a stilling well located at the south end of the South Park Marina dock adjacent to the boathouse to measure the LDW tidal variation.

The results of the tidal study will be used to verify the appropriate sample time for groundwater wells, as well as a description for how that determination was made. Groundwater samples will be taken during the lowering tide to collect water that is representative of the site.

4 Schedule and Reporting

Monitoring well installation will occur within 30 days of EPA's approval of this plan. Groundwater sampling will occur quarterly for a minimum of one year prior to performance of the removal action.

The quarterly monitoring results will be submitted to the EPA in the Quarterly Data reports within one month of receiving the validated results. The Quarterly Data reports will provide a description of sampling activities, analytical data, field measurements of groundwater quality parameters and groundwater levels and a data validation report. In addition, the groundwater concentrations shall be compared against State Water Quality Standards.

The data validation report will provide a review of all raw data to verify that the laboratory has supplied the required quality assurance/quality control (QA/QC) deliverables. The data will be validated in accordance with the QAPP. Qualified data will be flagged in project data tables.

Draft Quarterly Data Reports shall be submitted to EPA for review and comment. EPA will review the draft reports. EPA comments will then be incorporated into the final reports. The final submission will include a CD of all the analytical data.

The first Quarterly Data Report will also provide information on the tidal study performance and results. The report will detail the appropriate times for groundwater sampling at each well and discuss the rationale for this timing.

At the completion of one year of groundwater sampling, the data will be examined for any variations or trends by graphing and curve fitting. A true mean concentration for each well and chemical shall also be calculated and compared to the State Water

Quality Standards. In accordance with WAC 173-340-720 (9)(c)(v)(B), the true mean concentration is appropriate for cleanup levels based on chronic or carcinogenic threats. Due to the possibility of a large number of non-detect results and the difficulty of performing a statistical analysis on such a data set, groundwater data for each monitoring well may be directly compared to criteria in the State Water Quality Standards.

5 References

- EPA. 1995. Docket No. 10-95-0131-OPA (Administrative Complaint). *In the Matter of Basin Oil Company, Inc., Respondent. Issued to Terry J. Drexler, Basin Oil Company by Leroy Loiselle, Unit Manager, Emergency Response and Site Cleanup Unit #1, Office of Environmental Cleanup. October 19, 1995.* US Environmental Protection Agency, Seattle, WA.
- EPA. 2007. *Statement of work, T-117 Early Action Area. Amendment no. 1: non-time-critical removal action, Lower Duwamish Waterway Superfund site, Seattle, Washington.* US Environmental Protection Agency, Region 10, Seattle, WA.
- Freeze, R. Allen, and Cherry, John A., 1979. Groundwater. Prentice Hall, Englewood Cliffs, New Jersey.
- Hart Crowser. 1992. *Site Assessment UST Decommissioning, Malarkey Asphalt Company, 8700 South Dallas Avenue, Seattle, Washington.* April 27, 1992. Prepared for Duwamish Properties, Inc., Hart Crowser, Seattle, WA.
- Integral. 2006. *Site characterization data report, South Park soil remediation project.* Prepared for Seattle Public Utilities. Integral Consulting, Inc., Mercer Island, WA.
- Onsite. 2000. *PCB Removal/Containment Action, South Park Site [Formerly Malarkey Asphalt Company], 8700 South Dallas Avenue, Seattle, Washington.* February 29, 2000. Prepared for the Port of Seattle. Onsite Enterprises, Inc., Redmond, WA.
- SECOR. 1997. *Focused Site Characterization Report, Malarkey Asphalt Site, 8700 Dallas Avenue South, Seattle, Washington.* November 26, 1997. Prepared for Copeland, Landye, Bennett and Wolf, LP, Port of Seattle and City of Seattle. SECOR International Incorporated, Bellevue, WA.
- SECOR, 1998a. *Volume 1, Final Report, Malarkey Asphalt Site, 8700 Dallas Avenue South, Seattle, Washington.* May 15, 1998. Prepared for Copeland, Landye, Bennett and Wolf, LP, Port of Seattle and City of Seattle. SECOR International Incorporated, Bellevue, WA.
- SECOR, 1998b. *Volume 1, Final Report, Malarkey Asphalt Site, 8700 Dallas Avenue South, Seattle, Washington.* May 15, 1998. Prepared for Copeland, Landye, Bennett and Wolf, LP, Port of Seattle and City of Seattle. SECOR International Incorporated, Bellevue, WA.

- URS. 1994. *Site Inspection Report for the Malarkey Asphalt Company, Seattle, Washington*. September 19, 1994. Prepared for the U.S. Environmental Protection Agency, Region 10. URS Consultants, Seattle, WA.
- Wilbur, 2002. *Draft Technical report, South Park Bridge Project, Geology and Soils, Hazardous Materials Appendices*. Prepared for King County Department of Transportation. Submitted by Parson Brinckerhoff, Inc., Seattle, WA. Wilbur Consulting, Inc., Seattle, WA.
- Windward, DOF, Onsite. 2003. *Lower Duwamish Waterway Superfund site, Terminal 117 early action area. Task 1: Summary of existing information and data gaps analysis report*. Prepared for the Port of Seattle. Windward Environmental LLC, Dalton, Olmsted & Fuglevand, Inc., and Onsite Enterprises, Inc., Seattle, WA.
- Windward, DOF, Onsite. 2005a. *Lower Duwamish Waterway Superfund site, Terminal 117 early action area. T-117 sediment, soil and water field sampling, cruise and data report. Final*. Prepared for the Port of Seattle. Windward Environmental LLC, Dalton, Olmsted & Fuglevand, Inc., and Onsite Enterprises, Inc., Seattle, WA.
- Windward, DOF, Onsite. 2005b. *Lower Duwamish Waterway Superfund site, Terminal 117 early action area. T-117 sediment, soil and water field sampling, cruise and data report. Final*. Prepared for the Port of Seattle. Windward Environmental LLC, Dalton, Olmsted & Fuglevand, Inc., and Onsite Enterprises, Inc., Seattle, WA.
- Windward, DOF, Onsite. 2005c. *Lower Duwamish Waterway Superfund site, Terminal 117 early action area. T-117 sediment, soil and water field sampling, cruise and data report. Final*. Prepared for the Port of Seattle. Windward Environmental LLC, Dalton, Olmsted & Fuglevand, Inc., and Onsite Enterprises, Inc., Seattle, WA.