Quality Assurance Project Plan

Saginaw Mill
Groundwater Monitoring

by
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Approvals

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Cliff Kirchmer, Ecology Quality Assurance Officer	Date

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Abstract

The former Saginaw Mill site is located in Aberdeen, Washington, on the south shore of the Chehalis River. A Site Hazard Assessment conducted in 1993 determined that site soils were contaminated with diesel, heavy-oil-range Total Petroleum Hydrocarbons (TPH) and formaldehyde. Formaldehyde also was detected in on-site groundwater at concentrations above the Model Toxics Control Act (MTCA) Method B carcinogenic cleanup level of 1.46 ug/L. Between 1996 and 1999, two detailed site characterization studies were conducted and site cleanup was initiated. In 1999, the University of Washington planted poplar trees in the central and southwestern portions of the site as part of a continued phytoremediation-based site cleanup. Groundwater samples were collected in 2000 to provide data on formaldehyde concentrations subsequent to the poplar tree planting. The 2000 data showed that formaldehyde concentrations in groundwater had declined to levels near the reporting limit of 20 ug/L. The primary goal of this project is to collect current groundwater data for formaldehyde to assess the progress of the ongoing phytoremediation. New data is also needed to assess whether an on-site area where the trees did not survive still has formaldehyde levels high enough to warrant replanting these areas.

Background

The former Saginaw Mill site is located in Aberdeen, Washington on the south shore of the Chehalis River where it enters Grays Harbor (Figure 1). In April 1993, a Site Hazard Assessment (SHA) of the property was prepared for Grays Harbor County. Diesel, heavy-oil-range TPH and formaldehyde were detected in soil at levels above their respective MTCA cleanup levels. Formaldehyde also was detected in groundwater at concentrations of 2020 ug/L (MW-2) and 600 ug/L (MW-3). Formaldehyde concentrations in groundwater were above both MTCA Method B cleanup levels for formaldehyde (carcinogenic level of 1.46 ug/L and the non-carcinogenic level of 1,600 ug/L). Based on the SHA, the Department of Ecology (Ecology) ranked the site a "1" (representing "most threat" on a scale of 1 to 5) under the Washington Ranking Method and placed it on Ecology's Hazardous Site List.

Between 1996 and 1999, two site characterization studies were conducted and site cleanup was initiated. All structures were removed except for the footings of former tanks in the treatment chemical tank area. Cleanup activities at the site also included removal of the most highly TPH-contaminated soils. Small structural debris (wood and concrete fragments) remains in some places on the site.

Samples collected during the 1999 site characterization found that remnant soil contamination appeared to be limited to localized areas around the former fueling and boiler areas as well as the treatment chemical tank and kiln areas. Formaldehyde concentrations in on-site groundwater declined considerably between 1993 and 1999. In 1999, concentrations were near, or below, the laboratory reporting limit of 20 ug/L as shown in Table 1.

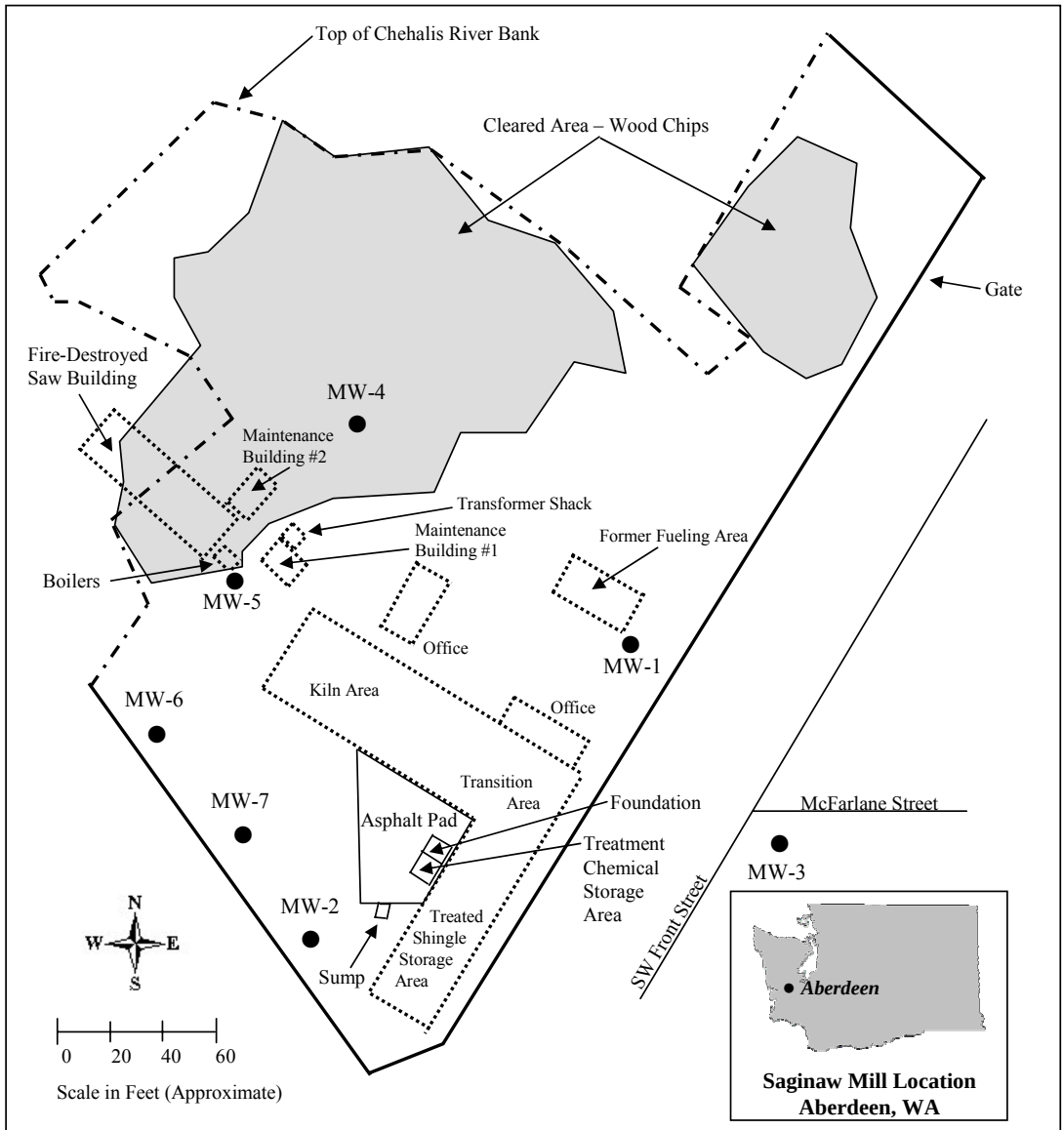

Figure 1: Saginaw Mill Sample Locations

Table 1: Formaldehyde Concentrations (ug/L) in Groundwater from 1993 to 2000

Monitoring Well	April 1993	August 1996	May 1999	August 2000
MW-1	--	140	28	61
MW-2	2020	1300	21	<20
MW-3	600	66	<20	29
MW-4	--	--	--	22
MW-5	--	--	--	35
MW-6	--	--	--	26
MW-7	--	--	--	35
Formaldehyde MTCA Method B Cleanup Levels in Groundwater				
	Non-carcinogen		Carcinogen	
	1600 ug/L		1.46 ug/L	

As part of a continued site cleanup, the University of Washington in 1999 planted poplar trees (phytoremediation) in the central and southwestern portions of the site in an attempt to remediate the formaldehyde-contaminated groundwater.

In 2000, four new wells were installed along the perimeter of the site and monitored to provide additional formaldehyde data prior to the potential remedial effects of the newly planted poplar tree phytoremediation plot. The wells also were installed to gain a better understanding of groundwater elevations and flow directions at the site. The monitoring results showed that overall formaldehyde concentrations were near the reporting limit of 20 ug/L.

The seven wells installed on site range in depth from 12 to 25 feet. The well logs indicate that the geology of the site consists primarily of silty sand to at least 25 feet. A mixture of topsoil, rubble fill, and wood chips overlay the thick layer of silty sand. Depth to groundwater ranges from approximately 3 to 14 feet below the ground surface. In 2000, groundwater levels in the south and southwestern parts of the site showed a relatively steep gradient toward the estuary to the northwest. Groundwater levels at the eastern edge of the site indicate that groundwater in this part of the site flows to the southeast. Groundwater flow on site appears to be influenced by the tidal cycles of Grays Harbor.

Project Description

The goal of this project is to provide the Toxics Cleanup Program (TCP) with groundwater monitoring data for formaldehyde to assess the progress of the phytoremediation (poplar tree plantation). The primary objective is to measure current formaldehyde concentrations to determine if they are continuing to decline. The data is also needed to assess whether an on-site area where the trees did not survive still has formaldehyde levels high enough to warrant replanting these areas.

Tasks to meet these objectives are:

- Collect groundwater samples in the early spring and late summer for one year for formaldehyde from seven monitoring wells and petroleum constituents from two monitoring wells (MW-1, MW-5) (Figure 1).

- Prepare data summary sheets at the completion of each sampling event and a technical report at the completion of all sampling summarizing significant findings.

Organization and Schedule

The project will be organized with key personnel performing the following functions:

Name	Duties	Phone
Pam Marti	Project Lead	(360)407-6768
Dom Reale	Quality Assurance (QA) Project Plan and Report Review	(360)407-6266
Dean Momohara	Analysis Supervisor	(360)871-8808
Pam Covey	Sample Tracking	(360)871-8827
Dale Norton	QA Project Plan and Report Review	(360)407-6765
Will Kendra	QA Project Plan and Report Review	(360)407-6698
Cliff Kirchmer	QA Project Plan Review and Technical Assistance	(360)407-6455
Stuart Magoon	Laboratory Director	(360)871-8801

This project is scheduled to be completed in one year. Project milestones and projected dates of completion are listed below. At the completion of the summer monitoring, all data will be summarized in a technical report.

Milestone	Date
QA Project Plan Approved	March 2005
Groundwater Sampling	April 2005
Data Transmitted to Client	June 2005
Groundwater Sampling	August 2005
Data Transmitted to Client	October 2005
Draft Technical Report	December 2005
Final Technical Report	January 2006
EIM Data Entry Due Date	January 2006

The estimated laboratory budget for this project is $4,000, which will cover the analytical costs for the two groundwater sampling events. The analytical costs for this project reflect the contract price of $110 for each formaldehyde analysis plus a 25% contract fee. Analytical costs for samples analyzed for TPH-Dx are $125 per sample, which reflects the 50% discount that Ecology programs receive at Manchester Laboratory.

Data Quality Objectives

For this project to succeed, the bias (systematic error) and precision (random error) must be low to reveal variability in concentrations between samples. Sampling bias will be minimized by using standard procedures for sampling, preservation, transportation, and storage of the samples.

The measurement quality objectives (maximum acceptable values) for this project are listed in Table 2.

Table 2: Measurement Quality Objectives

Parameter	Recovery Precision for LCS(1)	Precision for Duplicate Samples (RPD)	Matrix Spike Recoveries	Precision for Duplicate Matrix Spikes (RPD)	Required Reporting Limit
Formaldehyde	66-155%	20%	40-155%	20%	20 ug/L
NWTPH-Dx	50-150%	50%	NA	50%	0.1 mg/L

(1) The limits of the recovery precision for LCS is ±3 standard deviations.

Analytical and field quality control samples are discussed in the Quality Control Procedures section below.

Sampling Design and Field Procedures

Groundwater samples will be collected in the spring and summer of 2005 to assess the progress of ongoing phytoremediation to reduce the concentrations of formaldehyde at the site. New data is also needed to assess if an on-site area where the trees have not survived still has formaldehyde concentrations high enough to warrant replanting. Samples will be collected from seven monitoring wells (Figure 1) during low tide and will be assumed to be representative of the groundwater quality of the site. Table 3 lists well construction details as well as water table elevation as measured on August 28, 2000, which is also shown in Figure 2.

Table 3: Saginaw Mill Well Construction Details

Well ID	Well Type	Total Depth (feet)	Screen Interval (feet)	Water Table Elevation* (feet)
MW-1	--	12	--	7.43
MW-2	--	12	--	7.94
MW-3	--	13.5	--	5.94
MW-4	2” PVC	25	15-25	4.91
MW-5	2” PVC	25	15-25	4.66
MW-6	2” PVC	23	13-23	2.92
MW-7	2” PVC	15	5-15	3.39

* Water Table Elevation 8/28/2000 measured between 9:07 and 9:50 am, two hours after low tide.

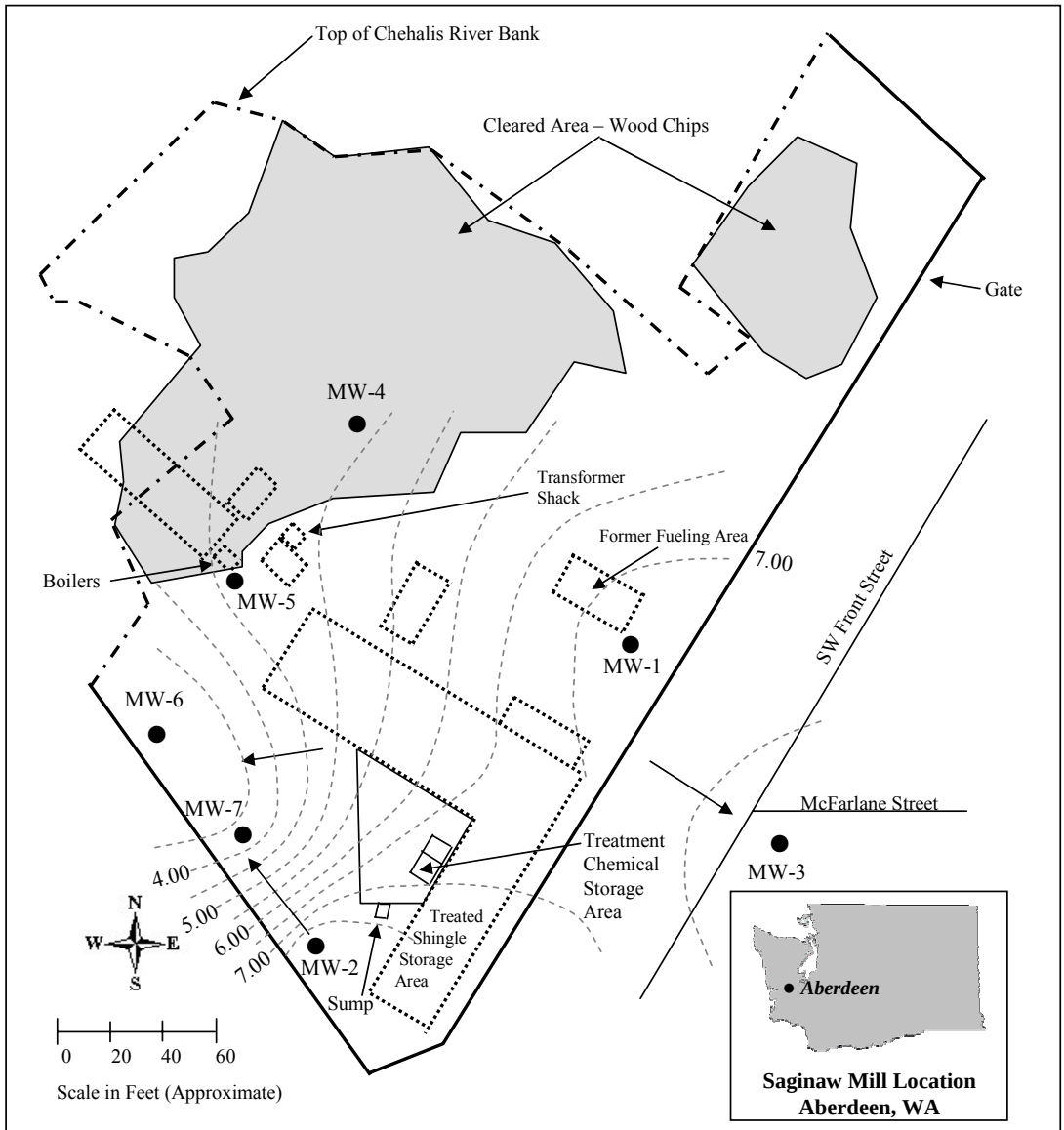

Figure 2: Groundwater Flow Direction – August 28, 2000

To determine groundwater flow direction, water levels will be measured from all the monitoring wells upon arriving at the site and prior to any sampling. Water levels will be measured from a surveyed measuring point using a Solinst water level meter. Measurements will be recorded to 0.01 foot and will be accurate to 0.03 foot. Water levels will be measured again in each well prior to sampling. Well volumes will be calculated using the height of water in the well casing above the bottom of the well.

The monitoring wells will be purged and sampled using a Grundfos Redi-Flo2 stainless steel submersible pump. The pump intake will be placed at the middle of the screened interval in each monitoring well and purged at a pump rate of 0.5 to 1-liter/minute. Wells will be purged through a continuous flow cell until pH, specific conductivity, and temperature readings stabilize or a minimum of three well volumes have been purged. Purge water from the wells will be stored on site in 55-gallon drums. This waste will be transported and disposed of in accordance with State of Washington regulations (Chapter 173-340-400 WAC). During previous sampling, wells MW-1, MW-4, and MW-7 have purged dry. Should this happen during monitoring, the wells will be allowed to recharge with native formation water prior to sampling. Samples will be collected from the monitoring wells directly from the pump discharge line after purging. The pump will be decontaminated between each well by circulating laboratory grade detergent/water through the pump followed by a tap water rinse, with each cycle lasting five minutes.

Formaldehyde samples will be collected in 125 mL amber glass bottles. NWTPH-Dx samples will be collected in 1-gallon glass jars with Teflon lined caps. Upon sample collection and proper labeling, all samples will be stored in an ice-filled cooler. Samples will be transported to the Ecology's Operation Center in Lacey. Samples will be kept in the walk-in cooler until picked up by the courier and delivered to Ecology/EPA Manchester Environmental Laboratory in Manchester, Washington. Formaldehyde samples will then be delivered to a contract laboratory. Chain-of-custody procedures will be followed according to Manchester Environmental Laboratory protocol (Ecology, 2003). In the event that a sample is damaged during transit or testing, a new sample may be collected and submitted for analysis. The laboratory should notify the project lead as soon as possible when a sample is unsuitable. Formaldehyde samples will be analyzed within the maximum acceptable holding time of three days. NWTPH-Dx samples will be extracted within seven days and analyzed within 40 days.

Laboratory Procedures

All groundwater samples will be analyzed for formaldehyde using EPA Method 8315 (U.S. EPA, 1996), with a reporting limit of 20 ug/L. Diesel and heavy oil will be analyzed using method NWTPH-Dx (Ecology, 2003) with a reporting limit of 0.1 mg/L.

The MTCA Method B cleanup level for formaldehyde as a carcinogen (1.46 ug/L) is below the laboratory reporting limit (20 ug/L), therefore, where formaldehyde is detected below the laboratory reporting limit in groundwater samples, a determination of the concentration relative to the cleanup level can not be made with certainty. The MTCA Method A cleanup level for TPH-Dx is 500 ug/L.

Quality Control Procedures

Field Quality Control

Field quality control will consist of collecting field duplicates. Field duplicate sample results will provide an estimate of overall sampling and analytical precision. One field duplicate will be collected from either monitoring well MW-5 or MW-6 for each sampling event. A field duplicate is a second sample from the same well using identical sampling procedures a short time after the well has equilibrated. The relative percent difference (RPD) will be calculated for each duplicate set and will be used to give a rough estimate overall precision.

Lab Quality Control

Routine quality control procedures will be adequate to demonstrate that the MQOs for this project have been met. Laboratory quality control tests consist of method blanks, matrix spikes for formaldehyde, as well as duplicate and check standards (lab control standards). Analytical precision can be estimated from duplicate and check standards, duplicate sample analysis, and duplicate spiked sample analyses. Analytical bias will be estimated from matrix spikes, matrix spike duplicates, and check standards. Recoveries from check standards provide an estimate of bias due to calibration. Mean percent recoveries of spiked sample analyses provide an estimate of bias due to interference. Results of quality control analyses will be reported in the same units as expressed for the MQOs. Laboratory staff will conduct quality assurance review of all analytical data generated at Manchester Environmental Laboratory prior to releasing the data to the project lead.

Data Review, Verification, and Validation

The Manchester Environmental Laboratory (MEL) will conduct a review of all laboratory analysis for the project including contract laboratory's data and case narratives. MEL will verify that the methods and protocols specified in the QA Project Plan were followed; that all calibrations, checks on quality control, and intermediate calculations were performed; and that the data are consistent, correct, and complete, with no errors or omissions. Evaluation criteria will include the acceptability of instrument calibration, procedural blanks, spike samples' analysis, precision data, laboratory control sample analysis, and appropriateness of the data qualifiers assigned. MEL will prepare a written report of the results of their data review.

The project manager will review MEL's data QA report and any contract laboratory's data package to verify that MQOs were met. The project manager will check these data and reports for completeness and reasonableness. Based on these assessments, the data will either be accepted, accepted with appropriate qualifications, or rejected.

Data Quality Assessment and Reporting

Once the data have been reviewed and validated, the project lead will determine if the data can be used toward meeting the project goals and objectives. During the project, a data summary will be prepared and sent to the project manager at the completion of the first round of sampling. A technical report will be prepared at the completion of all sampling and will include the following:

- Maps of the study area showing sample sites.
- Descriptions of field and laboratory methods.
- Discussion of data quality and the significance of any problems encountered in the analyses.
- Summary tables of field and chemical data.
- Observations on significant or potentially significant findings.
- Recommendations based on project goals.

At the completion of the project, data suitable for archiving will be transitioned to the Environmental Information Management (EIM) database.

References

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